NORTON SAINT-GOBAIN

WINTER

Reshaping your world

PRECISION TECHNOLOGY
TOOL GRINDING

SAINT-GOBAIN

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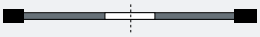

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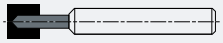

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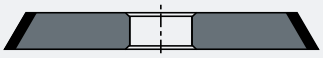

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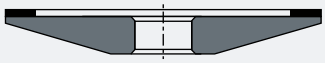

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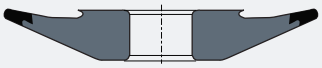

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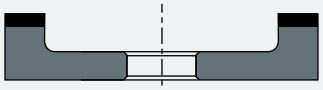

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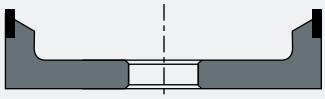

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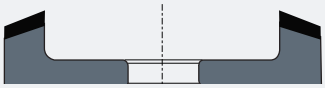

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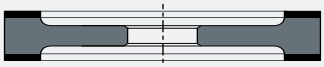

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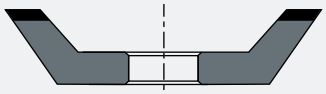

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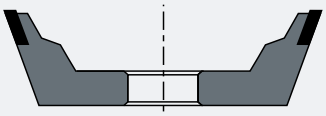

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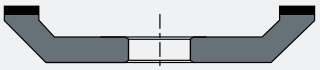

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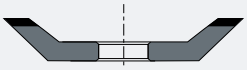

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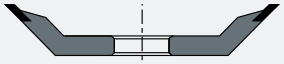

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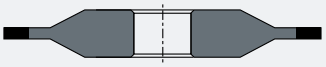

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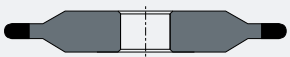

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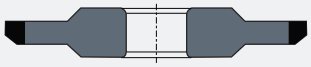

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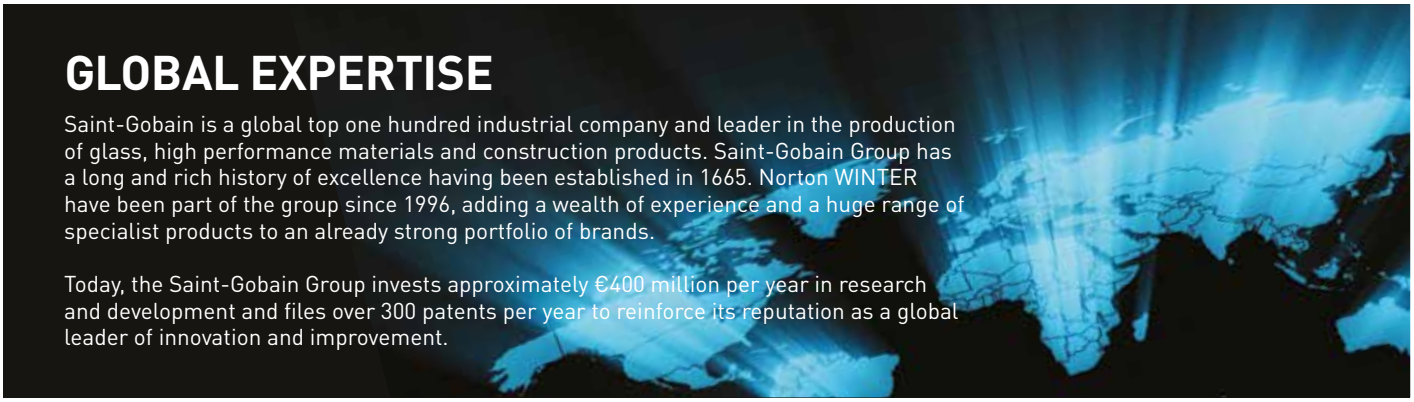
OUR CUSTOMER **CONNECTION**

As a Saint-Gobain brand, our customer-first philosophy, diverse product portfolio and strong global presence are our hallmarks and, we are an important part of a network that spans 45 countries with new locations being added every year. Saint-Gobain Abrasives employ over 16.000 people and is the only manufacturer to offer such a comprehensive range of abrasives and dressing tools in the industry.

For over 160 years, Norton WINTER has been one of the most well respected names in the industry and is synonymous with high quality diamond and cBN grinding products. Our unique combination of unbeatable quality, market leading expertise and outstanding service, are the foundations on which our success is built.



GLOBAL EXPERTISE

Saint-Gobain is a global top one hundred industrial company and leader in the production of glass, high performance materials and construction products. Saint-Gobain Group has a long and rich history of excellence having been established in 1665. Norton WINTER have been part of the group since 1996, adding a wealth of experience and a huge range of specialist products to an already strong portfolio of brands.

Today, the Saint-Gobain Group invests approximately €400 million per year in research and development and files over 300 patents per year to reinforce its reputation as a global leader of innovation and improvement.

THE NORTON WINTER BRAND PROMISES:

MARKET LEADING QUALITY

From day 1, Norton WINTER has stood for quality. From design to delivery, we exact the highest standards at every stage to ensure that we produce only the best products for our customers. Norton WINTER diamond tools are recognised for their exceptional performance and outstanding value for money.

INNOVATION

To this day, the Norton WINTER philosophy is closely connected to innovation and technical progress. As a pioneer, we have always been, and continue to be, actively invested in the future development of grinding technologies. Take advantage of our team of dedicated R&D scientists at Norton WINTER's purpose-built European Grinding Technology Centre.

CUSTOM-MADE SOLUTIONS

Over 75% of all Norton WINTER products are developed in close cooperation with our customers. Our product managers and application engineers relish the technological challenge of achieving the best grinding results for our customers. As such, we are happy to provide optimised grinding solutions to meet your specific requirements in a way that delivers the greatest benefit. At all times our aim is to generate cost savings, improved productivity, reduced down time, and better quality at every stage of your process.

OUTSTANDING SERVICE

At Norton WINTER we pride ourselves on offering a full service. From finding the perfect product to optimising your processes, we encourage all of our customers to take advantage of our technical expertise and years of industry experience. Our field sales force and customer service department are at your disposal.

OPERATIONAL EXCELLENCE

As a responsible manufacturer, Norton WINTER continually strives to minimise its negative impact on the environment and upholds industry leading standards of health and safety. Norton WINTER carries international certification to ISA 9001 (Quality Management), ISO 14001 (Environmental Management) and OHSAS 18001 (Health and Safety Management). Additionally, all rotating Norton WINTER tools bear the OSA safety seal (OSA: Organization for the Safety of Abrasives), providing our customers with the highest safety specification in a tool application.

A CORPORATE **PERSPECTIVE**

Saint-Gobain Abrasives are reshaping your world by bringing powerful, precise and user-friendly solutions that grind and finish all types of materials.

Our customers require only the smartest designs and highest performance products, that's why innovation and improvement are at the heart of everything we do. Material sciences and technological development are an obsession and the satisfaction of our customers is what drives us in the pursuit of perfections.

TRUST NORTON WINTER
ONE BRAND, ONE TECHNOLOGY LEADER

Norton Winter, the premium brand for diamond and cBN grinding products, is one of the most well established and respected brands in the market. With over 160 years' experience, Norton Winter offers a performance package designed to generate cost savings through increased productivity, less down time, and better quality.


NORTON
SAINT-GOBAIN
WINTER

YOUR SAFETY IS **OUR PRIORITY**

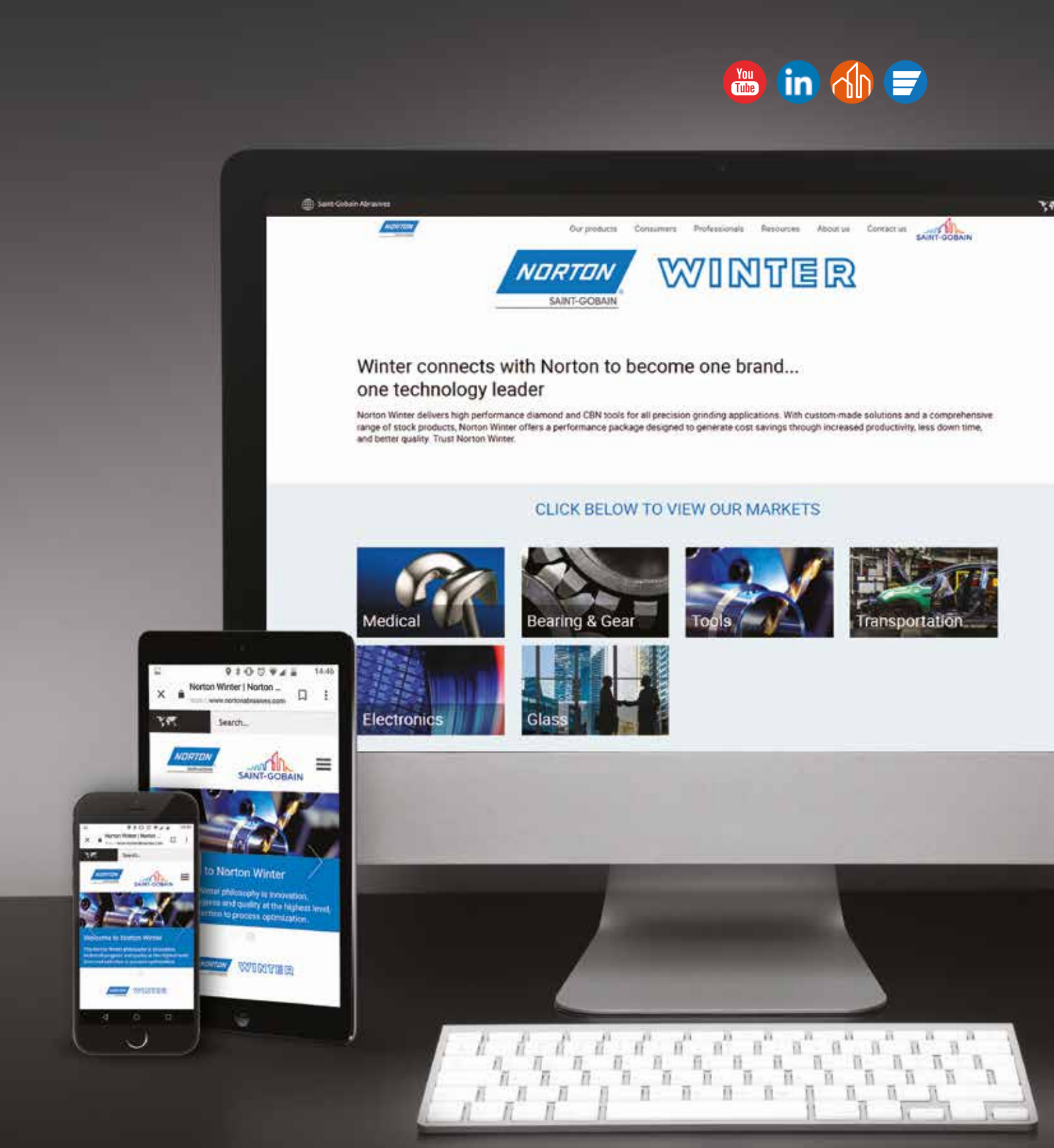
Your safety is our top priority and we understand that the nature of our customers' work presents inherent risks. To help minimise those risks, all Norton WINTER products are manufactured in accordance with the most rigorous European and International health, safety and environmental regulations.

THE ORGANISATION FOR THE SAFETY OF ABRASIVES

We are proud to carry the oSa trademark.
As a member of the oSa, we are positioned amongst the very best manufacturers with the highest levels of safety. Through a stringent monitoring and audit system year after year, we maintain our reputation as a reliably safe and responsible producer of quality abrasives. We conform to European and International standards, EN12413, EN13236 and EN13743 for bonded, diamond and coated products and ISO 9001, 14001 and OHSAS 18001 for our manufacturing sites. Where possible, always opt for products and suppliers who carry the oSa® trademark to ensure quality products of the highest safety level.

THE FEDERATION OF EUROPEAN PRODUCERS OF ABRASIVES

As a member of the FEPA association, we stay up-to-date with all technical, legal and scientific regulatory frameworks. Together with oSa, FEPA pursues the objective of supporting both currently attained safety standards and potential future developments.



DISCOVER MORE FROM OUR EXPERTS AT:

www.nortonabrasives.com

NORTON
SAINT-GOBAIN
WINTER

SNAPSHOTS OF A LONG **HISTORY**

In 1847 Ernst Winter established a family-owned company with a simple vision of developing the best ultra-hard crystal tools that money could buy. Today, we still adhere to that vision and throughout our history have gone on to develop a reputation as industry pioneers, trend-setters and technological leaders. We are Norton WINTER.

1847 Ernst Winter
Goldsmith and diamantaire founded his diamond tool workshop.

1872 WINTER in Hamburg
The company establishes its first building in Hamburg.

1960s WINTER in Space
Laser reflectors ground with WINTER diamond tools enable the most accurate astronomic and geographic measurements.

1983 Celebrities
Helmut Schmidt (Federal Republic of Germany's former Chancellor) visits WINTER and acts a "diamond maker".

2017 Norton WINTER
WINTER merges with abrasives giant Norton to form Norton WINTER.

Posters and Brochures in the course of time

Success from the beginning
Former letterhead and contemporary advertisement of WINTER with images showing medals received at important exhibitions.

NORTON
SAINT-GOBAIN

WINTER INNOVATIONS

v-Prime

ULTIMATE EDGE STABILITY IN CNC GRINDING OF ROUND TOOLS

TIGER II

INNOVATIVE GRINDING WHEELS FOR FACE GRINDING

1-FLUTE

HIGH PERFORMANCE GRINDING WHEELS FOR FLUTE GRINDING

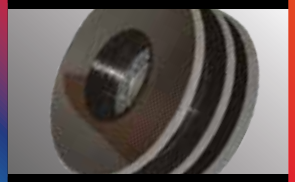
DDS CUT

CNC CONTROLLED DRESSING OF BONDED & SUPER ABRASIVE GRINDING WHEELS

AEON

HIGH PRECISION ELECTROSTATIC GRINDING

CARBON FORCE



FORCING THE LIMITS OF O.D. GRINDING

PARADIGM

A PARADIGM SHIFT IN BONDED TECHNOLOGY

YOUR SINGLE SOURCE FOR GLOBAL GRINDING INNOVATIONS

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ABRASIVE PRODUCTS FOR MACHINING ROUND TOOLS

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ROUND TOOLS GENERAL INFORMATION

The product range for round tools is extensive. Different materials and tool geometries make various demands on the grinding tools used in manufacture.

Shorter grinding times, better suitability for automation and longer dressing intervals are required.
Specific grinding wheel characteristics such as edge stability and free-grinding behaviour have to be carefully balanced.

Information
Further information on applications and products can be found at
www.nortonabrasives.com

GENERAL INFORMATION

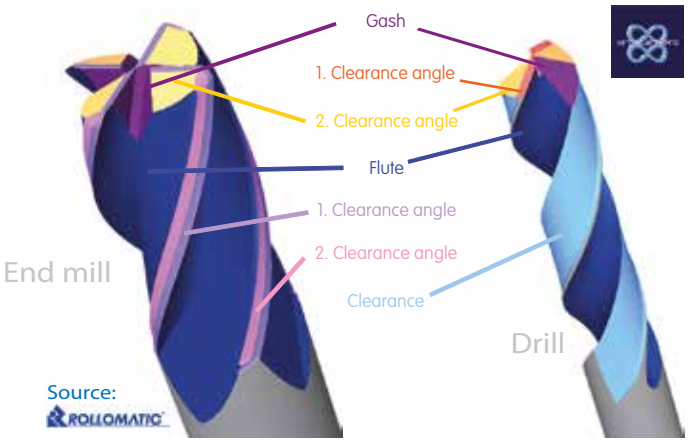
Drills, end mills, reamers, stepped tools and special-purpose tools in varying designs and geometries are described as round tools. Tool geometries are produced by grinding in successive production steps. A typical sequence starts with the preparation of the blank, (tools for trimming blanks can be found in the section for 'Diamond and cBN cut-off wheels') which is followed by flute grinding, gashing and grinding of the clearance angles.

FLUTE | GASH | CLEARANCE ANGLES

This section is structured according to the procedure described.

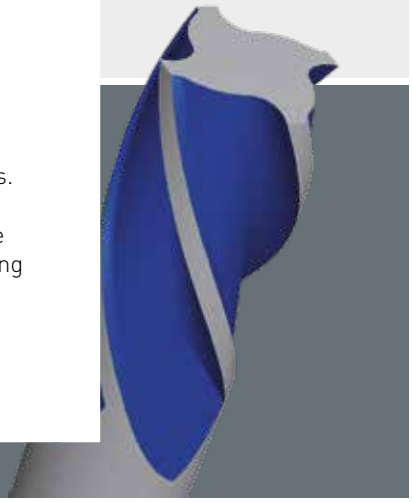
Here you see an example of an end mill and a drill. Generally, the same tool geometries are used for the individual process steps. Only flute grinding uses different grinding wheel designs.

While 1A1 and 1V1 grinding wheels are used primarily for end mills, profile grinding wheels such as 14F1 and similar (Norton WINTER shape 700) are preferred for drill production.

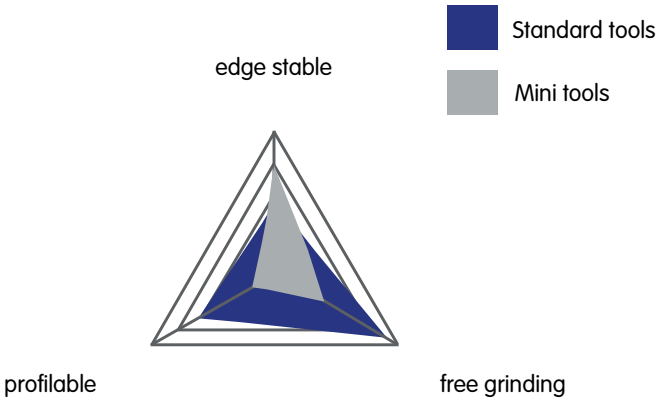


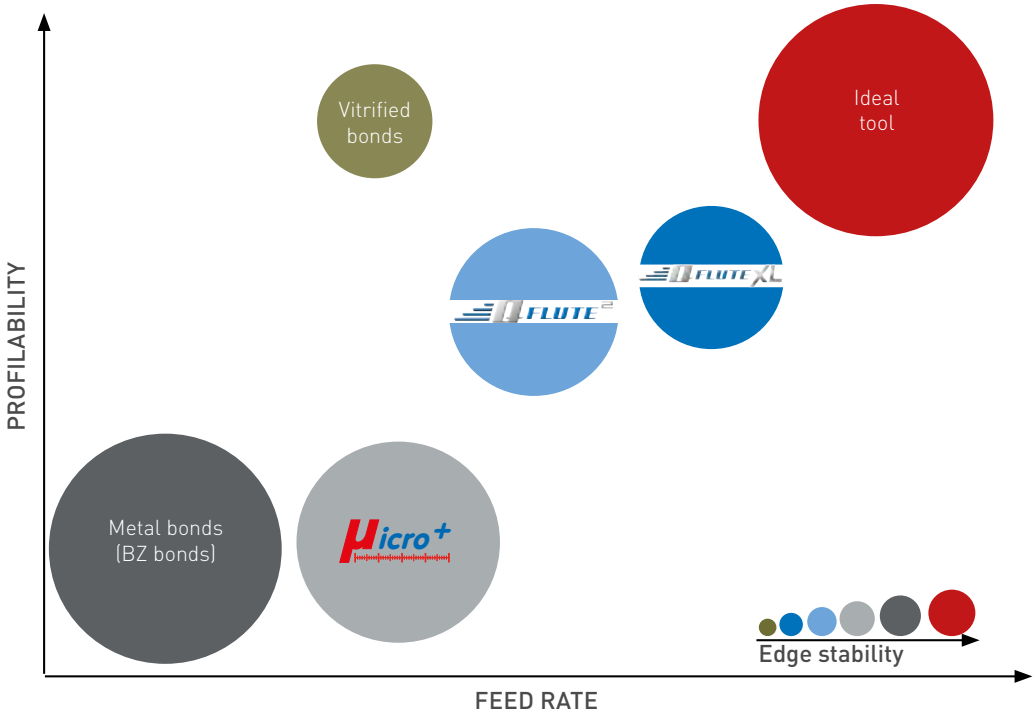
DIAMOND & CBN GRINDING WHEELS FOR FLUTE GRINDING

Flute grinding is the most time-consuming and thus most cost-intensive manufacturing step during drill and end mill production. It is necessary to optimise the machine and cooling lubricant systems as well as the abrasives. In recent years, machines have become more compact, spindle power has increased, axis paths have been reduced and machine controls have become more efficient. At the same time, Norton WINTER has developed flute grinding tools which meet these increasing requirements and which now enable the improved machine capacity to deliver a higher and more economic output. Matched to the application and the system environment, innovative Norton WINTER flute grinding wheels are always the best solution.



Grinding wheels in the Q-Flute range have proved to be particularly useful for standard tools.
The combination of excellent free-grinding behaviour and profile retention allows economic flute grinding with high feed rates. Q-Flute grinding wheels can also be dressed on the grinding machines.
Mini and micro tools require bond systems with exceptional edge stability. Norton WINTER metal bonds (BZ bonds) and high-performance resin bonds (µicro⁺) are the number one choice here.





HIGH-PERFORMANCE FLUTE GRINDING

In the last years Norton WINTER has set the benchmark in machining of round-tools with its Q-Flute² for flute grinding operations. With Q-Flute², clearly improved material removal rates are possible whilst at the same time maintaining edge stability, resulting in a successful combination of durability and free-grinding behaviour. Dramatically increased feed rates with simultaneously longer dressing intervals were achieved.

APPLICATION AREAS Q-Flute²

Q-Flute2 is the solution for all flute grinding applications in the diameter range above 3 mm. This bond system is applicable not only under oil but also under emulsion or water. It provides outstanding results when grinding tungsten carbide and HSS tools.

THE OPTIMAL ADDITION

The latest innovation of Norton WINTER for flute grinding is Q-FluteXL. Based on the wide experience in flute grinding operations by using Q-Flute², Norton WINTER started the development of a new innovative solution for flute grinding. The Q-FluteXL is the optimal addition for the established Q-Flute² and should be used everywhere, where Q-Flute² is not free grinding enough. The Q-FluteXL family is a completely new & innovative bond system, which places itself to the far increasing challenges against a modern flute grinding wheel. The possibility to adjust Q-FluteXL to every single requirement by choosing a different version is an additional benefit of Q-FluteXL.

APPLICATION AREAS Q-FluteXL

Wherever a more free grinding behaviour than Q-Flute² is required. Q-FluteXL is the optimum choice. This is the case at very high Material Removal Rates due to big workpiece diameter, straight flutes or workpiece related big contact areas. Also under bad coolant conditions or on low power machines Q-FluteXL is showing its strength.

SPECIFICATION	APPLICATIONS
Q-Flute²	TC, oil coolant
Q-Flute² W	TC, water-based cooling
Q-FluteXL	TC, oil and water-based cooling
Q-Flute²	HSS, oil and water-based cooling
Q-FluteXL	HSS, oil and water-based cooling

Norton WINTER FlutePolish

After grinding (roughing) the flute to achieve the correct geometry, the flute can be polished to produce a better surface finish. The polished surface improves the performance of drills and end mills when used on aluminium alloys, hardened steel materials or when drilling very hard wood. Polishing helps to transport material chips efficiently out of the drilled hole to reduce friction, this also helps to reduce the risk of chips becoming welded to the cutting edge. Using Norton WINTER FlutePolish is an ideal way to complete the production of round tools, with it improving the cutting edge of the tool and providing a more consistent and extended tool life.

FEATURES

- Newly developed elastic bond structure
- Increased feed rate, faster process
- Highly wear resistant
- Reduced abrasive consumption
- Can withstand high infeed and feed rates

BENEFITS

- Flexible & highly conformable
- Polishes a greater surface area of the part
- Excellent surface finish quality (mirror shine)
- Reduced set-up and cycle times, increased productivity
- Long wheel life
- Lowers overall process cost (cost per part ratio)
- Reduced loading, wheel burning and improves polish quality

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
BZ480		Metal bond for mini and micro tools
µicro⁺ series		Wear-resistant high-performance resin bonds for mini and micro tools
Q-Flute²		High-performance resin bond for flute grinding
Q-FluteXL		High-performance resin bond for flute grinding
K+920		More wear-resistant resin bond also dry grinding
K+921		More wear-resistant resin bond preferably wet grinding
K+1421R		Standard resin bond for CNC applications
K+1421N		Standard resin bond for CNC applications

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
MSS444		Metal bond for mini and micro tools
Q-Flute²		High-performance resin bond for flute grinding
Q-FluteXL		High-performance resin bond for flute grinding
KSS920		More wear-resistant resin bond also dry grinding
KSS12N		Standard resin bond for CNC applications

STANDARD DIMENSIONS FOR FLUTE GRINDING

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers	Tungsten carbide HSS Cermet	All CNC tool grinding machines	1A1, 1V1, 14F1 a.o. Ø 50...250 T 3...30 X 5...15	See table above	Oil Emulsion
Micro drills Mini end mills Burrs	Tungsten carbide HSS	Precision tool grinding machines for mini and micro tools	3A1, 4A9, 14V1 Ø 50...200 U 2...6 X 5...10	See table above	Oil Emulsion

Other dimensions on request

ROUND TOOLS FLUTE GRINDING

NORTON WINTER Q-FLUTE XL AND Q-FLUTE² EXAMPLES OF USE

CASE STUDY 1:

Q-FLUTE XL 60

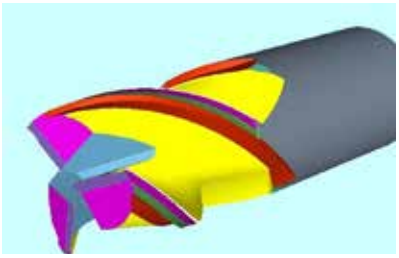
GRINDING WHEEL	D46 Q-FluteXL60
MACHINE	Reinecker WZS700
COOLANT	Oil
WORK PIECE	TC end mill Ø 20 mm
GRINDING PARAMETERS	
FEED RATE	160 mm/min
DEPTH OF CUT	3 mm
CUTTING SPEED	18 m/s
MRR	8 mm³/mm · s

BENEFITS
- 15% reduced cycle time
- 25% less wheel wear
- Wheel is working in self sharpening

CASE STUDY 2:

Q-FLUTE²

GRINDING WHEEL	D54 Q-Flute²
MACHINE	Anca
COOLANT	Oil
WORK PIECE	TC end mill Ø 12.5 mm
GRINDING PARAMETERS	
FEED RATE	250 mm/min
DEPTH OF CUT	4 mm
CUTTING SPEED	18 m/s
MRR	16 mm³/mm · s

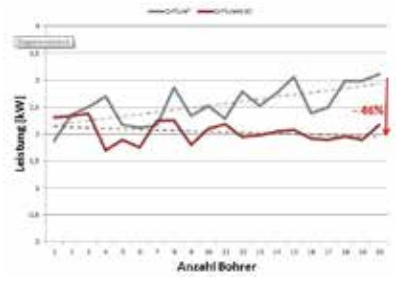


BENEFITS
- 25% higher feed rate
- Huge time savings
- Significant cost savings

CASE STUDY 3

Q-FLUTE XL 40

GRINDING WHEEL	D54 Q-FluteXL40 + FlutePolish
MACHINE	Walter Helitronic Power
COOLANT	Oil
WORK PIECE	TC drill Ø 10 mm
GRINDING PARAMETERS	
FEED RATE	200 mm/min
DEPTH OF CUT	3.5 mm
CUTTING SPEED	18 m/s
MRR	11.6 mm³/mm · s
PARAMETER FLUTE POLISHING	
FEED RATE	v_f = 180 mm/min
INFEED	a_e = 0.05...0.1mm
CUTTING SPEED	v_c = 20 m/s



BENEFITS
- 40% reduced spindle load
- 20% shorter cycle time
- Significant lower thermal stress for the work piece
- Polishing 3x faster
- Perfect cutting edge and surface qualit

DRESSING RECOMMENDATIONS

SHAPE	D	T	H	ABRASIVE	GRIT SIZE HARDNESS STRUCTURE	BOND	ORDER NUMBER
01	200	10	32	39C	120 K	VS	69936675637
01	200	10	32	39C	240 K	VS	69078651221
01	250	10	51	39C	120 K	VS	69936642093
01	250	10	51	39C	240 K	VS	69078651223

PROCESS PARAMETERS FOR FLUTE GRINDING OF TUNGSTEN CARBIDE AND HSS TOOLS (Q'_w)

Recommended operating parameters

Feed rate v_f [mm/min]

Infeed a_e [mm]

	30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300
2,0	1,0	1,3	1,7	2,0	2,3	2,7	3,0	3,3	4,0	4,7	5,3	6,0	6,7	7,3	8,0	8,7	9,3	10,0
2,2	1,1	1,5	1,8	2,2	2,6	2,9	3,3	3,7	4,4	5,1	5,9	6,6	7,3	8,1	8,8	9,5	10,3	11,0
2,4	1,2	1,6	2,0	2,4	2,8	3,2	3,6	4,0	4,8	5,6	6,4	7,2	8,0	8,8	9,6	10,4	11,2	12,0
2,6	1,3	1,7	2,2	2,6	3,0	3,5	3,9	4,3	5,2	6,1	6,9	7,8	8,7	9,5	10,4	11,3	12,1	13,0
2,8	1,4	1,9	2,3	2,8	3,3	3,7	4,2	4,7	5,6	6,5	7,5	8,4	9,3	10,3	11,2	12,1	13,1	14,0
3,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0	6,0	7,0	8,0	9,0	10,0	11,0	12,0	13,0	14,0	15,0
3,2	1,6	2,1	2,7	3,2	3,7	4,3	4,8	5,3	6,4	7,5	8,5	9,6	10,7	11,7	12,8	13,9	14,9	16,0
3,4	1,7	2,3	2,8	3,4	4,0	4,5	5,1	5,7	6,8	7,9	9,1	10,2	11,3	12,5	13,6	14,7	15,9	17,0
3,6	1,8	2,4	3,0	3,6	4,2	4,8	5,4	6,0	7,2	8,4	9,6	10,8	12,0	13,2	14,4	15,6	16,8	18,0
3,8	1,9	2,5	3,2	3,8	4,4	5,1	5,7	6,3	7,6	8,9	10,1	11,4	12,7	13,9	15,2	16,5	17,7	19,0
4,0	2,0	2,7	3,3	4,0	4,7	5,3	6,0	6,7	8,0	9,3	10,7	12,0	13,3	14,7	16,0	17,3	18,7	20,0
4,2	2,1	2,8	3,5	4,2	4,9	5,6	6,3	7,0	8,4	9,8	11,2	12,6	14,0	15,4	16,8	18,2	19,6	21,0
4,4	2,2	2,9	3,7	4,4	5,1	5,9	6,6	7,3	8,8	10,3	11,7	13,2	14,7	16,1	17,6	19,1	20,5	22,0
4,6	2,3	3,1	3,8	4,6	5,4	6,1	6,9	7,7	9,2	10,7	12,3	13,8	15,3	16,9	18,4	19,9	21,5	23,0
4,8	2,4	3,2	4,0	4,8	5,6	6,4	7,2	8,0	9,6	11,2	12,8	14,4	16,0	17,6	19,2	20,8	22,4	24,0
5,0	2,5	3,3	4,2	5,0	5,8	6,7	7,5	8,3	10,0	11,7	13,3	15,0	16,7	18,3	20,0	21,7	23,3	25,0

Potential of improvements

Minimum Q'_w if ≥ D46 — FLUTE XL

Minimum Q'_w if D46 & D54 — FLUTE²

The feed rates stated are guidelines only and apply to both diamond and cBN tools. Feed rates have to be adjusted for small workpiece diameters, extreme flute widths and grinding wheels with a diameter of less than 100 mm.

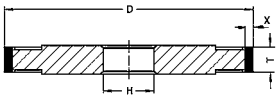
ROUND TOOLS FLUTE GRINDING

STOCK PROGRAM Q-FLUTE² & Q-FLUTE XL⁴⁰

The demand of the market to have an extensive range of abrasive products available from stock has grown steadily in recent years. To meet this requirement we offer a new range of the proven Q-Flute² and Q-FluteXL grinding wheels available ex stock. The target is a considerably wider range of grinding wheel shapes to be delivered to our customers within a very short time.

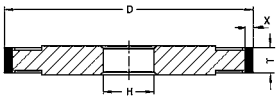
In the future various dimensions of semi-finished components will be stored. After receiving the customer order, these semi-finished parts can be finished into a variety of grinding wheels in the shortest possible time. The delivery time for all producible grinding wheel dimensions from semi-finished components will be about 5 working days. Due to that we offer our customers maximum flexibility and shortest possible lead times. Additionally, Norton WINTER provides a layer depth increased by 60% for 1A1 grinding wheels, thus we offer clearly more abrasive layer for their money.

1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS						
SP1A1	100x8x16	20	D54	Q-Flute²	C	7958765140
SP1A1	100x10x16	20	D54	Q-Flute²	C	7958765147
SP1A1	100x12x16	20	D54	Q-Flute²	C	7958765148
SP1A1	100x15x16	20	D54	Q-Flute²	C	7958765149
SP1A1	125x8x16	20	D54	Q-Flute²	C	7958765150
SP1A1	125x10x16	20	D54	Q-Flute²	C	7958765151
SP1A1	125x12x16	20	D54	Q-Flute²	C	7958765152
SP1A1	125x15x16	20	D54	Q-Flute²	C	7958765153
SP1A1	150x8x16	20	D54	Q-Flute²	C	7958765154
SP1A1	150x10x16	20	D54	Q-Flute²	C	7958765155
SP1A1	150x12x16	20	D54	Q-Flute²	C	7958765156
SP1A1	150x15x16	20	D54	Q-Flute²	C	7958765157

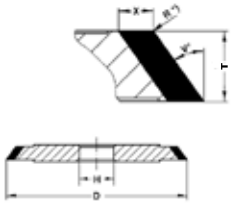
1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS						
SP1A1	100x8x16	20	D54	Q-FluteXL⁴⁰	C	7958765158
SP1A1	100x10x16	20	D54	Q-FluteXL⁴⁰	C	7958765159
SP1A1	100x12x16	20	D54	Q-FluteXL⁴⁰	C	7958765160
SP1A1	100x15x16	20	D54	Q-FluteXL⁴⁰	C	7958765161
SP1A1	125x8x16	20	D54	Q-FluteXL⁴⁰	C	7958765162
SP1A1	125x10x16	20	D54	Q-FluteXL⁴⁰	C	7958765163
SP1A1	125x12x16	20	D54	Q-FluteXL⁴⁰	C	7958765165
SP1A1	125x15x16	20	D54	Q-FluteXL⁴⁰	C	7958765166
SP1A1	150x8x16	20	D54	Q-FluteXL⁴⁰	C	7958765167
SP1A1	150x10x16	20	D54	Q-FluteXL⁴⁰	C	7958765168
SP1A1	150x12x16	20	D54	Q-FluteXL⁴⁰	C	7958765169
SP1A1	150x15x16	20	D54	Q-FluteXL⁴⁰	C	7958765170

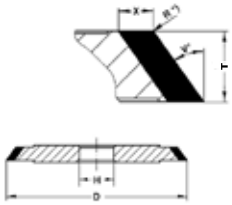
Delivery time approx. 5 working days after receipt of order.

1V1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	V (°)	H (mm)	GRIT SIZE	BOND	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
SP1V1	100x10x14	10	20	D54	Q-Flute²	C	66260137553
SP1V1	100x12x14	10	20	D54	Q-Flute²	C	66260113283
SP1V1	100x15x13	10	20	D54	Q-Flute²	C	60157680737
SP1V1	125x10x14	10	20	D54	Q-Flute²	C	66260129330
SP1V1	125x12x14	10	20	D54	Q-Flute²	C	66260113290
SP1V1	125x15x13	10	20	D54	Q-Flute²	C	66260128867
SP1V1	150x12x11	20	20	D54	Q-Flute²	C	7958756013
SP1V1	150x15x13	10	20	D54	Q-Flute²	C	7958754106

1V1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	V (°)	H (mm)	GRIT SIZE	BOND	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
SP1V1	100x10x12	20	20	D54	Q-FluteXL⁴⁰	C	7958763630
SP1V1	100x10x10	30	20	D54	Q-FluteXL⁴⁰	C	7958762522
SP1V1	100x12x14	10	20	D54	Q-FluteXL⁴⁰	C	7958755459
SP1V1	125x10x14	10	20	D54	Q-FluteXL⁴⁰	C	7958763554
SP1V1	125x10x13	15	20	D54	Q-FluteXL⁴⁰	C	7958763555
SP1V1	125x15x10	20	20	D54	Q-FluteXL⁴⁰	C	7958762965
SP1V1	150x12x11	20	20	D54	Q-FluteXL⁴⁰	C	7958755445

Delivery time approx. 5 working days after receipt of order.

These tables show only examples of possible dimensions that can be produced from semi-finished parts! Other dimensions on request. Delivery time approx. 5 working days with availability of semi-finished parts also for non-listed dimensions.

ROUND TOOLS FLUTE GRINDING

DRESSING ON THE PRODUCTION MACHINE

Each tool change on a grinding machine causes a degree of run-out and positional error, which can produce small deviations from the nominal tool geometry. Demands made on the accuracy of round tools, however, are constantly increasing. Norton WINTER Q-Flute grinding wheels are the solution to this problem. Q-Flute technology combines innovative flute grinding with the precise touch dressing process.

This innovative technology enables considerable quality improvements to the main and minor cutting edges, without adversely affecting grinding performance. By regularly regenerating the wheel topography, tighter tolerances and fully automatic shift operations are possible.

AREAS OF APPLICATION

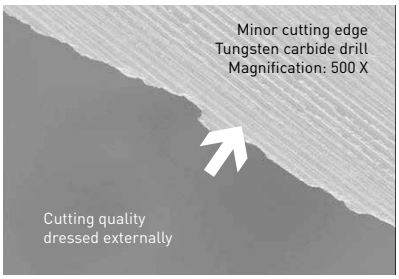
Norton WINTER Q-Flute grinding wheels finding their areas of application att all applications where high MRR are required.

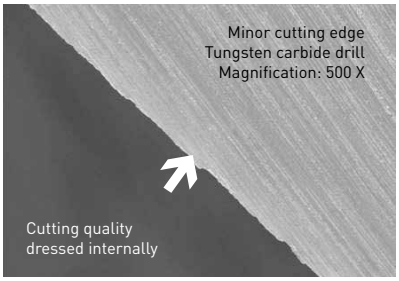
NORTON WINTER Q-FLUTE EXAMPLES OF USE

CASE STUDY 1:

Q-FLUTE²

GRINDING WHEEL	D54 Q-Flute²
DRESSER	Norton WINTER DDS Roller dresser
MACHINE	Walter Helitronic
COOLANT	Oil
WORK PIECE	TC end mill Ø 16 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 150 mm/min
DEPTH OF CUT	a_e = 3.5 mm
CUTTING SPEED	v_c = 18 m/s
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 8.75 mm³/mm · s
DRESSING PARAMETERS	
SPEED RATIO	q_d = 0.9
OVERLAP RATE	U_d = 3
DRESSING INFEED	a_{ed} = 2x3 µm





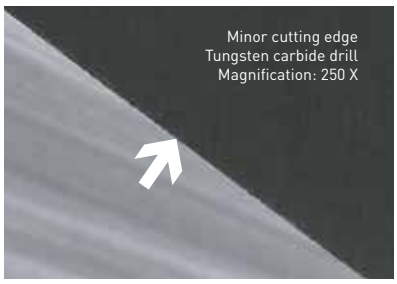
BENEFITS

- Very good cutting quality
- Maximum profile accuracy
- Tightest tolerances

CASE STUDY 2:

Q-FLUTE XL⁴⁰

GRINDING WHEEL	D46 Q-FluteXL⁴⁰
DRESSER	Walter Helitronic
COOLANT	Oil
WORK PIECE	TC drill, Ø 10 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 200 mm/min
DEPTH OF CUT	a_e = 3.5 mm
CUTTING SPEED	v_c = 18 m/s

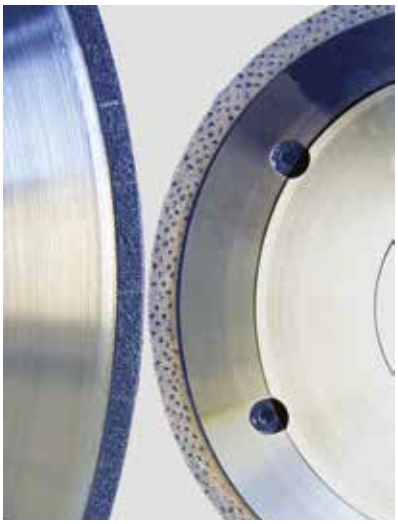


NORTON WINTER DIAMOND DRESSING SYSTEM (DDS)

The Diamond Dressing System (DDS) allows CNC dressing of diamond grinding wheels directly on production grinders.

Despite the extreme hardness of diamond in both cases, the same physical correlations are found when dressing "softer" abrasive materials such as Al_2O_3, SiC, SG, TG and cBN.

Even when dressing specifically designed diamond grinding wheels with the DDS roller dresser, the result can be influenced by overlap rate and speed ratio.



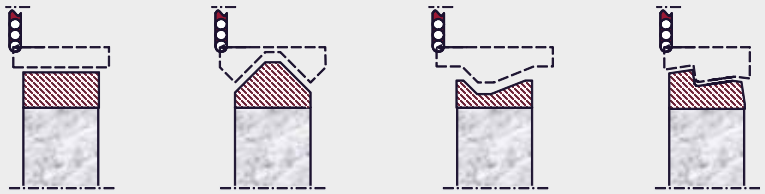
DRESSING PARAMETERS

Speed ratio:	q_d = 0.6...0.9
Overlap rate:	U_d = 2...6
Dressing infeed:	a_{ed} = 1...5 µm

PROFILE EXAMPLES

CNC-precision dressing
on the production machine

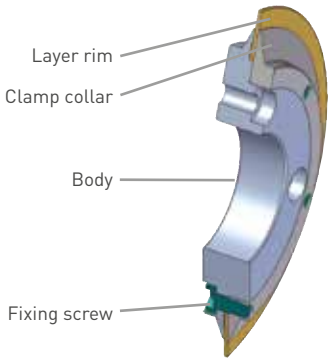
- greater profile accuracy
- very easy to automate
- dressing with production speeds



CHARACTERISTICS

The DDS diamond CNC dresser consists of a single sintered diamond layer, which is clamped in a two-piece steel holder. This ensures a constant layer width with a consistently high active diamond content throughout its entire lifetime. The design permits the highest possible degree of flexibility when dressing different profiles in a single working cycle. The only requirement is a grinding machine with CNC dressing spindle and an acoustic emission contact sensor.

With this dressing system, a broad range of different profiles can be created in a single working step.



PLEASE NOTE

Further information and types of form rollers for CNC dressing can be found in catalogue no. 5 'Dressing tools'.

PRECISION FLUTE GRINDING FOR MINI AND MICRO TOOLS

As well as innovation in new materials and tool designs, the recent trend towards miniaturisation has become considerably more important.

From mini- and micro- down to nano tools, nowadays tools with outer diameters below 0.1 mm are no longer exceptional. The production of these tools demands special grinding wheels with very small and stable edge radii.

Resin bonded grinding wheels are competing against metal bonded versions which are considerably slower by comparison (approx. 50% of the feed rate of resin bonds) but they are characterized by greater edge stability. Metal bonded grinding wheels achieve a dressing interval up to five times longer.

The decision whether to use resin bonds or metal bonds is often a matter of personal preference. It is a question of process control whether profile retention with slower feed rates or high output with high feed rates will be cost-effective.

The Norton WINTER range therefore consists of metal bonds with great edge stability (BZ bonds for diamond and MSS bonds for cBN) as well as resin bonds with perfect edge stability which are marketed under µicro⁺ brand. The tools of the Norton WINTER µicro⁺ range are grinding wheel systems that have been specifically developed for these requirements, which despite fast feed rates are characterised by their perfect edge stability compared to traditional resin bonds.

AREAS OF APPLICATION

Classic areas of application are mini and micro drills and end mills for electronics, medical technology and automotive industry. In addition, these grinding wheels can be used for similar metal removal tasks, e.g. burrs.

RECOMMENDATIONS DIAMOND

Ø 0.05 mm - 0.75 mm	D10...D20A	µicro⁺6013	C125
Ø 0.75 mm - 2 mm	D20A...D25	µicro⁺6015	C125
Ø 0.75 mm - 2 mm	D20A...D46	BZ480	C125
Ø 2 mm - 4 mm	D33...D46	µicro⁺6065	C125

RECOMMENDATIONS CBN

Ø 0.75 mm - 2 mm	B15...B35	µicro⁺6005	V300
Ø 0.75 mm - 2 mm	B25...B46	MSS444	V240
Ø 2 mm - 4 mm	B39...B64	SP4006T	V240

NORTON WINTER µICRO⁺ EXAMPLES OF USE

APPLICATION EXAMPLE 1

GRINDING TOOL	D46 µicro⁺ 6065 C135 A
GRINDING MACHINE	Kirner K360
COOLANT	Oil
WORK PIECE	Tungsten carbide burr, Ø 6 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 125 mm/min
INFEED	a_e = ca. 0.4 mm
CUTTING SPEED	v_c = 35 m/s
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 0.83 mm³/mm · s

BENEFITS

- Up to 300% increase in feed rate
- Impressive increase in capacity
- Huge reduction in costs

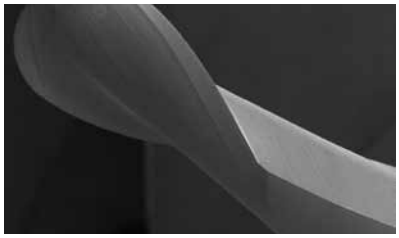
APPLICATION EXAMPLE 2

GRINDING TOOL	D15B µicro⁺ 6055 C125 A
GRINDING MACHINE	Rollomatic 620XS
COOLANT	Oil
WORK PIECE	Tungsten carbide drill, Ø 0.8 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 40 mm/min
INFEED	a_e = 0.3 mm
CUTTING SPEED	v_c = 25 m/s

BENEFITS
- 45% cycle time reduction
- Perfect edge quality
- Longer dressing intervals

APPLICATION EXAMPLE 3

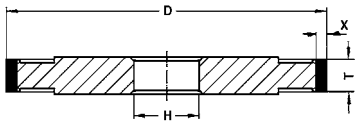
GRINDING TOOL	D15B µicro⁺ 6055 C125 E
GRINDING MACHINE	Rollomatic Nano6
COOLANT	Oil
WORK PIECE	Tungsten carbide end mill, Ø 0.05 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 0.8mm/min
INFEED	a_e = 0.015 mm
CUTTING SPEED	v_c = 25 m/s



BENEFITS
- Good dressability
- Very good surface quality
- Maximum profile accuracy

STANDARD FLUTE GRINDING

1A1/14A1 STOCK PROGRAMME

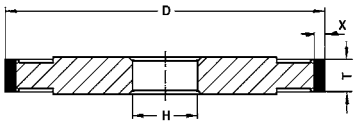


SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
K1A1	75x3x5	20	D46	K+920	C100	A	60157643388
K1A1	75x10x5	20	D64	K+1421R	C100	H	66260339426
K1A1	100x10x5	20	D64	K+1421R	C100	H	66260339422
K1A1	100x12x5	20	D64	K+1421R	C100	H	66260347629
K1A1	100x15x5	20	D64	K+1421R	C100	H	66260339419
K1A1	125x5x10	20	D64	K+1421R	C100	A	66260350079
K1A1	125x5x15	20	D126	K+921	C100	A	66260131770 [2]
K1A1	125x6x15	20	D64	K+921	C100	A	66260132044
K1A1	125x8x15	20	D64	K+921	C100	A	66260131843
K1A1	125x10x10	20	D64	K+1421R	C100	A	66260341750
K1A1	125x10x15	20	D64	K+921	C100	A	66260374178
K1A1	125x12x10	20	D64	K+1421R	C100	A	66260352659
1K14A1	150x2.3x7	50	D151	K+920	C100	A	66260129975 [1]
3K14A1	150x3.6x6	32	D151	K+920	C100	A	66260130484
K1A1	150x12x10	20	D64	K+1421R	C100	A	66260352657

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

ROUND TOOLS FLUTE GRINDING

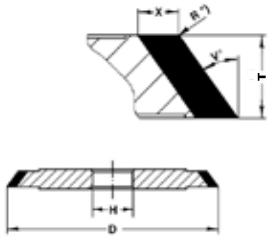
1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS							
K1A1	75x10x5	20	B107	KSS12N	V240	H	66260352656 [1]
K1A1	100x10x5	20	B107	KSS12N	V240	H	66260352654
K1A1	100x15x5	20	B107	KSS12N	V240	H	66260347909
K1A1	125x6x5	20	B107	KSS12N	V240	A	66260118167 [1]
K1A1	125x10x5	20	B107	KSS12N	V240	A	66260352653
K1A1	150x12x5	20	B107	KSS12N	V240	A	66260352652

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

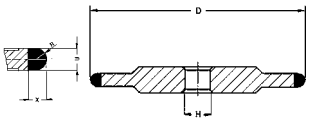
1V1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	V (°)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	COM-MENT
DIAMOND GRINDING WHEELS									
1K1V1	75x10x5	10	20	D64	K+1421R	C100	H	66260339433	
1K1V1	100x10x5	10	20	D64	K+1421R	C100	H	66260339432	
1K1V1	100x15x5	10	20	D64	K+1421R	C100	H	66260339431 [1]	
K1V1	100x15x5	20	20	D64	K+1421R	C100	H	66260347907 [1]	
K1V1	100x15x5	30	20	D64	K+1421R	C100	H	66260342813	
1K1V1	125x6x5	20	20	D64	K+1421R	C100	A	66260117593 [1]	R = 0.2 [3]
1K1V1	125x10x5	10	20	D64	K+1421R	C100	A	66260352633 [1]	
3K1V1	125x10x5	20	20	D64	K+1421R	C100	A	66260346267 [1]	R = 0.5 [3]
1K1V1	125x10x5	30	20	D64	K+1421R	C100	A	66260115545 [1]	
1K1V1	125x15x5	10	20	D64	K+1421R	C100	A	66260352641 [1]	
1K1V1	125x15x5	20	20	D64	K+1421R	C100	A	66260345983 [1]	R = 0.9 [3]
K1V1	125x15x5	30	20	D64	K+1421R	C100	A	66260352640 [1]	
K1V1	150x12x5	15	20	D64	K+1421R	C100	A	66260119886 [1]	
CBN GRINDING WHEELS									
1K1V1	100x10x5	10	20	B107	KSS12N	V240	H	66260127891 [1]	
1K1V1	100x15x5	10	20	B107	KSS12N	V240	H	66260116353 [1]	
K1V1	100x15x5	20	20	B107	KSS12N	V240	H	66260115554 [1]	
K1V1	100x15x5	30	20	B107	KSS12N	V240	H	66260115756 [1]	
1K1V1	125x12x5	10	20	B107	KSS12N	V240	A	66260119462 [1]	
K1V1	150x12x5	15	20	B107	KSS12N	V240	A	66260127964 [1]	

[1] Delivery time 5 - 6 weeks
[3] Typically for Hertel SE Drill

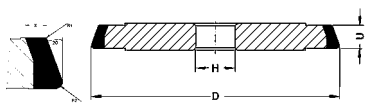
14F1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	R (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	COM-MENT
DIAMOND GRINDING WHEELS									
1K14F1	100x4x6	2	20	D64	K+1421R	C100	H	66260339416	
K14F1	125x3x5	1.5	20	D64	K+1421R	C100	H	66260114821	
1K14F1	150x1x5	0.5	20	D64	K+888TY	C125	A	66260116538	
K14F1	150x2x5	1	20	D64	K+888R	C100	A	66260348744	3)
1K14F1	150x3x7	1.5	20	D126	K+920	C100	A	66260133404	
K14F1	150x4x5	2	20	D64	K+1421R	C100	A	66260351943 1)	3)
K14F1	150x5x7	2.5	20	D64	K+1421R	C100	A	66260129473 1)	
17K14F1	200x2x7	1	20	D64	K+920	C100	E	60157695294	
4K14F1	200x3x7	1.5	20	D126	K+920	C100	E	66260381129	
		1.5	20	D151	K+1313RY	C100	E	66260134511	
2K14F1	200x5x7	2.5	20	D126	K+920	C100	A	66260136115	
		2.5	20	D151	K+1313RY	C100	A	66260132727 1)	
		2.5	20	D252	K+920	C100	A	66260132184 1)	
CBN GRINDING WHEELS									
K14F1	100x3x5	1.5	20	B107	KSS12N	V240	A	66260340210	
K14F1	100x4x5	2	20	B107	KSS12N	V240	A	66260116260	
1K14F1	100x4x5	2	20	B151	KSSJY-63	V240	H	60157643640 1)	
3K14F1	125x4x5	2	20	B107	KSS12N	V240	A	66260352649 1)	
K14F1	150x4x5	2	20	B107	KSS12N	V240	A	66260352648 1)	
17K14F1	200x2x7	1	20	B64	KSS007N-63	V180	E	60157695901	
4K14F1	200x3x7	1.5	20	B181	KSS007N-63	V180	E	66260133528	
2K14F1	200x5x7	2.5	20	B181	KSS007N-63	V180	A	60157695651	

1) Delivery time 5 - 6 weeks
3) Typically for Hertel SE Drill

700 DELIVERY PROGRAMME

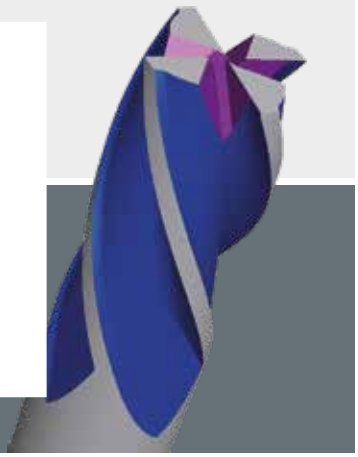


SHAPE	DxUxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	COMMENT
DIAMOND GRINDING WHEELS								
2K700	125x6x3	20	D46	K+1421R	C100	H	66260119545 1)	"Drill 3) Ø 3...6"
2K700	125x10x5	20	D46	K+1421R	C100	A	66260384095 1)	"Drill 3) Ø 6...8"
1K700	125x12x5	20	D46	K+1421R	C100	A	66260352647 1)	"Drill 3) Ø 8...11"
1K700	125x16x5	20	D46	K+1421R	C100	H	66260384094 1)	"Drill 3) Ø 11...15"
1K700	125x22x5	20	D46	K+1421R	C100	A	66260127878 1)	"Drill 3) Ø 15...20"

1) Delivery time 5 - 6 weeks
3) Typically for Hertel SE Drill

DIAMOND & CBN GRINDING WHEELS FOR GASHING

Gashing reduces the width of the chisel edge of a drill or end mill in order to reduce the forces during subsequent use of the tool. 12V9 wheels or pointed 1V1 / 14V1 wheels are generally used (the typical angle is 45°). Occasionally, 1A1 and 11V9 wheels are used. The advantage of 1V1 wheels over 12V9 wheels is a more rigid body.



SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
V-PRIME	↑	Innovative high-performance resin bond for gashing and grinding of clearance angles
V-Pro4073		High-performance resin bond for gashing and grinding of clearance angles
Q-Flute²		High-performance resin bond for flute grinding
K+980		More wear-resistant, resin bond with high edge stability
K+921		More wear-resistant resin bond preferably wet grinding
K+1421R		Standard resin bond for CNC applications
K+888R		Universal resin bond for dry grinding
K+1410		Free-grinding resin bond for dry grinding

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
V-PRIME	↑	Innovative high-performance resin bond for gashing and grinding of clearance angles
V-Pro4073		High-performance resin bond for gashing and grinding of clearance angles
KSS980		More wear-resistant, resin bond with high edge stability
KSSJY		Universal resin bond for wet grinding
KSS12N		Standard resin bond for CNC applications

STANDARD DIMENSIONS FOR GASHING

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers	Tungsten Carbide HSS Cermet	All CNC tool grinding machines	1A1, 1V1 Ø 50...150 T 3...30 X 5...15	Q-Flute² V-Pro K+ / KSS bonds	Oil Emulsion

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers	Tungsten Carbide HSS Cermet	All CNC tool grinding machines	12V9 Ø 50...150 W 2...3 X 6...10	V-Pro K+ / KSS bonds	Oil Emulsion

Other dimensions on request

INNOVATIVE GASHING WITH V-PRIME & V-PRO

Norton WINTER V-PRIME is the new and improved version of V-PRO wheels for round tool grinding, delivering the ultimate edge stability.

V-PRIME has been designed to provide excellent edge stability in gashing. In today's challenging economic environment, it is more important than ever to maintain constant wheel geometry for as long as possible, without the need for correction, as this enables increased output and improved quality. The new V-PRIME can be easily implemented without any machine or process adjustments, offering manufacturers immediate improvements. The well-known and approved Norton WINTER V-Pro will be kept for applications where a hard-brittle hybrid bond is preferred.

With V-PRIME and V-Pro, Norton WINTER now offers the perfect solution for every application problem to design an optimum process with the shortest cycle times and longest life times.

Apart from 12V9 grinding wheels, V-PRIME and V-Pro are available in other geometries for gashing of round tools

APPLICATION EXAMPLE - GASHING OF Ø 12mm TUNGSTEN CARBIDE END MILL

GRINDING TOOL	D64 V-PRIME5406
GRINDING MACHINE	ANCA MX7 Linear
COOLANT	Oil
WORK PIECE	Tungsten carbide end mill, Ø 12mm
GRINDING PARAMETERS	
FEED RATE	v_f = 100 mm/min
INFEED	a_e = ≈1.3 mm
CUTTING SPEED	v_c = 22 m/s

BENEFITS

- ≈20% reduction of grinding time
- Significant cost savings
- Faster machine set-up with easier wheel preparation

APPLICATION EXAMPLE - GASHING OF TUNGSTEN CARBIDE DRILLS

GRINDING TOOL	D64 V-Pro4073 C125 A
GRINDING MACHINE	ANCA TX7+
COOLANT	Oil
WORK PIECE	Tungsten carbide drill, Ø 9mm
GRINDING PARAMETERS	
FEED RATE	v_f = 60 mm/min
INFEED	a_e = 0.5 mm
CUTTING SPEED	v_c = 18 m/s

BENEFITS

- Reduction of down time through increased dressing intervals
- 25% reduction of grinding time
- Considerable improvement of productivity

ROUND TOOLS GASHING

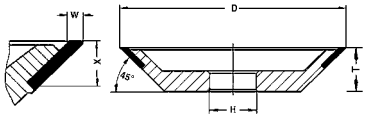
APPLICATION EXAMPLE–RE-GRINDING OF HSS END MILLS

GRINDING TOOL	B107 V-Pro4073 V300 A
GRINDING MACHINE	Schneeberger Norma
COOLANT	Oil
WORK PIECE	HSS end mill, Ø 35mm
GRINDING PARAMETERS	
FEED RATE	v_f = 40 mm/min
INFEED	a_e = 1.5 mm
CUTTING SPEED	v_c = 35 m/s

BENEFITS

- Very good edge stability and lifetime
- 30% reduced grinding time
- Significantcost savings

12V9 STOCK PROGRAMME

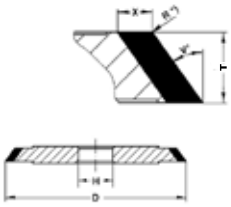


SHAPE	DxWxX (mm)	T (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
3K12V9	100x3x10	20	20	D46	V-PRIME5406		H	66260167741
		20	20	D64	V-PRIME5406		H	66260165036
4SP12V9	100x3x10	20	20	D46	V-Pro4073	C125	A	7958711384
		20	20	D64	V-Pro4073	C125	A	69014147396
5K12V9	125x3x10	25	20	D46	V-PRIME5406		H	66260165639
		25	20	D64	V-PRIME5406		H	66260165037
1SP12V9	125x3x10	25	20	D46	V-Pro4073	C125	A	7958709321
		25	20	D64	V-Pro4073	C125	A	69014144422
CBN GRINDING WHEELS								
4SP12V9	100x3x10	20	20	B107	V-Pro4073	V300	A	7958722543
1SP12V9	125x3x10	25	20	B107	V-Pro4073	V300	A	7958710238

11V9 V-Pro and V-Prime grinding wheels ex stock are shown in the next section „clearance angle grinding" of this chapter.

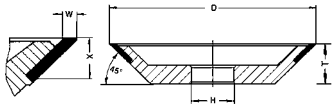
GRINDING WHEELS FOR GASHING

1V1 / 14V1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	V (°)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
SP1V1	100x10x6	45	20	D54	Q-Flute²		A	66260129991 *)
K1V1	100x10x10	45	20	D64	V-PRIME5406		A	66260174928
K1V1	100x15x5	45	20	D64	K+1421R	C100	H	66260352665 2)
1K1V1	125x10x5	45	20	D64	K+1421R	C100	A	66260352664
SP1V1	125x10x6	45	20	D54	Q-Flute²		A	66260115514 *)
K1V1	125x10x10	45	20	D64	V-PRIME5406		A	66260176643
K1V1	125x15x5	45	20	D64	K+1421R	C100	A	66260352639 1)
CBN GRINDING WHEELS								
K1V1	100x15x5	45	20	B107	KSS12N	V240	H	66260352663 1)
1K1V1	125x12x5	45	20	B107	KSS12N	V240	A	66260352661

12V9 STOCK PROGRAMME



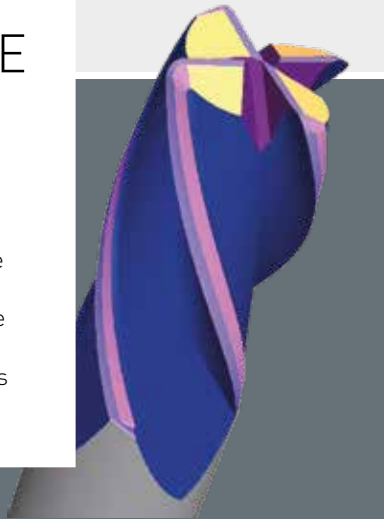
SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
2K12V9	50x2x6	20	19	45	D64	K+1421R	C100	A	66260128817
3K12V9	75x2x10	20	20	45	D64	K+1421R	C100	H	66260338583
2K12V9	75x3x10	20	20	45	D64	K+1421R	C100	H	66260352673
6K12V9	100x2x10	20	20	45	D64	K+1421R	C100	H	66260344811
3K12V9	100x3x10	20	20	45	D64	K+1421R	C100	H	66260339437
		20	20	45	D126	K+888R	C100	H	66260128545
9K12V9	125x2x10	20	25	45	D64	K+1410	C125	H	69014182731
	125x3x10	20	25	45	D64	K+980-42	C125	H	60157672850 1)
	150x3x10	20	25	45	D91	K+921	C125	H	66260383462
5K12V9	125x3x10	20	25	45	D64	K+1421R	C100	H	66260334260
5K12V9	150x3x10	20	25	45	D64	K+1421R	C100	H	66260117874
CBN GRINDING WHEELS									
3K12V9	75x2x10	20	20	45	B107	KSS12N	V240	H	66260352670
6K12V9	100x2x10	20	20	45	B107	KSS12N	V240	H	66260352669
		20	20	45	B107	KSS980-60	V240	H	60157685426
1K12V9	100x3x15	20	20	45	B107	KSS12N	V240	H	66260352668
		20	20	45	B151	KSSJY-77	V240	H	60157642984
9K12V9	125x2x10	20	25	45	B107	KSS980-60	V240	H	60157685183
5K12V9	125x3x10	20	25	45	B107	KSS12N	V240	H	66260354629
6K12V9	125x3x15	20	25	45	B107	KSS12N	V240	H	66260352667
		20	25	45	B151	KSSJY-77	V240	H	66260128064

Besides gashing, the items listed on these pages are also suitable for flute grinding, clearance grinding and radius sharpening depending on machine software.

*) Delivery time approx. 5 working days after receipt of order.
1) Delivery time 5 - 6 weeks
2) Available while stocks last

DIAMOND & CBN GRINDING WHEELS FOR CLEARANCE ANGLE GRINDING

Grinding clearance angles on the cutting edge of a tool reduces the contact area between the tool and the workpiece during drilling or milling processes. One or two clearance angles are usually ground on the face. Up to two clearance angles / clearances can be produced on the circumference; on some tools these take the form of radial clearance grinding. For grinding clearance angles 11V9 cup wheels or similar geometries are typically used. Our extensive standard range can be found on the following pages of this catalogue. 12V9 or surface grinding wheels are also used. Compatible tools with these geometries are listed in the chapters on flute grinding and gashing.



SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
V-PRIME	↑	Innovative high-performance resin bond for gashing and grinding of clearance angles
V-Pro4073		High-performance resin bond for gashing and grinding of clearance angles
K+980		More wear-resistant, resin bond with high edge stability
K+921		More wear-resistant resin bond preferably wet grinding
K+1421R		Standard resin bond for CNC applications
K+888R		Universal resin bond for dry grinding
K+1410		Free-grinding resin bond for dry grinding

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
V-PRIME	↑	Innovative high-performance resin bond for gashing and grinding of clearance angles
V-Pro4073		High-performance resin bond for gashing and grinding of clearance angles
KSS980		More wear-resistant, resin bond with high edge stability
KSS12N		Standard resin bond for CNC applications

STANDARD DIMENSIONS FOR THE GRINDING OF CLEARANCE ANGLES

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers	Tungsten Carbide HSS Cermet	All CNC tool grinding machines	6A9, 11V9, 12A2, ... Ø 75...125 W 2...3 X 10	V-Pro K+ / KSS bonds	Oil Emulsion

Other dimensions on request

INNOVATIVE CLEARANCE ANGLE GRINDING WITH V-PRIME AND V-PRO

Norton WINTER V-PRIME is the new and improved version of V-PRO wheels for round tool grinding, delivering the ultimate edge stability.

V-PRIME has been designed to provide excellent edge stability in clearance angle grinding. In today's challenging economic environment, it is more important than ever to maintain constant wheel geometry for as long as possible, without the need for correction, as this enables increased output and improved quality. The new V-PRIME can be easily implemented without any machine or process adjustments, offering manufacturers immediate improvements.

The well-known and approved Norton WINTER V-Pro will be kept for applications where a hard-brittle hybrid bond is preferred.

With V-PRIME and V-Pro, Norton WINTER now offers the perfect solution for every application problem to design an optimum process with the shortest cycle times and longest life times.

Apart from 11V9 grinding wheels, V-PRIME and V-Pro are available in other geometries for clearance angle grinding of round tools.

APPLICATION EXAMPLE - CLEARANCE GRINDING OF Ø 12mm TUNGSTEN CARBIDE END MILL

GRINDING TOOL	D64 V-PRIME5406
GRINDING MACHINE	ANCA MX7 Linear
COOLANT	Oil
WORK PIECE	Tungsten carbide end mill, Ø 12mm
GRINDING PARAMETERS	
FEED RATE	v_f = 250 mm/min
INFEED	a_e = ≈0.3 mm
CUTTING SPEED	1st v_c = 22 m/s 2nd v_c = 18 m/s

BENEFITS

- ≈15% reduction of grinding time
- Significant cost savings
- Faster machine set-up with easier wheel preparation

APPLICATION EXAMPLE - CLEARANCE ANGLE (CIRCUMFERENCE)

GRINDING TOOL	D64 V-Pro4073 C125 A
GRINDING MACHINE	SAACKE
COOLANT	Oil
WORK PIECE	Tungsten carbide drills; Ø 11 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 120 mm/min
INFEED	a_e = 1.2 mm
CUTTING SPEED	v_c = 17 m/s

BENEFITS

- 2 times longer dressing interval
- Huge time savings
- Significant increase in productivity

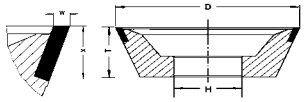
ROUND TOOLS CLEARANCE ANGLE GRINDING

APPLICATION EXAMPLE – CLEARANCE GRINDING (POINT RELIEF)

GRINDING TOOL	B107 V-Pro4073 V300 A
GRINDING MACHINE	Walter Helitronic
COOLANT	Oil
WORK PIECE	HSS-Fräser Ø.24 mm
GRINDING PARAMETERS	
FEED RATE	v_f = 120 mm/min
INFEED	a_e = app. 1 mm
CUTTING SPEED	v_c = 40 m/s

BENEFITS
- Fantastic lifetime
- Huge reduction of cycle time

11V9 STOCK PROGRAMME

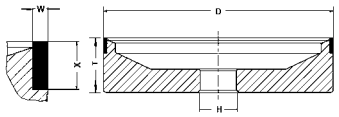


SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
2K11V9	75x3x10	20	30	D46	V-PRIME5406		H	66260173572
		20	30	D64	V-PRIME5406		H	66260165023
1SP11V9	75x3x10	20	30	D46	V-Pro4073	C125	A	7958711381
		20	30	D64	V-Pro4073	C125	A	7958708546
10K11V9	100x3x10	20	35	D46	V-PRIME5406		H	66260165042
		20	35	D64	V-PRIME5406		H	66260164307
3SP11V9	100x3x10	20	35	D46	V-Pro4073	C125	A	7958704895
		20	35	D64	V-Pro4073	C125	A	69014133000
11K11V9	125x3x10	20	40	D46	V-PRIME5406		H	66260178973
		20	40	D64	V-PRIME5406		H	66260168014
1SP11V9	125x3x10	20	40	D46	V-Pro4073	C125	A	7958711383
		20	40	D64	V-Pro4073	C125	A	7958709384
CBN GRINDING WHEELS								
1SP11V9	75x3x10	20	30	B107	V-Pro4073	V300	A	7958713361
3SP11V9	100x3x10	20	35	B107	V-Pro4073	V300	A	7958710236
2SP11V9	125x3x10	20	40	B107	V-Pro4073	V300	A	7958747439 [1]

12V9 V-Pro and V-Prime grinding wheels ex stock are shown in the previous section „gashing" of this chapter.
[2] Available while stocks last

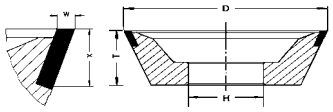
STANDARD GRINDING WHEELS FOR CLEARANCE ANGLE GRINDING

6A9 STOCK PROGRAMME



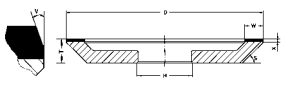
SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
11K6A9	100x3x10	20	30	D64	K+1421R	C100	H	66260339412
1K6A9	125x3x10	20	30	D126	K+920	C100	A	60157643461

11V9 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
7K11V9	75x2x10	20	30	D64	K+1421R	C100	H	66260338587
		20	30	D64	K+1410	C125	D	60157685425
2K11V9	75x3x10	20	30	D64	K+1421R	C100	H	66260347304
8K11V9	100x2x10	20	35	D64	K+1421R	C100	H	66260338586
		20	35	D64	K+1410	C125	H	69014163728
		20	35	D64	K+980-42	C125	H	66260324844
		20	35	D91	K+921	C125	H	66260383968
		20	35	D126	K+888R	C100	H	66260344473
10K11V9	100x3x10	20	35	D46	K+1421R	C100	H	66260346530 [1]
		20	35	D64	K+1421R	C100	H	66260334264
11K11V9	125x3x10	20	40	D64	K+1421R	C100	H	66260338584
CBN GRINDING WHEELS								
7K11V9	75x2x10	20	30	B107	KSS12N	V240	H	66260352681
		20	30	B107	KSS980-60	V240	H	60157685182
2K11V9	75x3x10	20	30	B107	KSS12N	V240	H	66260352679 [1]
8K11V9	100x2x10	20	35	B107	KSS12N	V240	H	66260352678
		20	35	B107	KSS980-60	V240	H	69014163185
10K11V9	100x3x10	20	35	B107	KSS12N	V240	H	66260352675
11K11V9	125x3x10	20	40	B107	KSS12N	V240	H	66260352674

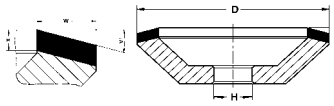
12A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS										
2K12A2	125x15x3	20	26	45	20	D46	K+1421R	C100	H	66260352597
CBN GRINDING WHEELS										
2K12A2	125x15x3	20	26	45	20	B91	KSS12N	V240	H	66260352593

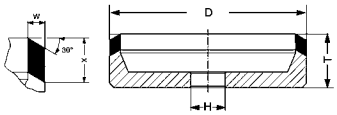
ROUND TOOLS CLEARANCE ANGLE GRINDING

12V5 STOCK PROGRAMME - „ONEPASS-WHEELS“



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
K12V5	100x10x5	20	28	20	D46	K+1421R	C100	H	66260352645
CBN GRINDING WHEELS									
K12V5	100x10x5	20	28	20	B91	KSS12N	V240	H	66260127380

6V5 STOCK PROGRAMME - „ONEPASS-WHEELS“



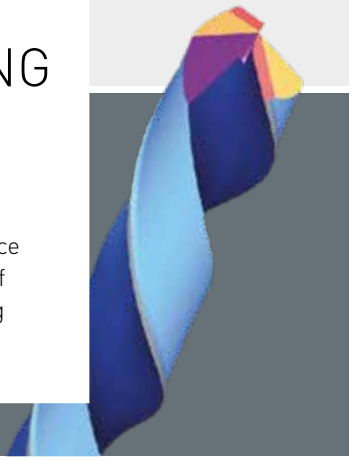
SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
6V5	100x4.5x10	20	34	30	D64	K+1421R	C100	H	66260370517
CBN GRINDING WHEELS									
1K6V5	100x4.5x10	20	34	30	B107	KSS12N	V240	H	66260370513 [1]

[1] Delivery time 5 - 6 weeks

Apart from grinding clearance angles, the items listed on these pages are also suitable for flute grinding, OD grinding, gashing, radial clearance grinding and radius sharpening, depending on the machine software.

DIAMOND & CBN GRINDING WHEELS FOR UNIVERSAL GRINDING

Universal grinding tasks include all the applications on universal tool grinding machines. Grinding wheels for grinding and re-sharpening of different tools are listed. Depending on the type of bond, the grinding wheels are suitable for either / or dry and wet grinding. According to the tool type and machine type, different geometries are required. Different types of cup wheels and several surface grinding wheels are listed on the following pages. Detailed information on fields of application is shown below each table. 1A1 grinding wheels for OD and ID grinding are listed in the 'Mould and Die' chapter.



SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
BZ560		Metal bond for wet and dry grinding
M+789		Special bond for tungsten carbide-steel combination grinding, dry
K+1414R		Resin bond for tungsten carbide-steel combination grinding, dry
K+1414N		Resin bond for tungsten carbide-steel combination grinding, dry
K+1414J		Resin bond for tungsten carbide-steel combination grinding, dry
K+888RY		Universal resin bond for wet grinding
K+888NY		Universal resin bond for wet grinding
K+888R		Universal resin bond for dry grinding
K+888N		Universal resin bond for dry grinding
K+888J		Universal resin bond for dry grinding
K+888F		Fine-grit resin bond for polish grinding
K+1410		Free-grinding resin bond for dry grinding
K+777R		Universal resin bond for fine-grain applications
K+777N		Universal resin bond for fine-grain applications
K+777J		Universal resin bond for fine-grain applications
KR250		Free-grinding resin bond, wet/dry grinding
K+730		Very free-grinding fine-grain bond, dry grinding possible

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KSS920		More wear-resistant resin bond also dry grinding
KSSTY		Universal resin bond for wet grinding
KSSRY		Universal resin bond for wet grinding
KSS12		Standard resin bond for CNC applications
KSS10N		Universal resin bond for tool grinding
KSS10J		Universal resin bond for tool grinding
KR102		Free-grinding resin bond for wet grinding
KSS007		Free-grinding resin bond for dry grinding and under oil
KSS1065		Particularly free-grinding dry grinding bond

ROUND TOOLS UNIVERSAL GRINDING

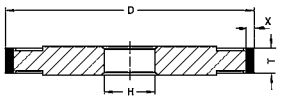
STANDARD DIMENSIONS FOR MANUAL GRINDING

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers Cutting chisels Gravers	Tungsten carbide HSS Cermet	All universal tool grinding machines	1A1, 14A1, 14F1,... Ø 75..125 U 2...4.4 X 3...6	Various bonds (see above)	Dry Emulsion

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Drills End mills Reamers Cutting chisels Gravers	Tungsten carbide HSS Cermet	All universal tool grinding machines	4A2, 11V9, 12A2,... Ø 75...175 W 3...10 X 1...10	Various bonds (see above)	Dry Emulsion

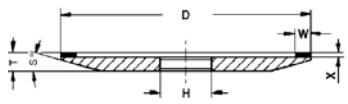
Other dimensions on request

1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
K1A1	100x6x10	20	D64	K+888R	C50	A	66260131547
K1A1	100x10x4	20	D126	K+1414N	C100	A	66260127052
APPLICATION For grinding tungsten carbide and carbide-tipped tools, for example OD grinding. Suitable for use on universal tool grinding machines.							
CBN GRINDING WHEELS							
K1A1	100x10x2	20	B126	KSSRY	V180	H	66260136247
K1A1	125x10x2	20	B126	KSS10N	V120	H	66260134925 [1]
APPLICATION For grinding HSS tools, for example OD grinding. Suitable for use on universal tool grinding machines.							

4A2 STOCK PROGRAMME

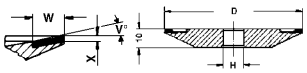


SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
K4A2	100x6x2	20	8	15	D64	K+888N	C50	H	66260137071 [1]
6K4A2	125x5x2	20	10	15	D46	K+888J	C50	H	60157643448
		20	10	15	D64	K+888R	C50	H	60157643256
1K4A2	125x6x2	20	10	15	D46	K+1410	C75	H	66260115833
		20	10	15	D64	K+1410	C100	H	66260128030
K4A2	150x5x4	20	13	15	D64	K+888N	C50	H	60157643184
K4A2	175x5x4	20	13	15	D64	K+888N	C50	H	60157643327
CBN GRINDING WHEELS									
K4A2	100x4x2	20	8	15	B107	KSS10N	V120	H	60157642646 [1]
K4A2	125x4x2	20	9	15	B107	KSS10N	V120	H	60157642812 [1]
K4A2	125x5x4	20	11	15	B126	KSS10J	V120	H	60157642977 [1]
3K4A2	150x3x2	20	17	20	B151	KSSRY	V240	A	66260134960 [1]
K4A2	150x4x2	20	11	15	B107	KSS10N	V120	H	60157642791
K4A2	175x5x4	20	13	15	B126	KSS10J	V120	H	60157643668
K4A2	200x6x2	20	11	15	B107	KSS10J	V120	H	60157643223 [1]

[1] Delivery time 5 - 6 weeks

APPLICATION
For face grinding, T < 10 mm: especially for narrow chip space. Suitable for universal tool grinding machines.

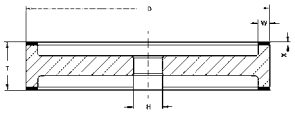
4V4 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS										
1K4V4	100x6x1	20	10	25	10	B151	KSSTY	V180	A	66260135829

APPLICATION For face grinding

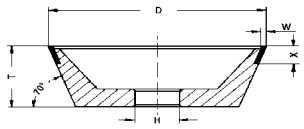
9A3 DELIVERY PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
1K9A3	175x5x2	20	30	D64	K+888N	C50	A	66260112486 [1]
		20	30	D126	K+888N	C75	A	66260116615 [1]
K9A3	175x8x2	20	35	D46	K+888NY	C31	A	66260136275 [1]
		20	35	D64	K+888NY	C31	A	66260134834 [1]

APPLICATION For grinding carbide-tipped cutters

11V9 STOCK PROGRAMME



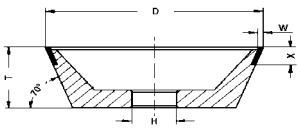
SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
K11V9	75x2x10	20	30	D15C	K+888R	C50	H	66260111375
		20	30	D46	K+888R	C75	D	66260128403
		20	30	D64	K+888R	C75	D	60157644128
		20	30	D64	K+888R	C75	D	66260136470
		20	30	D126	K+888R	C75	D	66260135883
K11V9	100x2x10	20	35	D15A	K+777R	C75	H	66260110921
		20	35	D64	K+888R	C75	D	60157642864
		20	35	D64	K+888R	C75	H	60157642816
		20	35	D91	K+888R	C75	D	60157642783
		20	35	D126	K+888R	C75	D	66260137065
		20	35	D126	K+1414J	C75	D	66260100363
		20	35	D126	K+1414N	C75	D	60157643573
		20	35	D151	K+1410	C75	D	66260129623
K11V9	100x3x10	20	35	D46	K+1414N	C75	D	60157643080
		20	35	D64	K+888R	C75	D	60157643467
		20	35	D91	K+888R	C75	D	66260134899
		20	35	D126	K+888R	C75	D	60157642950
		20	35	D126	K+1410	C75	D	66260136164
		20	35	D126	K+1414N	C75	D	66260134959
		20	35	D151	K+1410	C75	D	66260355670

[1] Delivery time 5 - 6 weeks

APPLICATION
For grinding tungsten carbide and carbide-tipped tools, gashing and grinding of clearance angles.
For use on universal tool grinding machines, dry and wet. Also for graver grinding machines.

ROUND TOOLS UNIVERSAL GRINDING

11V9 STOCK PROGRAMME

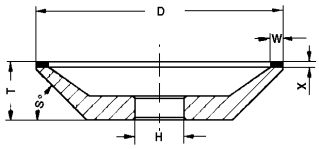


SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
M11V9	95.3x3.2x9.3	20	35	D91	M+789	C50	D	60157642796
		20	35	D126	M+789	C50	D	66260136404
		20	35	D126	M+789	C75	D	60157643011
M11V9	95.3x3.2x9.3	31.75	35	D151	M+789	C75	D	7958739858 [2]
M11V9	125x3x10	20	40	D126	M+789	C75	D	60157643328
CBN GRINDING WHEELS								
K11V9	75x2x6	20	30	B181	KSS007N	V180	D	60157643817 [*]
K11V9	75x2x10	20	30	B126	KSS10N	V180	D	60157643665
		20	30	B181	KSS007N	V180	D	66260136571 [*]
K11V9	75x3x10	20	30	B126	KSS10N	V180	D	60157643113
		20	30	B126	KSS007N	V180	D	60157643642 [*]
		20	30	B126	KSS10N	V180	D	60157643300
		20	30	B151	KSS1066-63	V180	H	66260355615
		20	30	B181	KSS007N	V180	D	66260135739 [*]
		20	30	B181	KSS007N-63	V180	D	60157642872 [*]
K11V9	100x3x10	20	35	B126	KSS10N	V180	D	60157643042
K11V9	125x2x10	20	40	B126	KSS10N	V180	H	60157643879
		20	40	B181	KSS007N	V180	D	66260135770 [*]

[*] KSS007N for high material removal rate at v_c > 30 m/s.
Infeed a_e = 0.05...0.15 mm
[2] Available while stocks last

APPLICATION
For grinding HSS tools, for gashing and grinding of clearance angles. For use on universal tool and graver grinding machines, dry and wet.

12A2 STOCK PROGRAMME

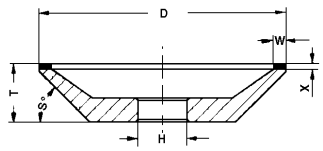


SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
1K12A2	75x3x4	20	24	45	D7	K+730	C50	B	60157643560
		20	24	45	D15B	K+777J	C50	B	66260135928
		20	24	45	D46	K+888J	C75	B	60157643552
		20	24	45	D64	K+888J	C75	B	66260136270
		20	24	45	D126	K+888R	C75	B	66260136273
K12A2	100x5x2	20	25	45	D46	K+888N	C50	H	60157643097
		20	25	45	D91	K+888R	C50	H	60157643285
		20	25	45	D91	K+888R-69	C50	A	66260147081
K12A2	100x6x4	20	27	45	D64	K+888R	C50	D	60157642582
		20	27	45	D126	K+888R	C75	B	60157642588
K12A2	100x10x2	20	25	45	D64	K+888J	C50	H	66260136330
		20	25	45	D126	K+888J	C50	H	60157642866
K12A2	100x10x4	20	27	45	D126	K+888N	C75	H	66260135975
K12A2	125x6x2	20	25	45	D46	K+888R	C50	H	60157642628
		20	25	45	D126	K+888R	C50	H	66260129825 [1]
K12A2	125x12.5x2	20	25	45	D64	K+888J	C50	H	60157642835
		20	25	45	D91	K+888J	C50	H	60157642684
		20	25	45	D126	K+888J	C50	H	60157642792
K12A2	150x15x2	20	25	45	D91	K+777N	C50	H	66260136459

[1] Delivery time 5 - 6 weeks

APPLICATION
For grinding tungsten carbide and carbide-tipped tools, e.g. reamers, gravers and cutters. For use on universal tool grinding machines, dry and wet grinding.

12A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
M12A2	75x3x4	20	24	45	D91	M+789	C50	A	60157643230
M12A2	100x6x4	20	27	45	D91	M+789	C50	H	60157642871 [2]
		20	27	45	D126	M+789	C50	H	60157642688

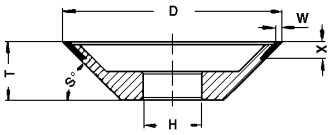
APPLICATION
For grinding tungsten carbide-tipped tools with up to 50% shank material. For use on universal tool and graver grinding machines, dry and wet grinding. Well suited for creep-feed grinding, e.g. for halving of gravers.

CBN GRINDING WHEELS									
1K12A2	75x3x4	20	24	45	B46	KSS10N	V180	H	60157643055
		20	24	45	B91	KSS10N	V180	H	66260135831
K12A2	100x5x2	20	12	20	B126	KSS10J	V120	H	66260136215 [1]
K12A2	100x5x2	20	25	45	B126	KSS10J	V120	H	60157643373
K12A2	150x5x2	20	18	20	B126	KSS10J	V120	H	66260134924
K12A2	175x5x4	20	22	20	B126	KSS10J	V120	H	66260128803
K12A2	200x5x4	20	24	20	B126	KSS10J	V120	H	66260127109

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

APPLICATION
For grinding HSS tools, especially cutting face. Suitable for use on universal tool grinding machines, dry and wet.

12V9 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
K12V9	75x2x6	20	20	45	D46	K+1414N	C75	D	66260110121
		20	20	45	D64	K+888R	C75	D	60157643020
K12V9	75x2x10	20	20	45	D15B	K+888F	C100	H	66260129105
2K12V9	75x2x10	20	25	45	D15C	K+777N	C75	D	66260116643
		20	25	45	D64	K+888R	C75	D	60157642957
		20	25	45	D91	K+888R	C75	D	66260132226
		20	25	45	D126	K+888R	C75	D	60157643465
K12V9	75x3x6	20	20	45	D46	K+1414N	C75	H	66260119257
K12V9	100x2x6	20	20	45	D151	K+888RY	C75	H	60157643322
K12V9	100x2x6	20	20	45	D91	K+888R	C75	H	66260114858 [2]
5K12V9	100x2x10	20	25	45	D46	K+888R	C75	D	66260118421
		20	25	45	D64	K+888R	C75	D	66260136069
		20	25	45	D126	K+888R	C75	D	60157643198
3K12V9	100x3x6	20	20	30	D91	K+888R	C75	A	66260107650

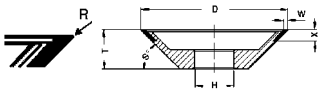
APPLICATION
For grinding tungsten carbide tools, gashing and grinding of cutting faces. For use on universal tool grinding machines, dry and wet.

CBN GRINDING WHEELS									
7K12V9	50x2x6	20	16	45	B126	KSS10N	V180	D	66260136491 [2]
K12V9	75x2x6	20	20	45	B126	KSS10N	V180	D	66260139893
2K12V9	75x2x10	20	25	45	B126	KSS10N	V180	D	66260136065

[2] Available while stocks last

ROUND TOOLS UNIVERSAL GRINDING

12V9 STOCK PROGRAMME



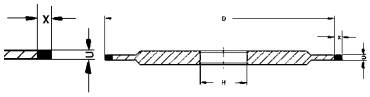
SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	R (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS										
3K12V9	75x3x6	20	20	45	1	B181	KSS007N	V180	D	60157643923 *)
K12V9	100x2x6	20	35	45	-	B126	KSS10N	V180	D	60157643398
5K12V9	100x2x10	20	25	45	-	B126	KSS10N	V180	D	60157643440
4K12V9	100x2x10	20	24	45	-	B181	KSS007N-63	V180	H	66260114593 *)
6K12V9	100x3x6	20	20	45	1	B181	KSS007N	V180	D	60157643800 *)
7K12V9	100x3x6	20	20	35	1	B181	KSS007N	V180	A	60157643335 *) 1)
1K12V9	100x3x15	20	22	45	-	B151	KSS007N-77	V180	H	60157642915 *) 1)
3K12V9	125x3x6	20	25	45	1	B181	KSS007N	V180	D	60157643131 *)
K12V9	125x3x10	20	25	45	-	B151	KSS007N-77	V180	D	66260112846 *)

*) KSS007N for high material removal rate at v_c > 30 m/s, infeed a_e = 0.05...0.15 mm

1) Delivery time 5 - 6 weeks

APPLICATION
For grinding HSS tools, e.g. cutting face and for gashing. Suitable for use on all universal tool grinding machines, wet and dry.

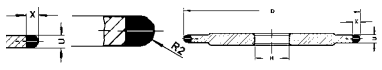
14A1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS							
1K14A1	75x2x6	20	D64	K+888R	C75	A	66260136218
K14A1	100x2x5	20	D76	K+1414N	C75	A	60157642932
		20	D126	K+888R	C75	A	66260113077

APPLICATION
For use on universal tool grinding machines, for gashing of tungsten carbide drills.

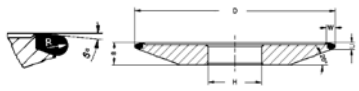
14F1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	R (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
K14F1	100x4x5	20	2	D107	K+888R	C100	H	66260136216

APPLICATION
For profile grinding of tungsten carbide tools.

700 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	R (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
1K700	75x2.2x3	20	1	5	D126	K+888R	C100	A	60157643225
1K700	100x2.2x3	20	1	5	D151	K+1414R	C100	A	60157643078 [1]
1K700	100x4.4x5	20	2	5	D126	K+888R	C100	A	60157643091 [1]

APPLICATION
For grinding spiral tungsten carbide tools, e.g. on NC tool grinding machines.

SHAPE	DxUxX (mm)	H (mm)	R (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS									
1K700	75x2.2x3	20	1	5	B126	KSS10N	V180	A	66260135767 [1]
		20	1	5	B151	KSSRY	V240	A	66260100354 [1]
1K700	100x2.2x3	20	1	5	B126	KSS10N	V180	A	60157643543 [1]
1K700	100x4.4x5	20	2	5	B126	KSS920	V180	A	60157643948 [1]
		20	2	5	B181	KSS007N	V180	A	60157642878 [2]
1K700	125x4.4x5	20	2	5	B126	KSS920	V180	A	66260135867
		20	2	5	B181	KSS007N	V180	A	60157642948 [1]

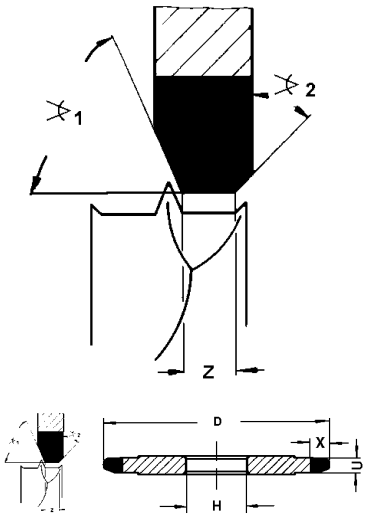
[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

APPLICATION
For grinding spiral HSS tools, e.g. on NC tool grinding machines. Reciprocating and creep-feed grinding. Suitable for cutting face grinding.

DIAMOND & CBN GRINDING WHEELS FOR SPECIAL TOOLS

This chapter provides an insight into special tools. It is impossible to itemize the wide variety of round tools in detail. If you require grinding tools for different operations, please contact us, we will find the best solution for you.

PROFILE GRINDING OF TUNGSTEN CARBIDE DOWEL DRILLS



APPLICATION EXAMPLE

NORTON SAINT-GOBAIN WINTER

GRINDING TOOL	D64 K+888R C75 or K+921 C100
GRINDING MACHINE	Deckel S11
COOLANT	Dry
WORK PIECE	Tungsten carbide dowel drills, Ø 4 to 18 mm
GRINDING PARAMETERS	
FEED	v_f = approx. 300 mm/min (manual)
INFEED	a_e = by hand
CUTTING SPEED	v_c = 18 m/s

BENEFITS

- High profile retention, quick removal
- Good surface, no heat damage

1D1 STOCK PROGRAMME

SHAPE	DxUxX (mm)	H (mm)	Z (mm)	V1 (°)	V2 (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	COMMENT
DIAMOND GRINDING WHEELS											
1K1D1	75x4.5x6	20	0.9	67.5	45	D64	K+888R	C75	H	60157642996	for Ø 4
1K1D1	75x4.5x6	20	1.4	67.5	45	D64	K+888R	C75	H	66260116659	for Ø 5
1K1D1	75x4.5x6	20	1.9	67.5	45	D64	K+888R	C75	H	66260136519	for Ø 6
1K1D1	75x5x6	20	2.8	67.5	45	D64	K+888R	C75	H	66260136520	for Ø 8
1K1D1	75x6x6	20	3.7	67.5	45	D64	K+888R	C75	H	66260136522	for Ø 10
CBN GRINDING WHEELS											
1K1D1	75x4.5x6	20	0.9	67.5	45	B107	KSS10N	V180	H	60157642715 [1]	for Ø 4
1K1D1	75x4.5x6	20	1.9	67.5	45	B107	KSS10N	V180	H	60157643017 [1]	for Ø 6
1K1D1	75x5x6	20	2.8	67.5	45	B107	KSS10N	V180	H	60157642955 [1]	for Ø 8

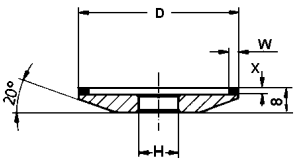
APPLICATION

For profile grinding of dowel drills (clearance) with simultaneous grinding of centre point tips and rough cutting edges.
Other dimensions can be supplied. When ordering, please state drill diameter or Z dimension.

[1] Delivery time 5 - 6 weeks

GRINDING WHEELS FOR MACHINING ROUTER BITS

4A2 DELIVERY PROGRAMME

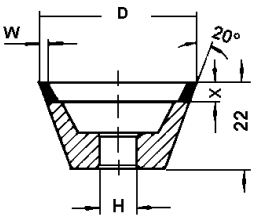


SHAPE	DxWxX (mm)	H (mm)	R	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
K4A2	50x3x2	10	-	D64	K+888N	C50	A	60157642922 [1]
CBN GRINDING WHEELS								
K4A2	50x3x2	10	-	B107	KSS10J	V120	A	66260136536 [1]

[1] Delivery time 5 - 6 weeks

APPLICATION
For grinding tooth faces of small router bits with chip thickness restriction.

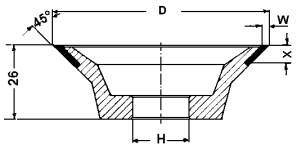
11V2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS							
K11V2	40x2x5	10	B126	KSS10N	V180	H	66260134764

APPLICATION
For grinding of single- or multi-edge router bits (cutting face bevel).

12V9 STOCK PROGRAMME



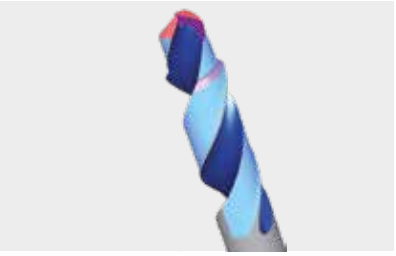
SHAPE	DxWxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND							
1K12V9	75x2.3x7.1	20	D46	K+888R	C75	H	60157642595
			D64	K+888R	C75	H	60157642687
CBN GRINDING WHEELS							
2K12V9	75x2.3x7.1	20	B126	KSS007-63	V180	H	66260113221

APPLICATION
For grinding of single- or multi-edge router bits (cutting face bevel).

APPLICATION EXAMPLES FOR SPECIAL TOOLS

APPLICATION EXAMPLE 1 - PEEL GRINDING OF STEPPED DRILLS

GRINDING TOOL	D64 BZ4415 C100 E
GRINDING MACHINE	Rollomatic NP4
COOLANT	Oil
WORKPIECE	Tungsten carbide drill Ø 14 mm by Ø 10.3 mm
GRINDING PARAMETERS	
FEED	v_f = 3.6 mm/min
INFEED	a_e = 1.85 mm
CUTTING SPEED	v_c = 63 m/s



BENEFITS

- Very good surface quality
- Superb edge stability

APPLICATION EXAMPLE 2 - GRINDING OF KNURLED PROFILE ON ROUGHING MILLS

GRINDING TOOL	D64 SP4006R C125 A
GRINDING MACHINE	Walter Helitronic
COOLANT	Oil
WORKPIECE	Tungsten carbide roughing end mill Ø 20 mm flute length 90 mm
GRINDING PARAMETERS	
FEED	v_f = 100 mm/min
INFEED	a_e = 2.5 mm
CUTTING SPEED	v_c = 25 m/s
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 4.16 mm³/mm · s

BENEFITS

- Substantially faster than crushable metal bonds
- Higher tool life than crushable metal bonds

APPLICATION EXAMPLE 3 - THREAD GRINDING ON TAPS

GRINDING TOOL	D25 V+2046 N1TC-23 C100 E
GRINDING MACHINE	SMS
COOLANT	Oil
WORKPIECE	Tungsten carbide tap
GRINDING PARAMETERS	
FEED	v_f = 10 mm/min
INFEED	a_e = 0.4 mm
WORKPIECE SPEED	n^w = 5 min^{-1}
CUTTING SPEED	v_c = 45 m/s
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 4.16 mm³/mm · s

BENEFITS

- Simple-to-dress diamond grinding wheel (with profile roller, see photo)
- Good adherence to profile, thus high tool life

NORTON
SAINT-GOBAIN

WINTER

GRINDING TOOLS FOR MACHINING CIRCULAR SAWS AND BAND SAWS

GRINDING TOOLS FOR MACHINING CARBIDETIPPED CIRCULAR SAW BLADES 49
Grinding wheels for the tooth face 51
Grinding wheels for top grinding 56
Grinding wheels for flank grinding 60
Grinding pins for hollow ground saw blades 62
Grinding wheels for chip breaker flutes 63
GRINDING WHEELS FOR STELLITE CIRCULAR SAW BLADES 64
GRINDING WHEELS FOR HSS CIRCULAR SAW BLADES 65
GRINDING WHEELS FOR MACHINING BAND SAWS 67

SAWS

Various types of saws (e.g. circular saws and band saws)
are used in the woodworking and plastics processing industries.

Grinding technology is used to create the tooth geometry of these saws.
A basic distinction can be made between one-piece saws and composite saws.

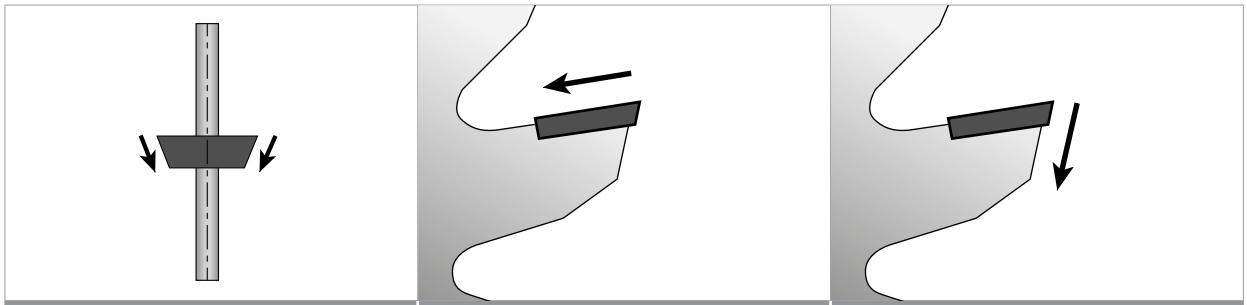
For example, HSS band saws and HSS circular saw blades are one-piece saws. The tooth geometry required for these saws is ground under CNC-controll using radial grinding wheels (see our 'profile S' programme). Saws of this type are sometimes also manufactured as segmented saws.

Composite saws, on the other hand, have carbide, cermet or diamond tips brazed onto a metal core.
The shape of the teeth (face, top and flank) is then ground sequentially (see illustration on next page).

Information
Further information on applications and products
can be found at
www.nortonabrasives.com

GRINDING TOOLS
FOR MACHINING CARBIDE-TIPPED CIRCULAR SAW BLADES

The manufacture of tungsten carbide-tipped circular saw blades consists of a number of steps that are performed sequentially on different machines. The first step is flank grinding, followed by the face and top grinding. Next the chip breaker flutes and hollow-tooth profiles are produced as required.



FLANK GRINDING | FACE GRINDING | TOP GRINDING

These steps can be carried out on a number of different machines, each needing its own grinding wheel geometry. With the unusually large range of Norton WINTER grinding wheels available we offer the optimum tool for all machines and applications. The following table is colour coded to help you quickly and easily find the wheel you need for your saw grinding machine.

SAWS

MACHINE	MACHINE TYPE	CODING
VOLLMER BIBERACH	CB, CC, CE, CEN, CEP, CHC, CHC, CHM, CHP, CHT, CNHB, CX and others	1
	CHD	2
	CC, CEF, CFL, CHAFT, CHAFTE, CHHF, CHF and others	3
VOLLMER DORNHAN	Finimat 600	1
	Finimat 800, Finimax	2
	Finimat Beta, Gamma	3
	Uniläpp	4
	Uniläpp F2	5
	Duo TS	6
WOODTRONIC	NC2, NC3, C4, C5	1
	CNC5	2
	CNC6F	3
AKEMAT	Akemat B / B10	1
	Akemat U / U10	2
	Akemat F / F10	3
WIDMA	Unimat	1
	HKS700/HIII	2
	HKS400, FS1000	3

For universal grinding machines and for Widma machines with bore H20 (BS700, HKS 500, HKS700, HKS700/H, HKS700/HI, HKS700/HII and others), please see our product programme in the chapter 'Milling cutters'.

GRINDING WHEELS FOR THE TOOTH FACE

Depending on the tooth pitch, differently shaped grinding wheels are needed to grind the tooth face. The greater the number of teeth around the circumference, the narrower the space between them and the thinner the grinding wheel has to be. Even the narrowest tooth gaps can be machined with our Tiger grinding wheels. For reasons of stability, conventional tooth gaps are mainly ground using 4A2, 12V2 or 222 grinding wheels.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
Tiger II L	↑	Wear-resistant bond to improve life for tooth-face grinding
Tiger II+		Wear-resistant bond to improve surface for tooth-face grinding
Tiger / Tiger II		Wear-resistant resin bond for tooth-face grinding
K+920 / K+921		Wear-resistant resin bond for tooth-face grinding
K+4821		Free-grinding CNC bond, e.g. for Cermet
K+888TY		Universal resin bond for wet grinding
K+888RY		Universal resin bond for wet grinding

STANDARD DIMENSIONS FOR GRINDING THE TOOTH FACE

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Circular saw blade tooth face grinding	Tungsten carbide Cermet	All established saw grinding machines	4A2, 12V2, 12V9, 222 Ø 100...200 W 2.3...8 X 2...5.5	Various bonds (see above)	Emulsion Oil

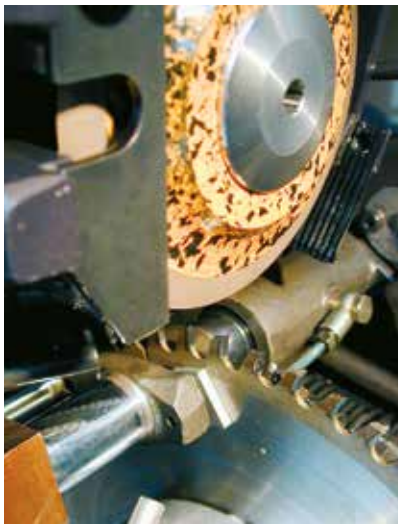
Other dimensions on request

TIGER

The Norton WINTER Tiger grinding wheel is the solution for economically grinding the cutting face on carbide-tipped saw blades.

The innovative geometry of the Tiger grinding wheel enables the tooth face to be ground without difficulty even where the chip spaces are narrow. The new design of the Tiger grinding wheel enables markedly narrower pitches to be machined.

The approved Norton WINTER K+bonds also guarantee long wheel life. Consequently, Tiger grinding wheels make every face grinding process not only faster, but economically more attractive.



SAWS CARBIDE-TIPPED CIRCULAR SAW BLADES - FACE

TIGER II TIGER II+ TIGER IIL

The Tiger II grinding wheel from Norton WINTER is the improved version of the proven Tiger face grinding wheel.
Tiger II+ and Tiger IIL as the result of the successful development of Tiger II are the latest generation of TigerII grinding wheels;
Tiger II+ has been designed to offer improved quality of ground parts, whilst Tiger IIL offers improved lifetime.
It is designed with a stable alu-phenolic body that reduces grinding pressure even further and in addition offers a high degree of fracture resistance.
With an angle of 25°, and on the new Tiger II 20° an even narrower angle of just 20°, narrow pitches are no problem for the Tiger II grinding wheel.
The Tiger II grinding wheel is the perfect combination of innovative wheel geometry and Norton WINTER's powerful K+ bonds.

RECOMMENDED USE

TIGER II

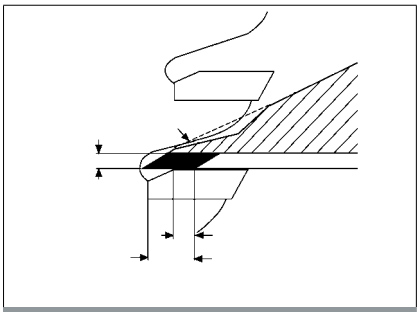
GRINDING TOOL	Tiger or Tiger II
MACHINE	Vollmer CHD
COOLANT	Oil
WORKPIECE	Carbide-tipped circular saw
GRINDING PARAMETERS	
FEED	v_f = 3...10 mm/s
INFEED	a_e = 0.05...0.2 mm
CUTTING SPEED	v_c = 45 m/s
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 0.15...2 mm³/mm · s

BENEFITS

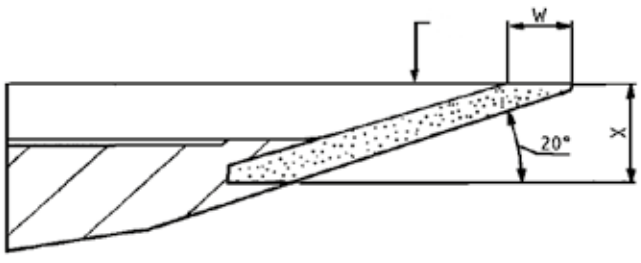
- For narrow chip spaces
- High fracture resistance

ADVANTAGES OF THE TIGER AND TIGER II FACE GRINDING WHEELS

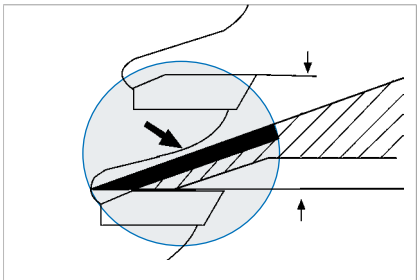
- Versions available for all automatic saw sharpening machines
- Particularly suitable for very narrow chip spaces
- Produces a very flat cutting face with no distortion
- No aluminium welding
- Self-dressing body (Tiger, Tiger II has no support of layer)
- Shorter grinding times, reduced grinding path (see diagram)
- Very long wheel life



12V2



TIGER II



TIGER

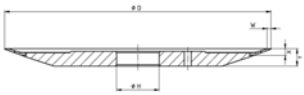
12V9 (TIGER) STOCK PROGRAMME

SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS										
3K12V9	100x2.3x4	25	10	20		Tiger		D	66260387961	1 2 1
3K12V9	125x2.3x4	25	10	20		Tiger		D	66260135761 [2]	2 1 2
1K12V9	125x2.3x4	32	13	20		Tiger		D	66260383182	1
1K12V9	150x2.3x4	32	13	20		Tiger		D	66260385221	1
1K12V9	155x2.3x4	32	13	20		Tiger		D	66260378555 [1]	1 1
		32	13	20		Tiger G		D	66260354959	1 1
1K12V9	200x2.3x4	32	13	20		Tiger		D	66260383180	2 2 2

May differ slightly from illustration depending on the machine's adapter flange

[2] Available while stocks last

12V2 (TIGER II) STOCK PROGRAMME

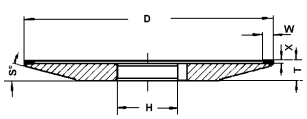


SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS										
1K12V2	125x2.5x5.5	32	13	25		Tiger II		H	66260375783	1
1K12V2	125x2.5x5.5	32	13	25		Tiger II L		H	7958794771	1
1K12V2	125x2.5x5.5	32	13	25		Tiger II +		H	7958794767	1
1K12V2	125x2.9x5.5	32	13	20		Tiger II 20°		H	60157695569	1
1K12V2	125x2.9x5.5	32	13	20		Tiger II + 20°		H	7958794768	1
1K12V2	125x2.9x5.5	32	13	20		Tiger II L 20°		H	7958794773	1
1K12V2	155x2.5x5.5	32	13	25		Tiger II		A	69014168642	1 1
1K12V2	160x2.5x5.5	32	13	25		Tiger II		A	60157672258 [1]	1
1K12V2	200x2.5x5.5	32	13	25		Tiger II		H	66260382131	2 2 2
1K12V2	200x2.5x5.5	32	13	25		Tiger II L		H	7958794775	2 2 2
1K12V2	200x2.5x5.5	32	13	25		Tiger II +		H	7958794770	2 2 2
1K12V2	200x2.9x5.5	32	13	20		Tiger II 20°		H	60157680758	2 2 2
1K12V2	200x2.9x5.5	32	13	20		Tiger II + 20°		H	7958794769	2 2 2
1K12V2	200x2.9x5.5	32	13	20		Tiger II L 20°		H	7958794774	2 2 2

May differ slightly from illustration depending on the machine's adapter flange

[1] Delivery time 5 - 6 weeks

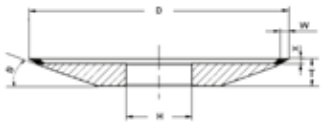
4A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS										
1K4A2	100x4x3	25	12	25	D46	K+888RY	C75	H	66260137095	1 2 1

SAWS CARBIDE-TIPPED CIRCULAR SAW BLADES - FACE

12V2 STOCK PROGRAMME

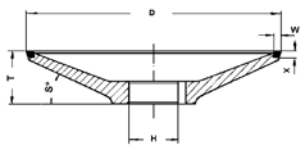


SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
2K12V2	100x4x2	25	10	30	20	D46	K+921	C125	A	66260128232	1 2 1
		25	10	30	20	D76	K+4821	C125	A	66260333648	1 2 1
5K12V2	125x4x2	32	13	30	20	D20A	K+730	C75	A	66260114168 [2]	1
		32	13	30	20	D46	K+921	C125	A	66260115804	1
		32	13	30	20	D46	K+4821	C125	A	66260134429	1
		32	13	30	20	D76	K+888RY	C125	A	66260135735	1
		32	13	30	20	D76	K+4821	C125	A	66260134487	1
6K12V2	150x4x2	32	13	30	15	D46	K+921	C125	A	66260127225 [2]	1 1
		32	13	30	15	D46	K+888RY	C125	A	66260113968	1 1
		32	13	30	15	D64	K+921	C125	A	66260118587	1 1
1K12V2	200x2x2	32	13	30	20	D46	K+921	C125	A	66260133948	2 2 2
2K12V2	200x4x2	32	13	30	20	D25	K+921	C100	A	66260130483	2 2 2
		32	13	30	20	D46	K+921	C125	A	66260117017	2 2 2
		32	13	30	20	D76	K+888RY	C125	A	66260115113	2 2 2
		32	13	30	20	D76	K+1414N	C100	A	7958707852	2 2 2

May differ slightly from illustration depending on the machine's adapter flange

[2] Available while stocks last.

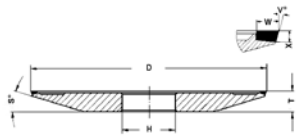
222 DELIVERY PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
1K222	125x3x3.3	25	26	15	25	D54	K+888RY	C75	A	60157642734 [1]	4

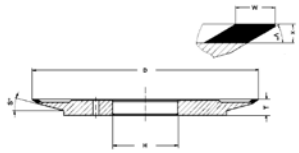
[1] Delivery time 5 - 6 weeks

222 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
1K222	100x2x1.6	25	8	15	15	D76	K+888RY	C125	A	60157643361 [1]	1 2 1
1K222	100x3x3.3	25	10	15	15	D54	K+888RY	C75	A	60157642681 [1]	1 2 1
		25	10	15	15	D76	K+888RY	C75	A	66260137081 [1]	1 2 1
2K222	100x3x1.8	25	8	15	15	D54	K+888RY	C75	A	60157642713 [2]	1 2 1
		25	8	15	15	D64	K+888RY	C75	A	66260135818 [1]	1 2 1
1K222	125x2.5x1.2	32	11.5	15	15	D54	K+888RY	C75	A	60157642666	1
		32	11.5	15	15	D76	K+888RY	C125	A	66260135745	1
1K222	125x3x3.8	32	14	15	15	D54	K+888RY	C75	A	60157642674	1
1K222	150x3x1.5	32	11.5	15	15	D64	K+920	C100	A	66260135724	1 1
5K222	150x3x2	32	12	15	15	D91	K+888TY	C150	A	60157643360	1 1
1K222	160x3x2	32	12	15	15	D64	K+921	C125	A	66260128437 [1]	1

May differ slightly from illustration depending on the machine's adapter flange



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
1K222	175x4x2	50.8	12	30	15	D76	K+888RY	C125	A	66260136435 [2]	3 5

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last.

GRINDING WHEELS FOR TOP GRINDING

Top grinding describes the peripheral grinding process of circular saw blades. This has two purposes: it ensures that the circularity of the saw is optimized and it defines the wedge and clearance angles, both of which are crucial for the cutting performance of any circular saw.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

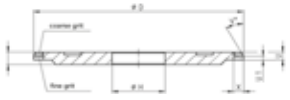
DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
K+921	↑	More wear-resistant resin bond preferably wet grinding
K+1313RY		Resin bond for mixed grinding and wet grinding
K+1421R		Standard resin bond for CNC applications
K+4821		Free-grinding CNC bond, e.g. for Cermet
K+888RY		Universal resin bond for wet grinding
K+1066		Resin bond for top grinding (resharpening, copes with body contact)
K+434		Free-grinding resin bond (synthetic coolant)
K+777N		Free-grinding resin bond (production grinding, oil)

STANDARD DIMENSIONS FOR GRINDING THE TOOTH BLADE

WORKPIECE	MATERIAL	MACHINE	GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Circular saw blade tooth top grinding	Tungsten carbide Cermet	All established saw grinding machines	4B1, 14M1, 222,... Ø 100...200 W 3...6 resp. U 5...8 X 3...10	Various bonds (see above)	Emulsion Oil

Other dimensions on request

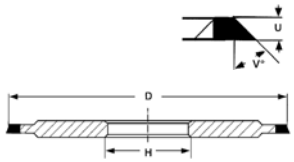
3M1 DOUBLE-LAYER DELIVERY PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	V (°)	U_{fine}	GRIT SIZE	BOND	CONCENTRATION	BODY	ORDER NUMBER	MACHINE
DIAMOND GRINDING WHEELS											
1K3M1	125x5x5	32	8	15	2B	2.5	D20B	K+1313RY	C100	A	60157643272 [1]	2
	125x5x5	32	8	15	2B	2.5	D126	K+1313RY	C125	A		
1K3M1	127x5x6	32	8	15	2B	2.5	D54	K+1313RY	C75	A	60157643404 [1]	2
	127x5x6	32	8	15	2B	2.5	D126	K+1313RY	C100	A		

[1] Delivery time 5 - 6 weeks

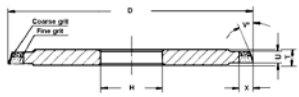
14B1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS										
2K14B1	125x5x7	32	8	15	D54	K+921	C125	A	66260114938 [1]	2

[1] Delivery time 5 - 6 weeks

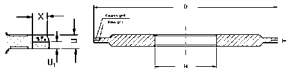
14B1 DOUBLE-LAYER STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	V (°)	U_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
1K14B1	127x5x7	32	8	5	2B 2.5	D46	K+4821	C75	H	66260134416	2
		32	8	5	2B 2.5	D107	K+4821	C100	H		
1K14B1	127x5x7	32	8	15	2B 2.5	D54	K+1313RY	C100	A	66260117412	2
		32	8	15	2B 2.5	D126	K+1313RY	C125	A		
		32	8	15	2B 2.5	D46	K+4821	C75	A	60157643587 [1]	2
		32	8	15	2B 2.5	D107	K+4821	C100	A		

[1] Delivery time 5 - 6 weeks

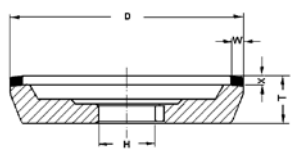
14M1 DOUBLE-LAYER STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	V (°)	U_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
1K14M1	150x5x8	32	10	8	2B 2.5	D46	K+921	C75	A	66260130887	1 2
		32	10	8	2B 2.5	D107	K+921	C100	A		
		32	10	8	2B 2.5	D46	K+1421R	C75	A	66260346277 [1]	1 2
		32	10	8	2B 2.5	D107	K+1421R	C100	A		
1K14M1	200x5x8	32	10	8	2B 2.5	D20B	K+1066	C75	A	66260379464	2
		32	10	8	2B 2.5	D91	K+1066	C100	A		
1K14M1	200x5x8	32	10	8	2B 2.5	D46	K+921	C75	A	66260375347	2
		32	10	8	2B 2.5	D107	K+921	C100	A		

[1] Delivery time 5 - 6 weeks

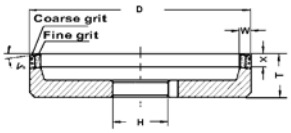
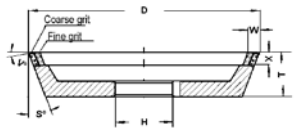
222 STOCK PROGRAMME



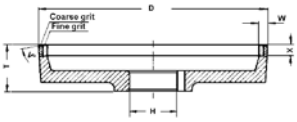
SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MACHINE
DIAMOND GRINDING WHEELS										
5K222	100x5x4	25	20	4	D76	K+888RY	C75	H	60157643743	1 2 1 2

SAWS CARBIDE-TIPPED CIRCULAR SAW BLADES - TOP

222 DOUBLE-LAYER STOCK PROGRAMME

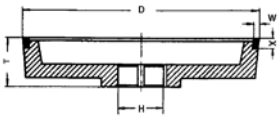
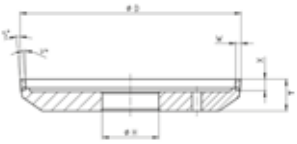
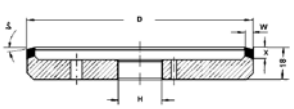
	SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)		W_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
	DIAMOND GRINDING WHEELS												
	6K222	100x5x6	25	20	8	2B	2.5	D46	K+888RY	C75	H	66260135827	1 2
			25	20	8	2B	2.5	D126	K+888RY	C100	H		
	1K222	100x5x10	25	24	8	2B	2.5	D46	K+434	C75	H	66260135783	1 2
			25	24	8	2B	2.5	D126	K+434	C100	H		
	2K222	100x5x10	25	24	8	2B	2.0	D46	K+888RY	C100	H	60157643263	1 2
			25	24	8	2B	2.0	D126	K+888RY	C125	H		
	9K222	125x5x6	25	20	8	2B	2.5	D46	K+888RY	C75	H	60157643868 [1]	4 1
			25	20	8	2B	2.5	D126	K+888RY	C100	H		
	4K222	100x5x6	25	20	8	2B	2.5	D46	K+888RY	C75	H	60157642914 [2]	1 2
			25	20	8	2B	2.5	D126	K+888RY	C100	H		

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last.

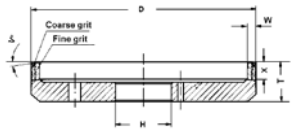
	SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)		W_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
	DIAMOND GRINDING WHEELS													
	4K222	125x5x6	25	26	8	5	2B	2.5	D46	K+888RY	C75	H	60157643430 [1]	4
			25	26	8	5	2B	2.5	D126	K+888RY	C100	H		

[1] Delivery time 5 - 6 weeks

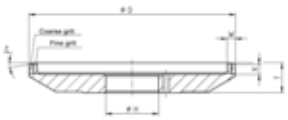
222 STOCK PROGRAMME

	SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
	DIAMOND GRINDING WHEELS											
	1K222	125x3x5	25	26	5	5	D54	K+888RY	C100	A	60157642941	4
	1K222	125x5x6.5	32	18	5	35	D54	K+888RY	C100	A	60157642641	1 2
			32	18	5	35	D126	K+888RY	C100	A	66260111456	1 2
	27K222	125x5x6	32	18	8		D91	K+4821	C100	A	60157643295	1 2
	18K222	125x5x10	32	22	8		D64	K+777N	C75	H	60157643301	1 2

222 DOUBLE-LAYER STOCK PROGRAMME



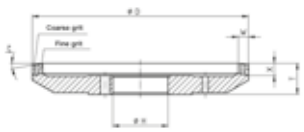
SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	W_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
3K222	125x5x6	32	18	8	2B 2.5	D46	K+434	C75	H	66260136498	1 2
		32	18	8	2B 2.5	D126	K+434	C100	H		
		32	18	8	2B 2.5	D46	K+888RY	C75	H	66260136530	1 2
		32	18	8	2B 2.5	D126	K+888RY	C100	H		
		32	18	8	2B 2.5	D46	K+888RY	C100	H	66260112775 [1]	1 2
		32	18	8	2B 2.5	D126	K+888RY	C125	H		
5K222	125x5x10	32	22	8	2B 2.5	D15C	K+888RY	C50	H	66260115711	1 2
		32	22	8	2B 2.5	D91	K+888RY	C75	H		
		32	22	8	2B 2.5	D20B	K+1066	C100	H	66260127556	1 2
		32	22	8	2B 2.5	D126	K+1066	C125	H		
		32	22	8	2B 2.5	D25	K+888RY	C100	H	60157643637	1 2
		32	22	8	2B 2.5	D76	K+888RY	C125	H		
		32	22	8	2B 2.5	D46	K+434	C75	H	60157642597	1 2
		32	22	8	2B 2.5	D126	K+434	C100	H		
		32	22	8	2B 2.5	D46	K+921	C100	H	66260133442	1 2
		32	22	8	2B 2.5	D126	K+921	C125	H		
		32	22	8	2B 2.5	D46	K+1066	C100	H	66260134470	1 2
		32	22	8	2B 2.5	D126	K+1066	C125	H		



52K222	125x5x6	32	18	5	2B 2.5	D20B	K+1313RY-42	C75	H	66260352075 [1]	1 2
		32	18	5	2B 2.5	D126	K+1313RY	C75	H		

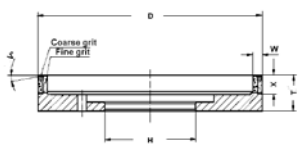
[1] Delivery time 5 - 6 weeks

222 TRIPLE-LAYER STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	W_{fine}	W_{coarse}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS												
5K222	125x6x6	32	18	8	3B 2	2	D20B	K+1066	C75	H	66260132898	1 2
		32	18	8	3B 2	2	D46	K+1066	C100	H		
		32	18	8	3B 2	2	D126	K+1066	C100	H		

222 DOUBLE-LAYER STOCK PROGRAMME



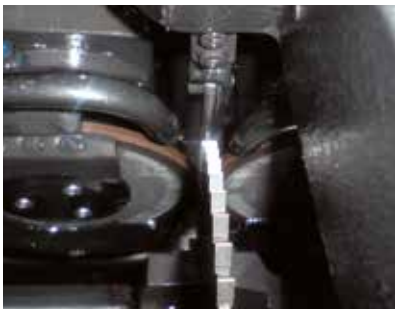
SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	W_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS											
31K222	125x5x6	50.8	20	8	2.5	D46	K+888RY	C75	H	66260135844 [1]	3 5
		50.8	20	8	2.5	D126	K+888RY	C100	H		
8K222	125x5x10	50.8	20	8	2.5	D20B	K+1313RY-42	C75	H	60157642975 [1]	3 5
		50.8	20	8	2.5	D126	K+1313RY	C100	H		
		50.8	20	8	2.5	D46	K+888RY	C75	H	66260135843	3 5
		50.8	20	8	2.5	D126	K+888RY	C100	H		

[1] Delivery time 5 - 6 weeks

GRINDING WHEELS FOR FLANK GRINDING

The cutting width of the circular saw blade is defined during the flank grinding process.

Two grinding wheels are simoultaneously fed from both sides to obtain the defined tooth width.



SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

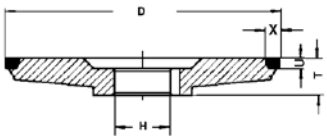
DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
K+921		More wear-resistant resin bond preferably wet grinding
K+888NY		Universal resin bond for wet grinding
K+888JY		Universal resin bond for wet grinding
K+730		Very free-grinding fine-grain bond, dry grinding possible

STANDARD DIMENSIONS FOR GRINDING TOOTH FLANKS

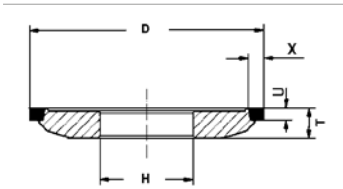
WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Circular saw blade tooth flank grinding	Tungsten carbide Cermet	All established saw grinding machines	700 Ø 76...100 U 2.5... 4 X 4.5...6.5	Various bonds (see above)	Emulsion Oil

Other dimensions on request

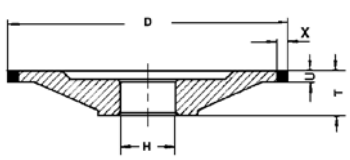
700 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
DIAMOND GRINDING WHEELS									
1K700	76x4x4.5	20	14	D54	K+921	C75	A	66260133242	3 6
		20	14	D91	K+730-42	C50	A	60157643342	3 6
		20	14	D126	K+888NY	C75	A	66260136474 [1]	3 6



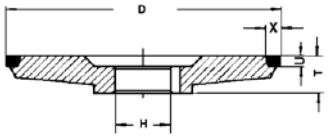
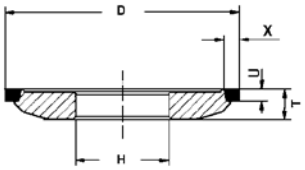
1K700	80x4x5	32	10	D64	K+921	C75	A	66260132865	3 3
1K700	86x2.5x5	32	10	D54	K+921	C50	A	69014158598 [1]	3 3
1K700	86x4x5	32	10	D54	K+921	C75	A	66260130320	3 3



1K700	100x4x4	20	16.5	D126	K+888NY	C75	H	60157642956 [1]	3

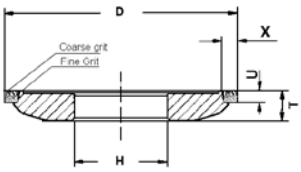
[1] Delivery time 5 - 6 weeks

700 STOCK PROGRAMME

	SHAPE	DxUxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
	DIAMOND GRINDING WHEELS									
	1K700	100x4x4.5	20	14	D54	K+921	C75	A	66260130080	6 3 3
			20	14	D91	K+730-42	C50	A	66260136591	6 3 3
			20	14	D91	K+888JY	C50	A	60157642952	6 3 3
			20	14	D126	K+888NY	C75	A	66260136408	6 3 3
	2K700	100x4x6.5	20	14	D54	K+921	C75	A	66260134535 [1]	6 3 3
			20	14	D126	K+888NY	C75	A	66260137143	6 3 3
	1K700	100x4x5	32	10	D54	K+921	C75	A	66260131923	3 3
			32	10	D64	K+921	C75	A	66260137345	3 3
			32	10	D91	K+730-42	C50	A	60157642622	3 3
			32	10	D107	K+888NY	C75	A	66260136539	3 3
			32	10	D126	K+888NY	C75	A	60157643744	3 3

[1] Delivery time 5 - 6 weeks

700 DOUBLE-LAYER STOCK PROGRAMME

	SHAPE	DxUxX (mm)	H (mm)	T (mm)		U_{fine}	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
	DIAMOND GRINDING WHEELS											
	3K700	86x4x5	32	10	2B	2.0	D54	K+921	C68	A	66260386978	3 3
			32	10	2B	2.0	D91	K+921	C75	A		
	8K700	100x4x6.5	32	10	2B	2.0	D46	K+921	C50	A	66260399091	3 3
			32	10	2B	2.0	D91	K+921	C75	A		

GRINDING PINS FOR HOLLOW GROUND SAW BLADES

There is a wide variety of tooth geometries to choose from for composite circular saw blades. Depending on the intended use of the saw, the tooth design can be flat, alternate, trapezoid or any combination of these.

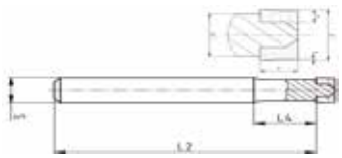
A saw can also have hollow ground teeth. The concave shape of the teeth gives very fine cuts with no burrs, thus making the saw highly suitable for processing veneered wood and laminated chipboards.

The rounded shape of hollow ground teeth is produced with 1A1W grinding pins. Calculation of the needed grinding pin diameter:
D = 2 x W + 1 (W = width of the saw blade)

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KS449	↑	More wear-resistant resin bond preferably wet grinding
K+920		More wear-resistant resin bond also for dry grinding
K+921		More wear-resistant resin bond preferably wet grinding
K+888TY		Universal resin bond for wet grinding
K+888RY		Universal resin bond for wet grinding

1A1W STOCK PROGRAMME



SHAPE	DxTxX (mm)	S (°)	L_2xS_1xL_4 (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING TOOLS								
5K1A1W	5x3x1.5	6	42x3.5x10	2°50'	D76	K+921	C125	60157643650
1K1A1W	6x3x1.5	6	42x3.5x10	2°50'	D76	K+921	C125	66260111416
8K1A1W	6.5x3x1.75	6	33x4.1x10	2°	D76	K+921-42	C125	66260134445
2K1A1W	6.5x3x1.75	6	42x3.1x10	2°50'	D76	K+921	C125	66260134718
		6	42x3.1x10	2°50'	D91	K+888TY	C150	60157643974
6K1A1W	6.5x3x1.75	6	42x4.1x10	-	D76	K+888RY	C125	66260111088
		6	42x4.1x10	-	D76	K+921	C125	66260368674
1K1A1W	6.5x3x1.75	6	42x5.1x10	2°50'	D76	K+920	C125	66260110241
		6	42x5.1x10	2°50'	D76	K+921	C125	66260133964
1K1A1W	6.5x3x2	6	42x4.5x10	-	D76	KS449	C125	66260341274
2K1A1W	7x3x2	6	42x5.1x10	2°50'	D76	K+921	C125	66260133966
		6	42x5.1x10	2°50'	D91	K+888TY	C150	60157643957
		6	42x5.1x10	2°50'	D91	K+920	C125	60157644164 [2]
		6	42x5.1x10	2°50'	D91	K+921	C125	60157643351

[2] Available while stocks last.

GRINDING WHEELS FOR CHIP BREAKER FLUTES

Chip breaker flutes are sometimes ground into the clearance area of the saw tooth in order to optimize the chip breakage and chip removal during sawing operations. Profile wheels (Norton WINTER shape 34P) or 1A1R grinding wheels with resin or metal bonds are used for this.

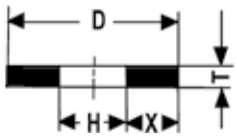
SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
BZ457	↑	Standard metal bond for chip breaker flutes
MR875		Standard metal bond for chip breaker flutes
K+888RY		Universal resin bond for wet grinding

34P STOCK PROGRAMME

SHAPE	DxTxX (mm)	E (mm)	R (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING WHEELS								
1BZ34P	125x0.5x5	0.4	0.25	32	D126	BZ457	C135	66260388921
1K34P	125x0.8x5	0.6	0.4	32	D151	K+888RY	C75	66260383651 [2]

1A1R DELIVERY PROGRAMME



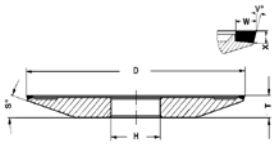
SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING WHEELS						
1BZ1A1R	30x0.3x11	8	D76	MR875	C125	66260337005 [1]
1BZ1A1R	30x0.4x11	8	D151	MR875	C125	66260340908 [1]

[1] Delivery time 7 weeks, minimum order quantity 6 pcs.
[2] Available while stocks last.

GRINDING WHEELS
FOR STELLITE CIRCULAR SAW BLADES

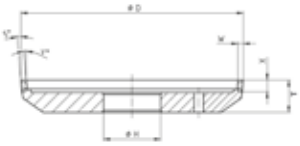
Typical applications such as face, top and flank grinding are performed on HSS and Stellite circular saws as well as on tungsten carbide-tipped saw blades. The kinematics of the applications are identical with those for tungsten carbide-tipped saws.
The bond KSSRY has been particularly developped for cBN grinding wheels.

222 STOCK PROGRAMME FOR FACE GRINDING



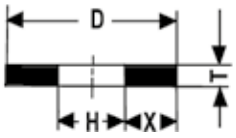
SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
CBN GRINDING WHEELS											
1K222	125x3x3.8	32	14	15	15	B107	KSSRY	V180	A	60157643417	1

222 STOCK PROGRAMME FOR TOP GRINDING



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	MA-CHINE
CBN GRINDING WHEELS											
1K222	125x3x6.5	32	18	5	35	B107	KSSRY	V240	A	60157643394	1 2

1A1R DELIVERY PROGRAMME FOR CHIP BREAKER FLUTES



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
CBN GRINDING WHEELS						
1BZ1A1R	25x0.3x8.5	8	B91	MR875	V300	66260341266 [1]

[1] Delivery time 5 - 6 weeks

PLEASE NOTE
Please refer to our stock programme in chapter "Milling cutters".

GRINDING WHEELS
FOR HSS CIRCULAR SAW BLADES

HSS saw blades are ground from the solid on special CNC grinding machines.
Very wear resistant profile wheels like 14F1 and similar (Norton WINTER shape 700) guarantee economic grinding processes.
For this application Norton WINTER has developed the innovative ProCurve range, which is successfully used for both initial profiling and re-sharpening under oil- and emulsion coolant.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	RECOMMENDATION FOR USE
ProCurve	Universal bond for HSS saws (emulsion coolant)
K+888TY	Universal resin bond for wet grinding

STANDARD DIMENSIONS FOR GRINDING ONE-PIECE CIRCULAR SAW BLADES

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Circular saw blades	HSS Tungsten carbide	All established saw grinding machines	700 Ø 150, 200 U 1.3...6 X 6.5...15	700 Ø 150, 200 U 1.3...6 X 6.5...15	Oil Emulsion

Other dimensions on request

APPLICATION EXAMPLE (INITIAL PROFILING)

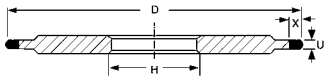
GRINDING TOOL	ProCurve
MACHINE	Loroch KBN 710
COOLANT	Oil
WORKPIECE	HSS circular saw blade, Ø 400 mm Thickness 2.5 mm, 180 teeth
GRINDING PARAMETERS	
FEED	v_f = 10.6 teeth / min
INFEED	a_e = 2.79 mm
CUTTING SPEED	v_c = 60m/s

BENEFITS

- 10% higher feed rate
- No burn
- Very little burr formation

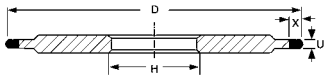
SAWS HSS CIRCULAR SAW BLADES

700 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	R (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS								
1K700	200x1.3x6.5	32	0.65		ProCurve		E	7958758236
2K700	200x1.6x7	32	0.8		ProCurve		E	7958761766
3K700	200x2x8	32	1		ProCurve		E	7958745748
2K700	200x2.5x8	32	1.25		ProCurve		E	7958756148
5K700	200x3x10	32	1.5		ProCurve		E	7958759735
3K700	200x3.5x10	32	1.75		ProCurve		E	7958761779 [2]
1K700	200x4x12.5	32	2		ProCurve		E	7958756329
1K700	200x5x15	32	2.5		ProCurve		E	7958761780 [1]

Other shapes and dimensions for e.g. Schmidt Tempo machines on request



SHAPE	DxUxX (mm)	H (mm)	R (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
1K700	200x1.3x6.5	32	0.65	D91	K+888TY	C125	E	66260129165 [1]
3K700	200x2x8	32	1	D91	K+888TY	C125	E	66260117948 [1]
5K700	200x3x10	32	1.5	D91	K+888TY	C125	E	69014129762 [1]

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last.

Tungsten carbide saw blades are primarily designed with carbide tips on steel blades. However, some applications require solid metal blades. Here, the same wheel geometries as for HSS saw blades are applicable.

GRINDING WHEELS
FOR MACHINING BAND SAWS

Band saws are ground using peripheral grinding wheels. These have either simple profiles (14F1, 1V1) or coordinate profiles (Norton WINTER shape 700).
Typical machines are the Vollmer-Biberach and Iseli. These machines are fitted with either cBN grinding wheels or conventional AL_2O_3 wheels.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KM64	↑	Standard resin bond for Stellite
KSS007N		Free-grinding resin bond for dry grinding

STANDARD DIMENSIONS FOR GRINDING BAND SAWS

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Band saws	HSS Stellite	All established band saw grinding machines	14F1, 1V1, 700 Ø 250, 300 U (variable) X (variable)	KSS007 KM64	Oil Emulsion

Other dimensions on request

APPLICATION EXAMPLE (INITIAL PROFILING)

NORTON SAINT-GOBAIN WINTER

GRINDING TOOL	1V1-300-10-10 50.8 B126 KM64 V24
MACHINE	Vollmer CA 300
COOLANT	Emulsion
WORKPIECE	Stellite-tipped band saw, l = 11.76 m, Thickness 1.8 mm, 300 teeth
GRINDING PARAMETERS	
FEED	v_f = 20 teeth / min
INFEED	a_e = 1 mm
CUTTING SPEED	v_c = 63 m/s

BENEFITS

- Very low wear
- Good price-performance ratio

Because of the large number of profiles, we do not keep grinding wheels in stock. Please get in touch with us to find the best solutions for your machining requirements.

NOTES

NORTON
SAINT-GOBAIN

WINTER

GRINDING TOOLS FOR THE PRODUCTION OF INSERTS

TRENDS IN THE MACHINING OF INSERTS 71

DIAMOND GRINDING WHEELS FOR TOP AND BOTTOM GRINDING OF INSERTS 72

Top and bottom grinding 72

Top and bottom grinding with planetary kinematics 73

DIAMOND GRINDING WHEELS FOR PERIPHERAL GRINDING OF INSERTS 74

DIAMOND GRINDING WHEELS FOR PROFILE GRINDING OF INSERTS 76

TRENDS

In the area of inserts, a wide variety of materials and tool geometries are machined. This makes great demands on the grinding tools required.

As a fundamental principle, there is a discernible trend towards higher requirements of the edge quality. Whereas a few years ago, grit sizes of D76 and coarser were used, currently grit sizes of D54 and finer are state of the art. In addition, a specialisation on individual types of inserts has occurred within the industry.
The universal grinding wheel is a thing of the past. Increasing cost pressure has resulted in a growing need for optimisation. The different requirements of individual insert types mean that individual solutions are needed.

Information
Further information on applications and products can be found at www.nortonabrasives.com

TRENDS IN THE MACHINING OF INSERTS

The current Norton WINTER grinding wheel programme for the machining of inserts offers solutions for all application areas in this industry sector. Customised to the respective grinding task and the system environment, the innovative diamond grinding wheels from Norton WINTER offer the ideal solutions under both oil and emulsion cooling.

REQUIREMENTS OF DIFFERENT INSERTS

NORTON WINTER	STANDARD TUNGSTEN CARBIDE INSERTS	LARGE TUNGSTEN CARBIDE INSERTS	POLISHED TUNGSTEN CARBIDE INSERTS	CERMET INSERTS	CERAMIC INSERTS
LOW WHEEL WEAR	●			●	●
HIGH FEED RATES	●	●		●	
COOL GRINDING BEHAVIOUR		●	●	●	
OPTIMAL EDGE QUALITIES			●		●

Inserts are produced in very large quantities: Every year, almost a billion inserts are produced around the world. Time savings of just a few seconds per insert can thus mean great increases in capacity. For this reason, more rigid, efficient and increasingly automated machines with shorter axis paths and faster control systems are being developed. In order to be able to meet these growing possibilities, the development of fast grinding, innovative grinding wheel systems continues apace in the insert production area.
In the development of materials, the requirements are also increasing. As a basic principle, the inserts must be harder than the material to be machined. Accordingly, the grinding tools also need to be optimised. In addition to the commercial aspects, the trend towards miniaturisation is becoming increasingly important in the insert industry. Although the requirements regarding cutting edge qualities are growing, e.g. in aluminium machining, the inserts are becoming increasingly smaller. This requires increased usage of fine-grit diamond grinding wheels during the peripheral and top and bottom grinding of inserts.

DEVELOPMENT TREND IN THE PERIPHERAL GRINDING OF INSERTS

IN THE PAST	TODAY			
ALL TYPES	STANDARD TUNGSTEN CARBIDE INSERT*	POLISHED TUNGSTEN CARBIDE INSERT	CERMET INSERT	CERAMIC INSERT
Standard resin bonds	High-performance resin bonds	Standard resin or ceramic bonds	Standard or high-performance resin bonds	High-performance resin or ceramic bonds
Different grit sizes D25...D91	Medium grit sizes D33...D54	Small grit sizes D15A...D33	Medium grit sizes D33...D54	Small grit sizes D15A...D33
Various concentrations C75...C125	Medium to high concentrations C100...C125	Low to medium concentrations C75...C100	Medium to high concentrations C100...C125	Various concentrations C75...C125

*] Large carbide inserts: Standard resin bonds up to D91

DRESSING RECOMMENDATIONS:

The success of the grinding process does not depend solely on the selection of the right grinding wheel. Grinding wheels are increasingly being adapted more closely to the respective requirements. Thus, the right conditioning and subsequently the selection of the best dressing tool are growing substantially in importance.
SAINT-GOBAIN Abrasives uses its decades of experience in this regard as a system supplier and provides customised dressing and grinding wheels in line with the job requirements

SPECIFICATION		AREA OF USE	
NORTON	22A150H8V200	Level+ GPK	D64 – D151
NORTON	22A120I8V200	Level+	D64 – D151
NORTON	31C120L8V5209	INSERT+	>D76
NORTON	31C180Jot9V500	INSERT+	D54 – D76
NORTON	31C220Jot9V500	INSERT+	D33 – D46
NORTON	31C320Jot9V5209	INSERT+	D10 - D25

DIAMOND GRINDING WHEELS
FOR TOP AND BOTTOM GRINDING OF INSERTS

With the Level⁺ series for the top and bottom grinding of inserts, Norton WINTER is setting new standards with regard to evenness and precision.
The Norton WINTER Level⁺ products, grinding wheel systems that have been specially developed for this application, are characterised by very free-grinding behaviour.
The grinding pressure can be significantly reduced and therefore long dressing intervals become possible.
The unique grinding characteristics of this product family also permit substantially higher feed rates so that impressive increases in productivity can be achieved.

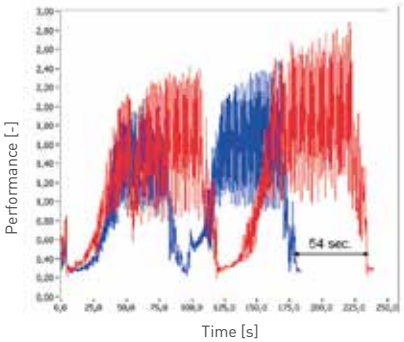
TOP AND BOTTOM GRINDING

STANDARD DIMENSIONS FOR TOP AND BOTTOM GRINDING OF INSERTS

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Inserts Plane knives etc.	Tungsten carbide Ceramic	Diskus Viotto Wendt ...	6A2 Ø 300...500 W 40...190 X 3...8	Norton WINTER LEVEL⁺	Emulsion Oil

OTHER DIMENSIONS ON REQUEST

WORKPIECE	Tungsten carbide insert
GRINDING TOOL	Level⁺ 219
GRINDING MACHINE	Viotto
COOLANT	Emulsion
GRINDING PARAMETERS	
FEED RATE	v_f = 25 mm/min
SPEED (TOP)	n = 900 min^{-1}
SPEED (BOTTOM)	n = 350 min^{-1}
ALLOWANCE / SIDE	a_e = 0.15 mm
DRESSING INTERVAL	15 inserts
CYCLE TIME	t = 88 s



RED = Competition
BLUE = Level⁺
The illustration shows the time savings compared to the competition, based on two ground workpieces.

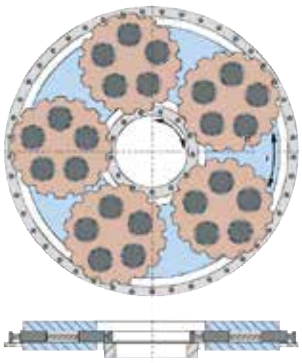
BENEFITS

- 20% higher feed rate
- 25% savings in grinding time
- 33% longer dressing interval
- More constant grinding characteristics
- Lower power consumptio

TOP AND BOTTOM GRINDING WITH PLANETARY KINEMATICS

The Level⁺ GPK (Grinding with Planetary Kinematics) grinding wheel is a variant from the Level⁺ family, developed for top and bottom grinding with planetary kinematics.

The Level⁺ GPK is characterised by very free-grinding behaviour, which means that short grinding times, high material removal rates and high outputs are possible. In addition to the commercial benefits, this specification also has very constant grinding behaviour with tight dimensional tolerances and excellent surface qualities and workpiece evenness.



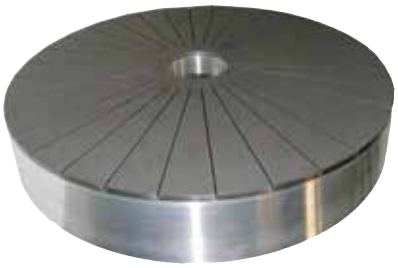
STANDARD DIMENSIONS FOR TOP AND BOTTOM GRINDING WITH PLANETARY KINEMATICS

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Inserts Plane knives etc.	Tungsten carbide	AMT Melchiorre Peter Wolters Stähli ...	6A2 Ø 500...1020 W 40...190	Norton WINTER LEVEL⁺ GPK	Oil Emulsion

Other dimensions on request

APPLICATION EXAMPLE:

WORKPIECE	Tungsten carbide insert
GRINDING TOOL	D46 Level⁺ GPK
GRINDING MACHINE	Peter Wolters AC 700
COOLANT	Emulsion
GRINDING PARAMETERS	
WORKPIECES / LOAD	204 inserts
ALLOWANCE / SIDE	a_e = 0.25 mm
CYCLE TIME	t = 180 s



BENEFITS

- Dimensional tolerance - 5 µm
- Surface quality (R_a) 0.25 - µm
- Flatness - 1 µm

INSERT+

DIAMOND GRINDING WHEELS
FOR PERIPHERAL GRINDING OF INSERTS

The Norton WINTER INSERT+ family consists of specially developed grinding wheels for every type of insert. The programme includes in particular free-grinding specifications, with which e.g. in the area of standard inserts superb material removal rates can be achieved, as well as very robust, low-wear systems for the area of special inserts (ceramic, cBN...). For polished inserts, fine-grit variants are included in the portfolio, where an impressive combination of best cutting edge quality and high material removal rate is achieved. Let yourself be convinced by the performance of our systems!

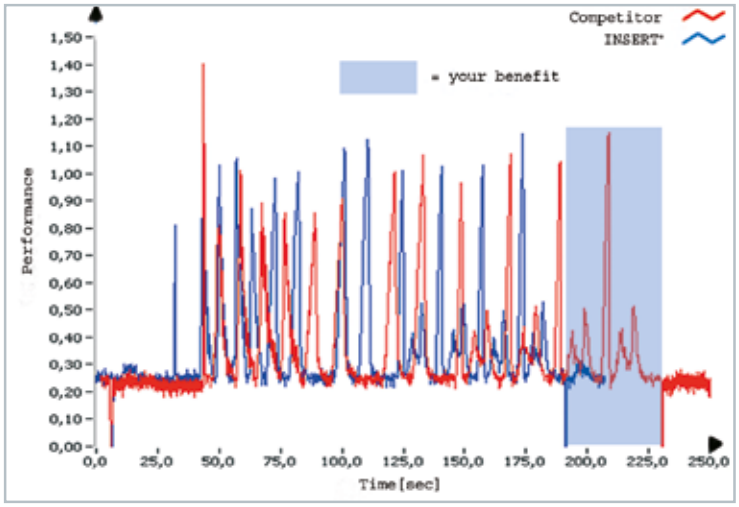
NORTON WINTER INSERT+

Can be used for the grinding of

- Tungsten carbide
- Cermet
- cBN
- Ceramic

...under emulsion and oil
Chipping < 10 µm

Picture: In this example, the time benefit generated by Norton WINTER INSERT+ is 30 seconds per insert!



APPLICATION RECOMMENDATIONS

NORTON SAINT-GOBAIN WINTER	STANDARD HM WP	GROSSE HM WP	POLIERTE HM WP	CERMET WP	SPEZIAL WP
D64...D76	SP4062 KS521 SP4006 W+7100 W+3102	SP4006 SP4017		SP4006N SP4017 W+3084 Paradigm	K+980 SP4006
D46...D54		Paradigm			
D25...D39			W+3102 W+3084		
D15...D20					SP4017 Paradigm PCX
>D15			PCX		

Grinding wheels for machining cBN inserts please find in chapter “Grinding tools for PCD and PCBN machining”.

STANDARD DIMENSIONS FOR PERIPHERAL GRINDING OF INSERTS

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Insert	Tungsten carbide Cermet Ceramic cBN	Agathon EWAG WAIDA Wendt ...	2A2T, 11A2,... Ø 250, 350, 400 W 3...25 X 3...15	Norton WINTER INSERT+	Oil Emulsion

INSERT+ EXAMPLES OF USE

APPLICATION EXAMPLE 1

INSERT+

WORKPIECE	Tungsten carbide insert
GRINDING TOOL	D46 INSERT+ 4006N-98 C110 A
GRINDING MACHINE	Agathon 400 Penta
COOLANT	Oil
GRINDING PARAMETERS	
FEED RATE (SIDES)	v_f = 30/15 mm/min
CUTTING SPEED	v_c = 21 m/s
ALLOWANCE / SIDE	a_e = 0.1 mm
DRESSING INTERVAL	100 inserts
CYCLE TIME	t = 90 s

BENEFITS

- 15% higher feed rate
- 8% lower cycle time
- 10-fold dressing interval
- Reduced wear of the grinding wheel

APPLICATION EXAMPLE 2

INSERT+

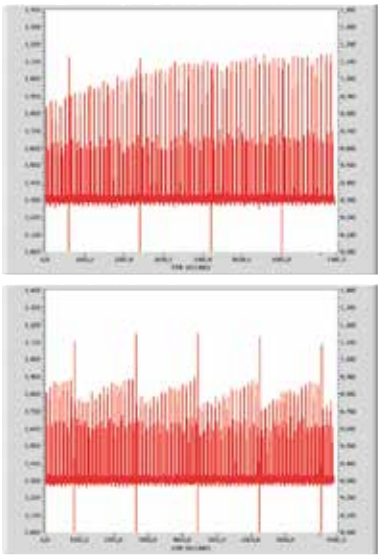
WORKPIECE	Polished tungsten carbide insert
GRINDING TOOL	D15C INSERT+4201 A
GRINDING MACHINE	Agathon LEO
COOLANT	Oil
GRINDING PARAMETERS	
FEED RATE (SIDES)	v_f = 15/5 mm/min
CUTTING SPEED	v_c = 21 m/s
ALLOWANCE / SIDE	a_e = 0.2 mm
DRESSING INTERVAL	20 inserts
CYCLE TIME	t = 43 s

BENEFITS

- 20% longer dressing interval
- 50% lower dressing amount
- 10% lower cycle time

PICTURE STANDARD:

- Increasing power consumption
- Dressing effect insufficient



Picture "optimised with INSERT+"
Stable grinding process,
substantially lower grinding pressure

APPLICATION EXAMPLE 3

INSERT+

WORKPIECE	Tungsten carbide insert
GRINDING TOOL	D46 INSERT+ 4062 C100 A
GRINDING MACHINE	Agathon 400 Penta
COOLANT	Oil
GRINDING PARAMETERS	
FEED RATE (SIDES)	v_f = 18 mm/min
CUTTING SPEED	v_c = 18 m/s
ALLOWANCE / SIDE	a_e = 0.4 mm
DRESSING INTERVAL	10 insert
CYCLE TIME	t = 97 s

BENEFITS

- 20% higher lifetime
- 10% seconds time savings per insert
- More than 15% cost reduction per insert

DIAMOND GRINDING WHEELS
FOR PROFILE GRINDING OF INSERTS

The profiling of inserts is a multi-faceted process. Various contours are generated, from simple flutes to complex profiles on the periphery of the inserts. Therefore, the applied profile wheels (e.g. 1E1, 1F1 or 1V1) are made from metal or resin bonds. With multi-process profiles (e.g. grooves for positive locking of the inserts in rotary holders), crushable metal or vitrified bond systems are frequently used.

APPLICATION EXAMPLE MULTI-PROFILE WHEEL

NORTON SAINT-GOBAIN WINTER

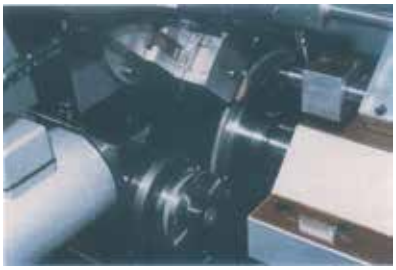
WORKPIECE	Tungsten carbide insert with 120° tapered flute (4fold flute width 2.5 mm)
GRINDING WHEEL	14A1-125-5-10 20 D64 Q-Flute
COOLANT	Emulsion
GRINDING PARAMETERS	
PROFILE DEPTH	0.7 mm
INFEED	a_e = 0.7 mm
CUTTING SPEED	v_c = 28 m/s
FEED RATE	v_f = 260 mm/min
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 3 mm³/mm · s

BENEFITS
- 47% time savings

APPLICATION EXAMPLE PROFILE WHEEL

NORTON SAINT-GOBAIN WINTER

WORKPIECE	Tungsten carbide insert with pre-sintered threaded profile
GRINDING WHEEL	MC1A1-150-4.5-5 D64 DMC C75
COOLANT	Emulsion
GRINDING PARAMETERS	
PROFILE DEPTH	0.95 mm
RESIDUAL ALLOWANCE	0.6 mm
INFEED	a_e = 0.6 mm
CUTTING SPEED	v^c = 23 m/s
FEED RATE	v_f = 150 mm/min
SPECIFIC MATERIAL REMOVAL RATE	Q'_w = 1.5 mm³/mm · s



BENEFITS
- 80% cost savings

DMC CONDITIONS OF USE

The crushing device should be part of the original machine; at least it should be strongly mounted onto the machine. By doing so, the advantages of profiling, without annoying tool changing, can be utilised. Pre-forming of the layer to the required profile is also possible.

Crushing can be carried out either with a powered grinding wheel, which drives the profiling roller, or with a powered profiling roller driving the grinding wheel. (If attention is not paid to this point, the wear of the profile roller will increase).

Profile crushing should always be performed using flood coolant, as the grinding wheel and the crushing roll must be lubricated. Additionally, during crushing, the abrasive layer must be cleaned with a Norton WINTER stone No. 2 or No. 5. This reduces profile distortion that may occur due to adherent wheel particles.

NORTON
SAINT-GOBAIN
WINTER

GRINDING TOOLS FOR PCD & PCBN MACHINING

GRINDING OF PCD AND PCBN INSERTS	**79**
Innovative vitrified bond PCX	80
High-performance grinding of solid PCBN inserts	81
Standard tools for manual PCD machining	82

PCD / PCBN

Diamond is the hardest known material and is used as MCD (monocrystalline diamond) and PCD (polycrystalline diamond) in the tools industry in a multitude of ways. The machining of diamond is not only difficult due to its hardness. Diamond is very brittle and therefore needs very free-cutting grinding wheels to generate good cutting edge qualities.

In addition to diamond, polycrystalline boron nitride (PCBN) cutting tools are increasingly being used in the industry; cBN is the second hardest known material and offers enormous lifetime benefits in comparison with tungsten carbide tools when turning and milling hardened steel, cast iron and sintered metals.

Information
Further information on applications and products can be found at
www.nortonabrasives.com

GRINDING OF PCD AND PCBN INSERTS

The machining of superhard materials such as PCD and PCBN places particularly great demands on grinding tools. There are hardly any differences in hardness between the workpiece and the diamond grain used in the grinding wheel, meaning that wear-resistant but free-grinding systems are required. Depending on the application, metal, vitrified, hybrid or resin bonds are used. Some standard specifications are available ex stock. With regard to your specific application, please simply ask us.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
VFK		Metal bond for rough pre-grinding
VF		Metal bond for pre-grinding
VFF		Metal bond universal for pre- and finish grinding
VP		Metal bond for polish grinding
VPP		Metal bond for finest polish grinding
INSERT+CBN		Hybrid bond for solid PCBN inserts
PCX2050J		More wear resistant vitrified bond for profile tools, also for MCD
PCX2350H		Universal vitrified bond, also for high carbide proportions
PCX4350H		Most free grinding vitrified bond for large contact areas, small grit sizes

STANDARD DIMENSIONS FOR THE GRINDING OF PCD AND PCBN TOOLS

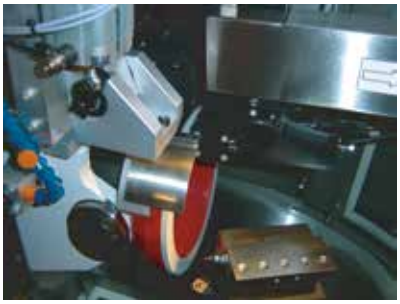
WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Inserts Milling cutters etc.	PCD PCBN	Manual and CNC tool grinding machines	2A2, 6A2, 11A2,... Ø 100...400 W 3...20 X 6...15	Vitrified, hybrid or metal bonds	Oil Emulsion

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Inserts Milling cutters etc.	PCD PCBN	CNC tool grinding machines OD grinding machines	1A1, 14A1, etc. Ø 100...500 U 3...15 X 5...10	Vitrified, resin or metal bonds	Oil Emulsion

Other dimensions on request

INNOVATIVE VITRIFIED BOND PCX

Norton WINTER PCX raises the bar for machining hard materials like PCD and PCBN (especially very brittle grades with low cBN percentages <80% cBN). More and more often, very fine grit sizes are preferred to meet the increasing demand on cutting edge quality. Due to the freegrinding behaviour of the new PCX range, coarser grit sizes achieve the same edge quality as formerly used grinding wheels with finer grits. PCX allows high feed rates and reduced recondition intervals and thus combines perfect cutting edge qualities with improved productivity.



APPLICATION EXAMPLE 1

PCX

GRINDING TOOL	D15A PCX2350H C120A
GRINDING MACHINE	EWAG EASYGRIND
COOLANT	Emulsion
WORKPIECE	PCD milling insert (brazed, high carbide proportion)
GRINDING PARAMETERS	
FEED RATE	v_f = 2 mm/min
STOCK	a_e = 0.3 mm
CUTTING SPEED	v_c = 11 m/s

BENEFITS

- 45% time savings
- Very good edge quality
- Perfect surface quality on carbide backing

APPLICATION EXAMPLE 2

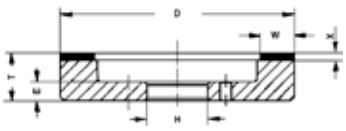
PCX

GRINDING TOOL	D15A PCX2350H C120A
GRINDING MACHINE	Coburn RG5
COOLANT	Emulsion
WORKPIECE	PCD insert (brazed, low carbide proportion)
GRINDING PARAMETERS	
FEED RATE	Pressure controlled
STOCK	a_e = 0.4 mm
CUTTING SPEED	v_c = 9.5 m/s

BENEFITS

- Reduced cycle time
- Edge chipping 6 µm (cutting face)
- Applicable for roughing and finishing

6A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	E (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
5VG6A2	150x5x10	40	40	10	D15A	PCX2350H	C120	A	7958716963 [1]
4VG6A2	150x10x10	40	40	10	D15A	PCX2350H	C120	A	7958704537 [2]
3VG6A2	150x20x10	40	40	10	D10	PCX2350H	C120	A	69014142334
		40	40	10	D15A	PCX2350H	C120	A	69014142337
2VG6A2	200x20x10	40	40	13	D15A	PCX2350H	C120	A	7958706277 [1]

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

HIGH-PERFORMANCE GRINDING OF SOLID PCBN INSERTS

The grindability of the manifold PCBN grades differs considerably because of the large variety of combinations of cBN content, cBN grit size and binder.
The features required for individual application areas are determined by the stipulated variables. For e. g. milling operations with interupted cut, hard and tough PCBN grades with high cBN content are necessary. These inserts mostly consist of solid PCBN - a challenge for their grinding tools: excellent freegrinding behaviour and fast cutting features prevent the insert as well as the grinding wheel surface from being glazed.

Hybrid bonded tools proved to be the ideal solution for these fields of application. Norton WINTER INSERT+CBN has been developed especially for grinding solid PCBN inserts and has meanwhile become established. The very good freegrinding behaviour of Insert+CBN grants an enormous productivity increase within tight dimension tolerance and outstanding cutting edge quality.

APPLICATION EXAMPLE 1

INSERT

GRINDING TOOL	D46 INSERT+CBN C100 A
GRINDING MACHINE	WENDT WAC 725
COOLANT	Emulsion
WORKPIECE	solid PCBN insert
GRINDING PARAMETERS	
FEED RATE	v_f = 8 mm/min (sides), v_f = 20 mm/min (radii)
STOCK	a_e = 0.25 mm
CUTTING SPEED	v_c = 20 m/s
DRESSING INTERVAL	continuously

BENEFITS

- 30% reduction of wheel wear
- 10% time saving
- 16% grinding cost reduction

APPLICATION EXAMPLE 2

INSERT

GRINDING TOOL	D46 INSERT+CBN C100 A
GRINDING MACHINE	EWAMATIC
COOLANT	Dielectric fluid
WORKPIECE	solid PCBN insert
GRINDING PARAMETERS	
FEED RATE	v_f = 6 mm/min
STOCK	a_e = 0.2 mm
CUTTING SPEED	v_c = 22 m/s
DRESSING INTERVAL	1 x per workpiece

BENEFITS

- 60% reduction of grinding time
- Very good edge quality
- Perfect diminsional stability

APPLICATION EXAMPLE 3

INSERT

GRINDING TOOL	D46 INSERT+CBN C100 A
GRINDING MACHINE	Agathon 400 Penta
COOLANT	Oil
WORKPIECE	solid PCBN insert
GRINDING PARAMETERS	
FEED RATE	v_f = 6 mm/min (sides), v_f = 20 mm/min (radii)
STOCK	a_e = 0.2 mm
CUTTING SPEED	v_c = 20 m/s
DRESSING INTERVAL	1 x per workpiece

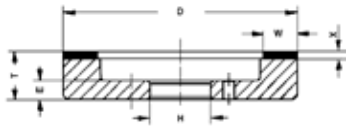
BENEFITS

- Outstanding grinding behaviour
- Enormous reduction of grinding time
- Considerable increase of lifetime in comparison to reference tool

STANDARD TOOLS FOR MANUAL PCD MACHINING

Apart from modern vitrified and hybrid bonds, metal bonded PCD grinding tools are still popular. These multi-purpose tools feature impressive lifetime, and are insensitive to variations in grinding pressure - which is important for manual applications. The selection assistant at the beginning of this chapter will help you to choose the best bond for your grinding task.

6A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	E (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
8BZ6A2	150x6x8	40	40	10*)		VFK		A	60157643172
1BZ6A2	150x20x4	40	40	10*)		VF		A	66260135795 1)
		40	40	10*)		VFF		A	60157643132
		40	40	10*)		VP		A	66260135772

May differ slightly from illustration depending on the machine's adapter flange

1) Delivery time 5 - 6 weeks
*) For EWAG manual machines

NORTON
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WINTER

KNIVES

GRINDING TOOLS FOR KNIFE MACHINING

DIAMOND AND CBN GRINDING WHEELS FOR SURFACE AND PROFILE GRINDING **85**

Grinding of flat and circular knives 86

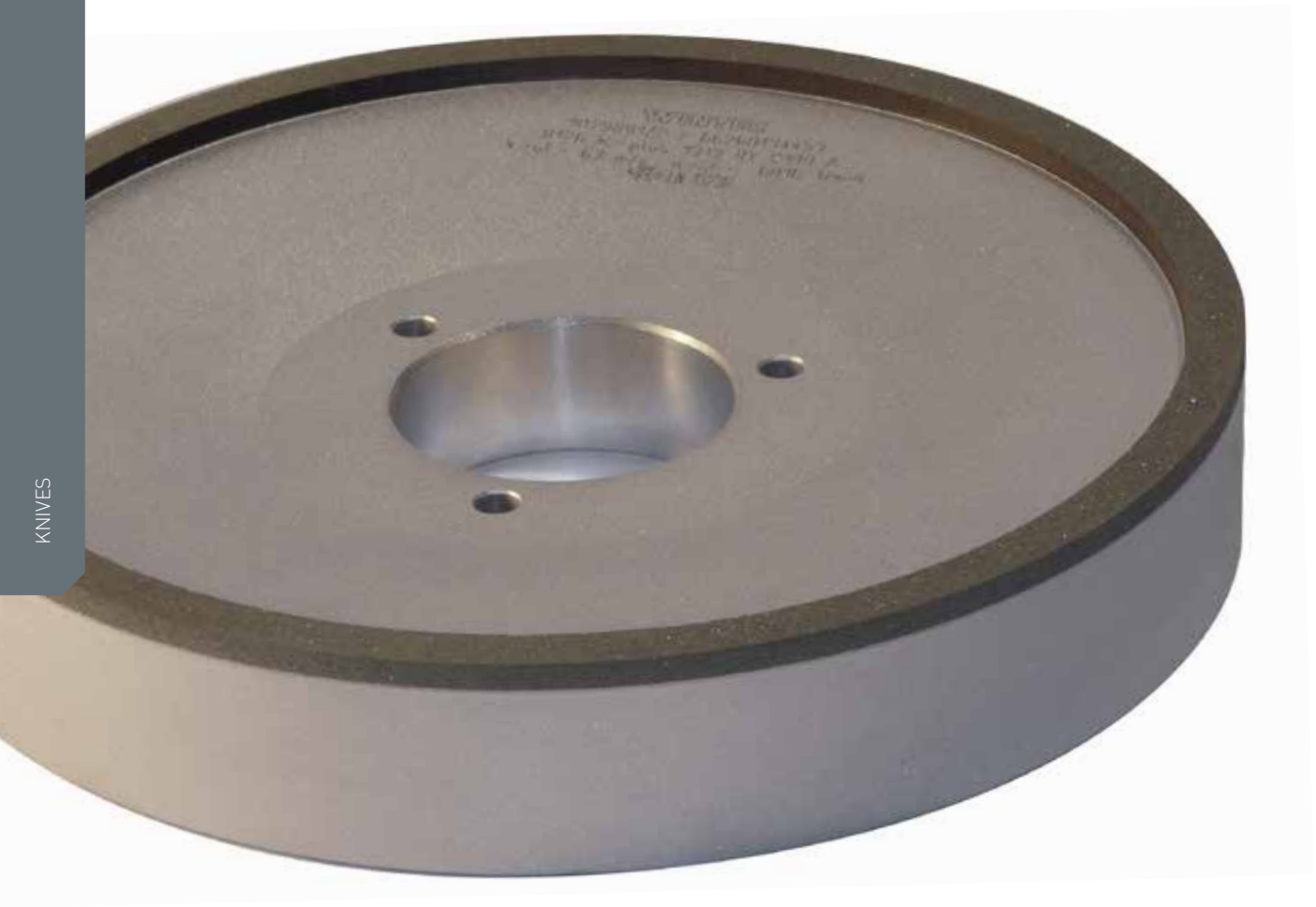
Grinding of profile knives 87

KNIVES

The knife industry includes various grinding applications in the manufacture of industrial knives such as flat, circular or profile knives.

The sharpness of the blade is the quality criterion for every type of knife. That is why most importance is given to the grinding of the blade facets. At the same time, this is also the most frequent application for superabrasive grinding tools in knife machining.

Information
Further information on applications and products can be found at
www.nortonabrasives.com



DIAMOND & CBN GRINDING WHEELS
FOR SURFACE AND PROFILE GRINDING

Norton WINTER offers metal and resin bonded grinding wheels for polish grinding of paper knives as well as roughly ground chopping knives for the recycling and shreddingsector

Both cup wheels for the grinding of flat and circular knives as well as peripheral wheels for the profiling of e.g. profile knives are available ex stock.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
BZ587	↑	Standard metal bond for knife machining
K+1313RY		Resin bond for tungsten carbide-steel combination grinding, wet
K+920		More wear-resistant resin bond also for dry grinding
K+4821		Free-grinding CNC bond, e.g. for Cermet
K+888RY		Univeral resin bond for wet grinding

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
MSS587	↑	Standard metal bond for knife machining
KSS920		More wear-resistant resin bond also for dry grinding
KSSRY		Univeral resin bond for wet grinding
KSSJY		Univeral resin bond for wet grinding
KSS007N		Free-grinding resin bond for dry grinding

STANDARD DIMENSIONS FOR KNIFE MACHINING

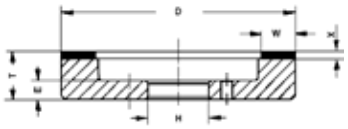
WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Flat knives Circular knives etc.	Tungsten carbide HSS	Göckel Reform Weinig	6A2, 222,... Ø 100...200 W 3...8 X 4...8	K+, KSS, BZ and MSS bonds	Oil Emulsion

WORKPIECE	MATERIAL	MACHINE	PERIPHERAL GRINDING WHEEL		COOLANT
			SHAPE	BOND	
Profile knives etc.	HSS	Universal blade grinding machines	14F1, 14A1 Ø 200 U 2...4 X 3...7	KSS bonds	Oil Emulsion

Other dimensions on request

GRINDING OF FLAT AND CIRCULAR KNIVES

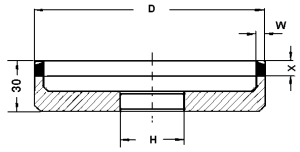
6A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
METAL BONDED DIAMOND GRINDING WHEELS								
3BZ6A2	200x8x4	75	35	D64	BZ587	C25	A	60157642913 [2), 5)]
6BZ6A2	200x8x8	20	31	D64	BZ587	C25	A	66260111969 [3)]
5BZ6A2	200x8x8	50	31	D64	BZ587	C25	A	66260110549 [4)]
3BZ6A2	200x8x8	75	35	D64	BZ587	C25	A	66260348688 [5)]
RESIN BONDED DIAMOND GRINDING WHEELS								
1K6A2	200x8x6	50	35	D126	K+1313RY	C100	A	7958762417 [4)]
2K6A2	200x8x6	75	35	D126	K+1313RY	C100	A	7958762416 [5)]
METAL BONDED CBN GRINDING WHEELS								
5BZ6A2	200x8x8	50	31	B126	MSS587	V120	A	66260133248 [4)]
3BZ6A2	200x8x8	75	35	B126	MSS587	V120	A	66260368698 [5)]
RESIN BONDED CBN GRINDING WHEELS								
2K6A2	125x3x4	20	18	B107	KSSRY	V120	H	66260134792 [6)]
1K6A2	150x4x6	20	29	B181	KSS007N-63	V180	A	60157643468 [3)]

May differ slightly from illustration depending on the machine's adapter flange
[3)] Universal tool grinding machines (bore can be adapted)
[4)] Göckel grinding machines
[5)] Reform grinding machines
[6)] Weinig grinding machines

222 STOCK PROGRAMME

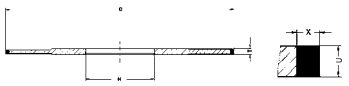


SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS									
3K222	100x3x6	20	30	3	B126	KSSRY	V120	A	60157643658 [6)]

[6)] Weinig grinding machines

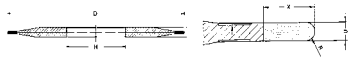
GRINDING OF PROFILE KNIVES

14A1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS								
2K14A1	200x4x10	60	6	D46	K+888RY	C100	A	66260112982 [1], [3]
CBN GRINDING WHEELS								
1K14A1	200x4x3	60	5	B91	KSSRY	V240	H	60157643410 [3]

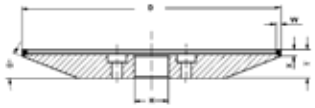
14F1 STOCK PROGRAMME



SHAPE	DxUxX (mm)	H (mm)	T (mm)	R	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
4K14F1	200x2x5	60	6	1	D54	K+888RY	C75	A	60157643156 [1], [3]
K14F1	200x3x5	60	10	1.5	D64	K+920	C100	A	66260336122 [1], [3]
3K14F1	200x4x6	60	5	2	D46	K+888RY	C100	H	66260111253 [1], [3]
		60	5	2	D151	K+1313RY	C100	H	66260114210 [1], [3]
9K14F1	200x2x7	20	10	1	D64	K+4821	C100	A	66260119930 [1]
		30	10	1	D64	K+4821	C100	A	66260127332 [1]
		31.75	10	1	D64	K+4821	C100	A	66260127734 [1]
		32	10	1	D64	K+4821	C100	A	66260350546 [1]
		40	10	1	D64	K+4821	C100	A	66260127638 [1]
		50	10	1	D64	K+4821	C100	A	66260118539 [1]
		60	10	1	D64	K+4821	C100	A	66260131361 [1]
13K14F1	200x2x7	60	5	1	D64	K+4821	C100	A	66260119140 [3]
7K14F1	200x4x7	20	10	2	D151	K+4821	C100	A	66260119142 [1]
		30	10	2	D151	K+4821	C100	A	66260395343 [1]
		31.75	10	2	D151	K+4821	C100	A	66260127145 [1]
		32	10	2	D151	K+4821	C100	A	66260350535 [1]
		40	10	2	D151	K+4821	C100	A	66260117349 [1]
		50	10	2	D151	K+4821	C100	A	66260117251 [1]
9K14F1	200x4x7	60	5	2	D151	K+4821	C100	H	66260127453 [3]
CBN GRINDING WHEELS									
5K14F1	200x2x5	60	6	1	B126	KSS920	V180	A	60157642627 [2], [3]
9K14F1	200x2x7	20	10	1	B126	KSSRY	V180	A	66260119631 [1]
		30	10		B126	KSSRY	V180	A	66260128533 [1]
		31.75	10		B126	KSSRY	V180	A	66260127835 [1]
		32	10		B126	KSSRY	V180	A	66260350545 [1]
		40	10		B126	KSSRY	V180	A	66260127441 [1]
		50	10		B126	KSSRY	V180	A	66260127044 [1]
		60	10		B126	KSSRY	V180	A	66260131760 [3]
13K14F1	200x2x7	60	5	1	B126	KSSRY	V180	A	66260119546 [3]
K14F1	200x3x5	60	10	1.5	B151	KSSR	V180	A	66260130748 [3]
1K14F1	200x4x3	60	5	2	B151	KSSRY	V240	H	60157642904 [3]

May differ slightly from illustration depending on the machine's adapter flange
[1] Delivery time 5 - 6 weeks [2] Available while stocks last [3] Weinig grinding machines

222 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS									
4K222	150x2x3.3	20	17	23	B107	KSSJY	V180	A	60157642630

700 STOCK PROGRAMME

SHAPE	DxWxX (mm)	H (mm)	T (mm)	R	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
7K700	200x1x5	20	10	0.5	D64	K+920	C75	E	60157678914 [2]
7K700	200x1x5	20	10	0.5	D126	K+920	C75	E	60157678913
CBN GRINDING WHEELS									
7K700	200x1x5	20	10	0.5	B151	KSSR	V180	E	60157678949

[2] Available while stocks last

NORTON
SAINT-GOBAIN

WINTER

GRINDING WHEELS FOR THE MACHINING OF MILLING TOOLS

DIAMOND AND CBN GRINDING WHEELS FOR GRINDING OF CUTTING FACES AND CLEARANCES **91**

Face grinding of profile cutters 92

Top grinding of profile cutters 94

Grinding of hobs 94

MILLING CUTTERS

In the woodworking industry, milling cutters are used for a variety of machining tasks. In this sector, there is a very wide range of milling cutters.
The most common are groove, joint, rebating, chamfering and profile cutters.
There are one-piece milling cutters as well as screwed and welded designs.
All of these tools place different demands on the grinding process.

Another major application area is hob grinding. Hobs are used in gear manufacturing and need to be ground and re-sharpened precisely with super-abrasive grinding wheels.

Information
Further information on applications and products can be found at
www.nortonabrasives.com

DIAMOND AND CBN GRINDING WHEELS OR GRINDING OF CUTTING FACES & CLEARANCES

The grinding of milling tools represents the last machining step in the manufacture and re-working of milling cutters. In a similar way to round tools and saw blades, the tool faces and the clearances (top) are the main applications for grinding. The machining of the top is particularly important here, as the runout of the milling tools is ensured in this manufacturing step. This then forms the basis for an even cutting performance.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
K+1421R		Standard resin bond for CNC applications
K+1414N		Resin bond for tungsten carbide-steel combination grinding, dry
K+1414J		Resin bond for tungsten carbide-steel combination grinding, dry
K+888R		Universal resin bond for dry grinding
K+888N		Universal resin bond for dry grinding
K+888J		Universal resin bond for dry grinding
K+1410		Free-grinding resin bond for dry grinding

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KSSTY		Universal resin bond for wet grinding
KSSRY		Universal resin bond for wet grinding
KSSJY		Universal resin bond for wet grinding
KSS12N		Standard resin bond for CNC applications
KSS10N		Universal resin bond for tool grinding
KSS10J		Universal resin bond for tool grinding
KSS007N		Free-grinding resin bond for dry grinding
K+888N		Universal resin bond for dry grinding

STANDARD DIMENSIONS FOR THE MACHINING OF MILLING TOOLS FOR THE WOODWORKING INDUSTRY

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Milling tools for the wookworking industry	Tungsten carbide HSS	Universal tool grinding machines	4A2, 12A2, 222,... Ø 100...200 W 3...8 X 2...4	K+, KSS bonds	Oill Emulsion (dry)

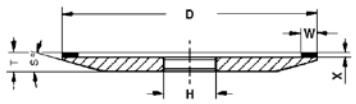
STANDARD DIMENSIONS FOR THE MACHINING OF HOBS

WORKPIECE	MATERIAL	MACHINE	CUP GRINDING WHEELS		COOLANT
			SHAPE	BOND	
Hobs	Tungsten carbide HSS	Universal tool grinding machines	4BT9, 222 Ø 100...150 W 1...10 X 1...3.3	K+, KSS, KM bonds	Oil Emulsion

Other dimensions on request

FACE GRINDING OF PROFILE CUTTERS

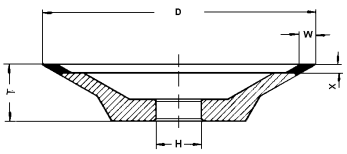
4A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
K4A2	100x6x2	20	8	15	D64	K+888N	C50	H	66260137071 [1]
6K4A2	125x5x2	20	10	15	D46	K+888J	C50	H	60157643448
			10	15	D64	K+888R	C50	H	60157643256
1K4A2	125x6x2	20	10	15	D46	K+1410	C75	H	66260115833
			10	15	D64	K+1410	C100	H	66260128030
K4A2	150x5x4	20	13	15	D64	K+888N	C50	H	60157643184
K4A2	175x5x4	20	13	15	D64	K+888N	C50	H	60157643327
CBN GRINDING WHEELS									
K4A2	100x4x2	20	8	15	B107	KSS10N	V120	H	60157642646 [1]
K4A2	125x4x2	20	6	15	B107	KSS10N	V120	H	60157642812 [1]
K4A2	125x5x4	20	15	15	B126	KSS10J	V120	H	60157642977 [1]
3K4A2	150x3x2	20	17	20	B151	KSSRY	V240	A	66260134960 [1]
K4A2	150x4x2	20	6	15	B107	KSS10N	V120	H	60157642791
K4A2	150x4x3	20	12	15	B91	KSS12N	V240	A	66260127081 [1]
K4A2	175x5x4	20	13	15	B126	KSS10J	V120	H	60157643668
K4A2	200x6x2	20	11	15	B107	KSS10J	V120	H	60157643223 [1]

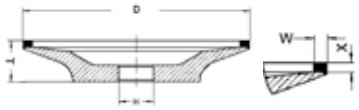
[1] Delivery time 5 - 6 weeks

12V2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
1K12V2	125x5x3	20	26	30	D64	K+888N	C50	H	60157642736
1K12V2	125x5x4	20	26	29	D46	K+888N	C50	H	66260129020
1K12V2	125x8x4	20	26	30	D46	K+888N	C50	H	60157642744
		20	26	30	D64	K+888N	C75	H	66260136367

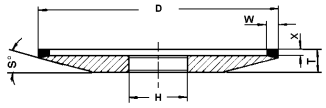
222 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
1K222	125x5x4	20	23	20	D64	K+1414J	C50	H	66260135758
16K222	125x5x4	20	23	20	D151	K+888R	C75	H	66260100321 [2]
		20	23	20	D181	K+888R	C100	H	60157643406
20K222	125x5x4	20	23	20	D46	K+888J	C50	H	66260349438
		20	23	20	D46	K+1410	C75	H	66260111759
		20	23	20	D64	K+888R	C50	H	66260117305
		20	23	20	D64	K+1410	C75	H	66260335191
		20	23	20	D91	K+888R	C50	H	66260117906
		20	23	20	D126	K+888R	C50	H	66260118608
		20	23	20	D151	K+888R	C75	H	66260130346
		20	23	20	D181	K+1410	C100	D	66260115578
		20	23	20	D181	K+1410	C100	H	66260352288
CBN GRINDING WHEELS									
20K222	125x5x4	20	23	20	B64	KSS007N-63	V120	D	66260115588
		20	23	20	B107	KSS10J	V120	H	66260133018
		20	23	20	B126	KSS10J	V120	H	66260350216
		20	23	20	B151	KSS007N-63	V120	H	66260135854
22K222	125x5x4	20	23 [1]	20	B107	KSS10J	V120	H	60157642903
1K222	150x5x4	20	23 [1]	20	B107	KSS007N-63	V120	H	66260115865

[1] 3 × 120° M6, pitch circle 32 3 × 120° Ø 6.6, pitch circle 36
[2] Available while stocks last

222 STOCK PROGRAMME

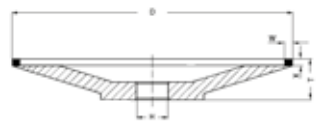


SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
2K222	150x3x3.3	20	12	12	D64	K+1410	C75	A	66260345390
2K222	200x3x3.3	20	12	12	D64	K+1410	C75	A	66260340765
CBN GRINDING WHEELS									
4K222	150x2x3.3	20	17	23	B107	KSSJY	V180	A	60157642630 [1]
2K222	150x3x3.3	20	12	12	B107	KSS007N-63	V180	A	66260345388
5K222	175x3x3.3	20	12	12	B107	KSS007N-63	V180	A	66260347845
2K222	200x3x3.3	20	12	12	B107	KSS007N-63	V180	A	66260340761

[1] Drawing see page 88

May differ slightly from illustration depending on the machine's adapter flange

222 STOCK PROGRAMME

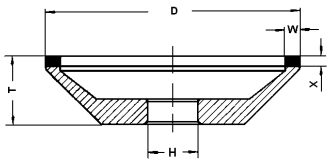


SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
14K222	150x5x4	20	23	20	D64	K+888R	C50	H	66260135778
		20	23	20	D151	K+1414N	C75	H	66260128468
2K222	175x5x4	20	26	18	D64	K+888R	C50	H	66260135779 [2]
6K222	200x5x4	20	28	16	D64	K+888R	C50	H	60157643208
CBN GRINDING WHEELS									
14K222	150x5x4	20	23	20	B54	KSS10J	V120	H	66260110861
		20	23	20	B107	KSS10J	V120	H	66260135777
2K222	175x5x4	20	26	18	B107	KSS10J	V120	H	66260135775
6K222	200x5x4	20	28	16	B107	KSS10J	V120	H	60157643768

[2] Available while stocks last.

TOP GRINDING OF PROFILE CUTTERS

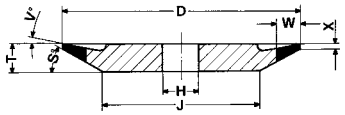
12A2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS									
K12A2	100x5x2	20	25	45	D46	K+888N	C50	H	60157643097
		20	25	45	D91	K+888R	C50	H	60157643285
		20	25	45	D91	K+888R-69	C50	A	66260147081
K12A2	100x6x4	20	27	45	D64	K+888R	C50	D	60157642582
		20	27	45	D126	K+888R	C75	B	60157642588
CBN GRINDING WHEELS									
K12A2	100x5x2	20	25	45	B126	KSS10J	V120	H	60157643373

GRINDING OF HOBS

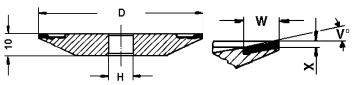
4BT9 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	V (°)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS										
K4BT9	100x10x1	20	10	5	20	D126	K+1421R	C75	A	66260348380
										Up to module 6
CBN GRINDING WHEELS										
K4BT9	100x10x1	20	10	5	20	B126	KSS12N	V180	A	66260132772
										Up to module 6

For creep feed and reciprocal grinding of straight- or spiral-fluted gear hobs

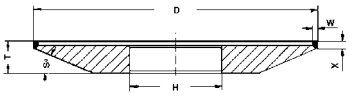
4V4 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS								
1K4V4	100x6x1	20	10	B151	KSSTY	V180	A	66260135829
								Up to module 6

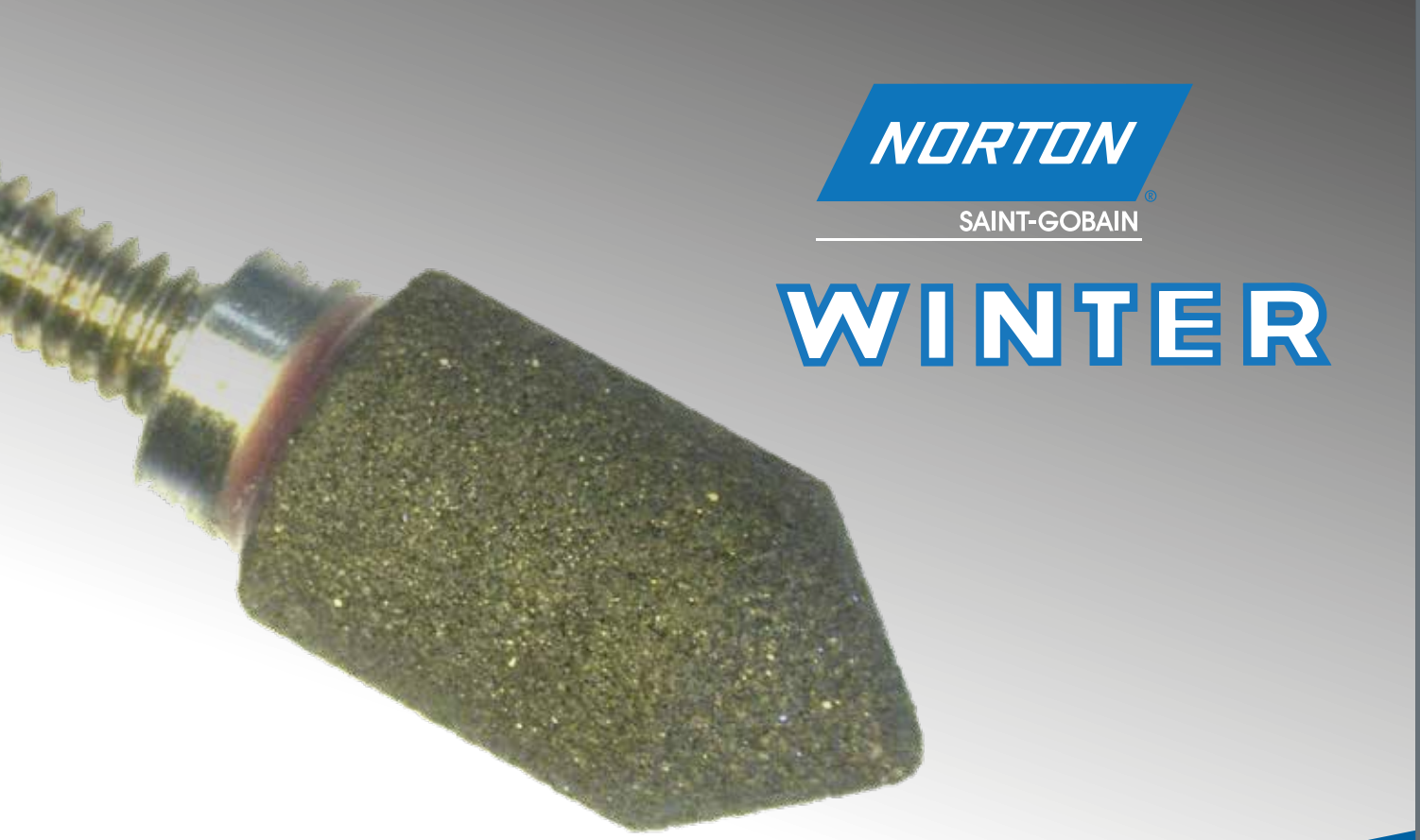
For creep feed and reciprocal grinding of straight-fluted hobs

222 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	T (mm)	S (°)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS									
1K222	150x2x3.3	50.8	17	20	B151	KSSRY	V300	A	60157644021
1K222	200x2x3.3	50.8	22	23	B151	KSSRY	V300	A	66260134942
									Up to module 6

For creep feed and reciprocal grinding of straight-fluted hobs



NORTON
SAINT-GOBAIN
WINTER

GRINDING TOOLS FOR THE MOULD-AND-DIE INDUSTRY

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MOULD AND DIE INDUSTRY

In the mould and die industry small lot sizes are the order of the day.
More often than not, products are manufactured on a ‘one-off’ basis according to exact customer specification; this requires flexible and efficient solutions.

Many companies use a high proportion of manual production steps. CNC operations and automated production lines are unusual, due to small lot sizes.

Information
Further information on applications and products can be found at
www.nortonabrasives.com

DIAMOND AND CBN GRINDING WHEELS
FOR SURFACE AND OD GRINDING

Vitrified and resin bonded diamond and cBN grinding wheels are used for surface and OD grinding.

The Norton WINTER MAXI stock programme offers a substantial choice of resin bonded 1A1 standard grinding wheels for machining tungsten carbide and steel. Vitrified bonded tools are also specified for individual machining tasks. Please contact us regarding your requirements.

MAXI PROGRAMME

DEVELOPMENT TREND IN THE PERIPHERAL GRINDING OF INSERTS

	T(mm)			
D (mm)	10 mm	15 mm	20 mm	30 mm
200 mm	Dia/cBN	Dia/cBN	Dia	
225 mm	Dia/cBN	Dia/cBN		
250 mm	Dia/cBN	Dia/cBN	Dia/cBN	
300 mm	Dia	Dia/cBN	Dia/cBN	Dia/cBN
350 mm	Dia		Dia/cBN	Dia/cBN
400 mm	Dia	cBN	Dia/cBN	Dia/cBN
450 mm			cBN	
500 mm			Dia/cBN	Dia
600 mm				Dia

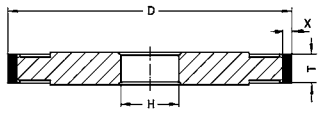
Available ex stock
Also availabe ex stock: K1A1-300-25-5 127 diamond.

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
Maxi 1313RY	↑	Special resin bond for tungsten carbide-steel combination grinding, wet
Maxi 1414R		Special resin bond for tungsten carbide-steel combination grinding, dry
Maxi 888RY		Universal resin bond for wet grinding
Maxi 888NY		Universal resin bond for wet grinding
Maxi 8837		Standard bond for surface and OD grinding
Maxi 125		Universal resin bond for surface and OD grinding > Ø250
Maxi 280		Universal resin bond for surface and OD grinding < Ø250
Maxi 777J		Universal resin bond for fine grit applications

CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
Maxi RY	↑	Universal resin bond for wet grinding
Maxi NY		Universal resin bond for wet grinding
Maxi 191		Universal resin bond for surface and OD grinding
Maxi 10N		Universal resin bond for tool grinding
Maxi 67		Standard bond for surface and OD grinding

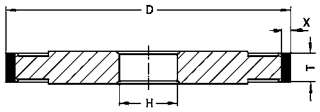
1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
11K1A1	200x10x5	51	D20B	Maxi 777J	C50	B	66260119254 [2]
		51	D91	Maxi 888NY	C75	B	66260119259
		51	D126	Maxi 888NY	C75	B	66260119262
11K1A1	200x20x5	51	D126	Maxi 888NY	C75	B	66260119266
11K1A1	225x10x5	51	D91	Maxi 280	C75	H	66260119623
11K1A1	250x15x5	76	D126	Maxi 888NY	C75	B	66260119337 [1]
11K1A1	250x20x5	76	D126	Maxi 1313RY	C75	B	66260119339 [2]
11K1A1	300x10x5	127	D91	Maxi 8837	C75	B	66260119219
		127	D126	Maxi 8837	C75	B	66260119221
11K1A1	300x15x5	127	D91	Maxi 125	C75	H	66260119648 [1]
		127	D91	Maxi 8837	C75	B	66260119208
		127	D126	Maxi 1313RY	C75	B	66260119206
		127	D126	Maxi 8837	C75	B	66260119210
11K1A1	300x20x5	127	D126	Maxi 8837	C75	B	66260119204
11K1A1	350x10x5	127	D126	Maxi 8837	C75	B	66260119187 [2]
11K1A1	350x20x5	127	D126	Maxi 8837	C75	B	66260119185
11K1A1	400x10x5	127	D126	Maxi 8837	C75	B	66260119231
11K1A1	400x20x5	127	D126	Maxi 1313RY	C75	B	66260119174
		127	D126	Maxi 8837	C75	B	66260119177
11K1A1	500x20x5	203.2	D126	Maxi 8837	C75	B	66260119514
		203.2	D126	Maxi 1313RY	C75	B	66260119518 [2]
K1A1	500x30x5	203.2	D126	Maxi 8837	C75	B	66260119523
K1A1	600x30x5	305	D126	Maxi 8837	C75	B	66260119524

Further dimensions up to 1000mm diamter on reques [1] Delivery time 5 - 6 weeks [2] Available while stocks last.

1A1 STOCK PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
CBN GRINDING WHEELS							
11K1A1	200x10x5	51	B126	Maxi 191	V180	A	66260119658
11K1A1	225x10x5	51	B126	Maxi 10N	V120	B	66260119537
11K1A1	225x15x5	51	B126	Maxi 10N	V120	B	66260119543
11K1A1	250x10x5	51	B126	Maxi 191	V180	H	66260119752
11K1A1	250x15x5	51	B91	Maxi 191	V180	H	66260119753
		51	B126	Maxi 10N	V120	B	66260119391
11K1A1	250x20x5	51	B126	Maxi 10N	V120	B	66260119393
11K1A1	300x15x5	76.2	B126	Maxi 67	V120	B	66260119390 [2]
11K1A1	300x15x5	127	B126	Maxi 67	V120	B	66260119386
11K1A1	300x20x5	76	B126	Maxi 191	V180	H	66260119780
11K1A1	300x20x5	127	B126	Maxi 67	V120	B	66260119384
11K1A1	300x30x5	127	B126	Maxi 67	V120	B	66260119366
11K1A1	350x20x5	127	B126	Maxi 67	V120	B	66260119367
		127	B126	Maxi 191	V180	H	66260119781
11K1A1	350x30x5	127	B126	Maxi 67	V120	B	66260119370
11K1A1	400x20x5	127	B126	Maxi 67	V120	B	66260119374
		127	B126	Maxi 67	V180	B	66260119376
11K1A1	400x30x5	127	B126	Maxi 67	V120	B	66260119380
		127	B126	Maxi 67	V180	B	66260119381
11K1A1	500x20x5	203.2	B126	Maxi 67	V120	B	66260119409

Further dimensions up to 1000mm diamter on request [1] Delivery time 5 - 6 weeks [2] Available while stocks last.

DIAMOND AND CBN GRINDING TOOLS FOR ID GRINDING

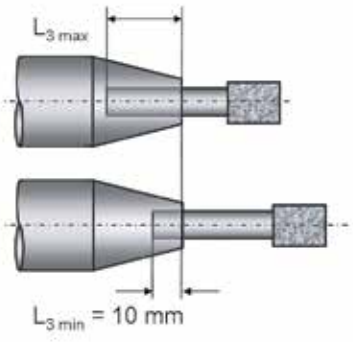
Many different materials are machined by ID grinding. The bond type of the grinding pin must be chosen according to the material.

VITRIFIED BONDS:
High resistance to wear and temperature, dressable, especially suited for hardened steels

RESIN BONDS:
Universally suitable for dry and wet grinding, especially for tungsten carbide and HSS

SINTERED METAL BONDS:
Extremely wear resistant with stable edge holding; well suited for short-chipping materials such as glass and ceramics

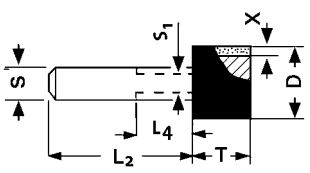
ELECTROPLATED METAL BONDS:
Single layer, high removal rates, surface roughness depending on grit size and condition of wear, especially suited for roughing tungsten carbide, glass and HSS



When choosing your grinding pin, please note that the diameter of the ID grinding tool should be no more than 70% of your bore. This keeps the contact area between the grinding pin and the workpiece in a comfortable range and avoids burning.
When in use, grinding pins are particularly prone to bending stress which can lead to tool failure if a particular threshold value is exceeded. For this reason, the permitted speed n_{perm} of a grinding pin must not be exceeded.
It is printed on the packaging label and is often engraved on the shaft of the grinding pin. The permitted speed shown there applies to a minimum clamping length of $L_{3\,min}$ = 10 mm.
Increasing the clamping length $L_{3\,min}$ will result in a new permitted speed. The ratio of increased clamping length and increase of permitted speed is not proportional but requires a recalculation of the new maximum of speed.
It is imperative to observe the permitted speed at all costs.
If the permitted speed is smaller than the adjustable speed of the grinding spindle, a different technical solution is required. If you have further questions, please contact us, we are pleased to help.

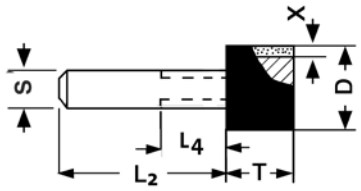
DIMENSIONING EXPLANATION

SAMPLE DESIGN K1A1W-8-6-2-6-60-4.1-8 D126 K+888RY C100		
K		Manufacturing process – internal abbreviation
Shape	1A1W	Cylindrical design
D	8	Head diameter
T	6	Head length
X	2	Layer thickness
S	6	Shaft diameter
L2	60	Shaft length
S1	4.1	Diameter of recess
L4	8	Length of recess
D126 K+888RY C100		Specification sample of resin bond grinding pin



VITRIFIED BONDED GRINDING TOOLS

Grinding pins and grinding wheels with vitrified bonds are used in wet grinding. Over and above the tried and tested Norton WINTER VSS cBN vitrified bond systems, the N7 bond range which is well-known for OD grinding, has recently produced outstanding ID grinding results.
Due to their high porosity, these innovative glass-ceramic systems permit cool grinding and a long tool life at the same time.
They are also available now as mini grinding tools with 'N7 bore'.



DESIGN MATRIX

C75-C200 V180-V480	DIAMETER D												
LAYER THICKNESS T	3	4	5	6	7	8	10	12	14	15	16	18	24
3	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
4	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
5	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
6	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
8	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
10	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
12	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
16	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN

SHAFT MATERIALS:

Steel	All applications
Tungsten carbide	Dimensions on request

Minimum order quantity for manufacture of non-stock items: 5 pieces per item
Special geometries on reques

GRINDING PINS / GRINDING WHEELS – SUMMARY AND RECOMMENDATIONS FOR USE

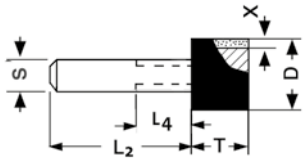
BOND TYPE	VITRIFIED BOND
Abrasive	**cBN (diamond on request)**
Bond designation	**Vitrified**
Features	Extremely high grit retention; protection against abrasion; very good profiling characteristics, highly porous, thus good transport for the cooling lubricant into and chip removal from the contact zone
Application areas	Predominantly hardened chrome steels, HSS and tool steels
RECOMMENDED USE	
Grinding wheel shape	**1A1W grinding pins and 1A8 grinding wheels**
Grit size d_k	B15 - B126
Bond	**"N7 Bore" (glass ceramic system); VSS (cBN ceramic)**
Circumferential speed v_c	40–80 m/s, please observe n_{perm}
Table feed rate v_f	0.1...2 m/min
Workpiece speed n_w	100...1000 min^{-1}
Infeed a_e	0.002...0.020 mm
Coolant	Oil and emulsion

IMPORTANT NOTES WHEN USING GRINDING PINS (SEE ALSO PAGE 100)

1A1W GRINDING PINS IN VITRIFIED BOND						
SHAPE	D	T	CLAMPING LENGTH $L_{3\ MIN}$	N_{PERM} (1/min)	CLAMPING LENGTH $L_{3\ MAX}$	N_{PERM} (1/min)
1A1W	3.0	6.0	10.0	16.000	52.0	139.000
1A1W	4.0	6.0	10.0	16.000	52.0	137.000
1A1W	5.0	6.0	10.0	16.000	52.0	144.000
1A1W	6.0	6.0	10.0	32.000	52.0	150.000
1A1W	6.0	8.0	10.0	32.000	50.0	150.000
1A1W	7.0	6.0	10.0	32.000	52.0	136.000
1A1W	7.0	8.0	10.0	31.000	50.0	136.000
1A1W	8.0	6.0	10.0	32.000	52.0	120.000
1A1W	8.0	10.0	10.0	30.000	48.0	120.000
1A1W	9.0	6.0	10.0	31.000	48.0	106.000
1A1W	10.0	6.0	10.0	30.000	52.0	96.000
1A1W	10.0	10.0	10.0	27.000	48.0	96.000
1A1W	12.0	6.0	10.0	29.000	52.0	80.000
1A1W	12.0	12.0	10.0	25.000	46.0	80.000
1A1W	14.0	6.0	10.0	28.000	52.0	68.000
1A1W	15.0	6.0	10.0	27.000	52.0	64.000
1A1W	15.0	15.0	10.0	20.000	43.0	64.000
1A1W	16.0	6.0	10.0	27.000	52.0	60.000
1A1W	18.0	6.0	10.0	25.000	52.0	53.000
1A1W	20.0	6.0	10.0	24.000	52.0	48.000
1A1W	24.0	6.0	10.0	22.000	52.0	40.000

n_{perm} (rpm) according to clamping length L

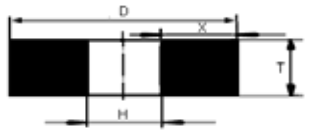
1A1W DELIVERY PROGRAMME



SHAPE	DxTxX (mm)	S	L_2 (mm)	L_4 (mm)	FINE (B64)	MEDIUM (B91)	ROUGH (B126)
CBN GRINDING PINS							
VG1A1W	5x6x1.5	3	60	8	66260398856	66260397474	66260392338
VG1A1W	6x6x1.5	6	60	8	66260391458	66260397676	66260392340
VG1A1W	7x6x2	6	60	8	66260398560	66260388279	66260399742
VG1A1W	8x6x2	6	60	8	66260394162	66260394381	66260398844
VG1A1W	9x10x2	6	60	12	66260397564	66260390983	66260391946
VG1A1W	10x10x2	6	60		66260398666	66260392785	66260392048
VG1A1W	11x10x2.5	6	60		66260396167	66260392086	66260387849
VG1A1W	12x10x2.5	6	60		69014161068	66260395187	66260391750
VG1A1W	13x10x2.5	6	60		66260393169	66260397188	66260396651
VG1A1W	14x10x2.5	6	60		66260397570	66260395789	66260399052
VG1A1W	15x10x3	6	60		69014163671	66260396690	66260396253

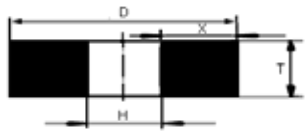
Delivery time 5 weeks
Minimum delivery 5 pieces per item

1A8 DELIVERY PROGRAMME



SHAPE	DxTxX (mm)	H (mm)	FINE (B64)	MEDIUM (B91)	ROUGH (B126)
CBN GRINDING WHEELS					
VG1A8	10x10x2.5	5	66260394977	66260396154	66260393099
VG1A8	10x14x2.5	5	66260388678	69014159655	66260389500
VG1A8	11x10x2.5	6	66260388179	69014158156	69014162201
VG1A8	11x14x2.5	6	66260393580	66260395957	69014162502
VG1A8	12x10x3	6	66260397982	66260391958	66260397203
VG1A8	12x15x2	8	66260396791	66260399966	69014163811
VG1A8	13 x10x3.5	6	69014158584	66260396259	69014161804
VG1A8	13x15x3.5	6	66260392385	69014157860	66260388105
VG1A8	15x10x4.5	6	66260391986	69014161961	66260392006
VG1A8	15x15x4.5	6	66260395087	66260394662	69014170907
VG1A8	18x10x5	8	69014170892	66260397567	66260393912
VG1A8	18x15x5	8	66260398493	69014163168	66260397713
VG1A8	20x10x7	6	66260397088	69014158063	69014167508
VG1A8	20x15x7	6	66260395689	66260398864	69014158009
VG1A8	20x20x7	6	66260396590	66260394465	66260397310
VG1A8	22x10x6	10	66260393995	66260394469	66260393414
VG1A8	22x15x6	10	69014158496	66260398870	66260393415
VG1A8	22x20x6	10	66260386897	69014165871	66260399016
VG1A8	24x10x7	10	66260392798	66260394272	66260394617
VG1A8	24x15x7	10	66260391599	69014160973	66260388018
VG1A8	24x20x7	10	66260388800	66260397874	66260399819
VG1A8	25x10x7.5	10	66260395803	66260399076	66260397621
VG1A8	25x15x7.5	10	69014159404	66260396477	66260392422
VG1A8	25x20x7.5	10	69014160101	69014162775	69014162620
VG1A8	27x18x8.5	10	66260387505	66260389478	69014158723
VG1A8	27x24x8.5	10	66260391606	66260389179	66260395124
VG1A8	28x19x9	10	69014167707	66260394180	66260399125

1A8 DELIVERY PROGRAMME

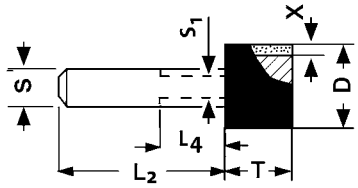


SHAPE	DxTxX (mm)	H (mm)	FINE (B64)	MEDIUM (B91)	ROUGH (B126)
CBN GRINDING WHEELS					
VG1A8	30x15x10	10	69014164708	66260395081	69014158026
VG1A8	30x20x10	10	66260396010	66260391583	66260391728
VG1A8	30x25x10	10	66260398109	66260399382	69014160727
VG1A8	32x15x11	10	69014161611	69014160784	66260386429
VG1A8	32x20x11	10	66260392312	66260393285	66260399630
VG1A8	32x25x11	10	66260396513	66260392286	69014162531
VG1A8	35x15x12.5	10	66260392314	66260396987	69014169332
VG1A8	35x20x12.5	10	66260393015	66260399488	69014167833
VG1A8	35x25x12.5	10	66260397416	66260397189	69014158134
VG1A8	37x15x12	13	66260394217	66260397990	66260398735
VG1A8	37x20x12	13	66260387318	66260398291	66260392838
VG1A8	37x25x12	13	66260397619	69014174592	66260388739
VG1A8	40x15x13.5	13	69014159520	69014158293	66260392840
VG1A8	40x20x13.5	13	66260396621	66260391194	69014158641
VG1A8	40x25x13.5	13	66260391722	66260394395	66260399842
VG1A8	45x15x16	13	66260399723	69014160796	69014158343
VG1A8	45x20x16	13	66260394724	66260387297	66260398944
VG1A8	45x25x16	13	66260397525	66260393298	66260395145

Delivery time 5 weeks
Ø < 25 mm minimum delivery 5 pieces per item
Ø ⩾ 25 mm minimum delivery 2 pieces per item

RESIN BONDED GRINDING TOOLS

Resin bonded grinding pins and grinding wheels are used for dry and wet grinding and for manual and automatic grinding as this type of bond can easily be adapted to the required application parameters. As a result of extensive research and development, the characteristics of phenolic or polyimide resins have led to standard bonds which are used in over 50% of all manufactured grinding tools, including both diamond and cBN tools.



DESIGN MATRIX

C75-C150 V120-V240	DIAMETER D												
LAYER THICKNESS T	3	4	5	6	7	8	10	12	14	15	16	18	24
2	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
3	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
4	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
5	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
6	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
8	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
10	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
12	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
16	-	-	-	-	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN

SHAFT MATERIALS:

Steel	All applications
Tungsten carbide	Dimensions on request
Heavy metal	Dimensions on request

Minimum order quantity for manufacture of non-stock items: 5 pieces per item
Special geometries on reques

GRINDING PINS / GRINDING WHEELS – SUMMARY AND RECOMMENDATIONS FOR USE

BOND TYPE	RESIN BOND	
Abrasive	DIAMOND	CBN
Bond designation	**K+888RY** for grinding pins **1A1W** **K+888RY** for grinding wheels **1A1**	**KSSRY** for grinding pins **1A1W** **KSSRY** for grinding wheels **1A1**
Features	Consistently good material removal rate, good service life, cool and soft grinding behaviour, roughness depth according to grit size and conditions of use. Wet and dry grinding	Consistently good material removal rate, good service life, cool and soft grinding behaviour, roughness depth according to grit size and conditions of use. Wet and dry grinding
Application areas	Tungsten carbide For carbide-tipped saw blades, drawing dies and other mould and die manufacturing. On ID and coordinate grinding machines.	HSS and hardened chrome steels: Case-hardened steels with bore diameters up to 20 mm. On ID and coordinate grinding machines.
RECOMMENDED USE		
Shape (Order Number)	**1A1W grinding pins and 1A1 grinding wheels**	**1A1W grinding pins and 1A1 grinding wheels**
Grit size d_k	D7 - D15C - D46 - D64 - D76 - D91 - D126	B91 - B126 - B151
Bonds	**K+ and KS Bonds**	**KSS Bonds**
Concentration	C50 to C150	V120 to V240
Circumferential speed v_c	15...25 m/s wet Please observe n_{perm} 10...20 m/s dry	...30 m/s wet Please observe n_{perm} ...20 m/s dry
Table feed rate v_f	0.5...5 m/min	0.5...5 m/min
Workpiece speed rate n_w	100...1000 min^{-1}	100...1000 min^{-1}
Feed rate s (= $v_f \cdot 10^3 : n_w$)	1 to 5 mm	1 to 5 mm
Infeed a_e	2...5% of d_k	2...5% of d_k
Coolant	Oil and emulsion	Oil and emulsion

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KS449		More wear-resistant resin bond preferably wet grinding
K+920		More wear-resistant resin bond preferably also dry grinding
K+921		More wear-resistant resin bond preferably wet grinding
K+888TY		Universal resin bond for wet grinding
K+888RY		Universal resin bond for wet grinding
K+1410		Free-grinding resin bond for dry grinding
K+777R		Universal resin bond for fine grit applications

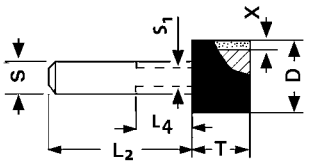
CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KSSRY		Universal resin bond for wet grinding
KSS10N		Universal resin bond for tool grinding

MPORTANT NOTES WHEN USING GRINDING PINS (SEE ALSO PAGE 100)

1A1W GRINDING PINS IN RESIN BOND						
SHAPE	D	T	CLAMPING LENGTH $L_{3\ MIN}$	N_{PERM} (1/min)	CLAMPING LENGTH $L_{3\ MAX}$	N_{PERM} (1/min)
1A1W	3.0	6.0	10.0	16.000	52.0	139.000
1A1W	4.0	6.0	10.0	16.000	52.0	137.000
1A1W	5.0	6.0	10.0	16.000	52.0	144.000
1A1W	6.0	6.0	10.0	32.000	52.0	150.000
1A1W	6.0	8.0	10.0	32.000	50.0	150.000
1A1W	7.0	6.0	10.0	32.000	52.0	136.000
1A1W	7.0	8.0	10.0	31.000	50.0	136.000
1A1W	8.0	6.0	10.0	32.000	52.0	120.000
1A1W	8.0	10.0	10.0	30.000	48.0	120.000
1A1W	9.0	6.0	10.0	31.000	48.0	106.000
1A1W	10.0	6.0	10.0	30.000	52.0	96.000
1A1W	10.0	10.0	10.0	27.000	48.0	96.000
1A1W	12.0	6.0	10.0	29.000	52.0	80.000
1A1W	12.0	12.0	10.0	25.000	46.0	80.000
1A1W	14.0	6.0	10.0	28.000	52.0	68.000
1A1W	15.0	6.0	10.0	27.000	52.0	64.000
1A1W	15.0	15.0	10.0	20.000	43.0	64.000
1A1W	16.0	6.0	10.0	27.000	52.0	60.000
1A1W	18.0	6.0	10.0	25.000	52.0	53.000
1A1W	20.0	6.0	10.0	24.000	52.0	48.000
1A1W	24.0	6.0	10.0	22.000	52.0	40.000

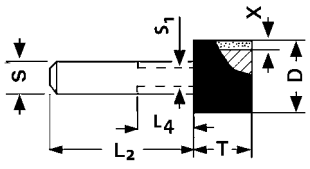
n_{perm} (rpm) according to clamping length L_3

1A1W STOCK PROGRAMME



SHAPE	DxTxX (mm)	S	L_2 (mm)	S_1	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING PINS									
K1A1W	3x6x0.65	3	60	1.7	8	D15C	K+888RY	C100	60157643985
		3	60	1.7	8	D46	K+888RY	C100	60157643693
		3	60	1.7	8	D64	K+888RY	C100	60157644200
		3	60	1.7	8	D91	K+888RY	C100	66260110217
		3	60	1.7	8	D126	K+888RY	C100	66260133993
K1A1W	4x6x1.15	3	60	1.7	8	D15C	K+888RY	C100	66260100083
		3	60	1.7	8	D46	K+888RY	C100	60157644166
		3	60	1.7	8	D64	K+888RY	C100	60157643874
		3	60	1.7	8	D91	K+888RY	C100	60157643582
		3	60	1.7	8	D126	K+888RY	C100	66260133998
5K1A1W	5x3x1.5	6	42	3.5	10	D76	K+921	C125	60157643650 [3]
K1A1W	5x6x1.5	3	60	2.1	8	D7	K+777R	C100	60157644191
		3	60	2.1	8	D15C	K+888RY	C100	60157643428
		3	60	2.1	8	D46	K+888RY	C100	66260110138
		3	60	2.1	8	D64	K+888RY	C100	60157643946
		3	60	2.1	8	D91	K+888RY	C100	66260134002 [1]
		3	60	2.1	8	D126	K+888RY	C100	66260134003
1K1A1W	6x3x1.5	6	42	3.5	10	D76	K+921	C125	66260111416 [3]
K1A1W	6x6x1.5	6	60	3	8	D15C	K+888RY	C100	66260100095
		6	60	3	8	D46	K+888RY	C100	60157643902
		6	60	3	8	D64	K+888RY	C100	66260134007
		6	60	3	8	D91	K+888RY	C100	66260110235
K1A1W	6x6x1.5	6	60	3.1	8	D64	K+888RY	C125	66260134006
		6	60	3.1	8	D126	K+888RY	C100	66260134009
K1A1W	6x8x1.5	6	60	3	8	D46	K+888RY	C100	60157643976
8K1A1W	6x8x1.5	6	75	3.1	10	D15C	K+888RY	C100	60157643224
		6	75	3.1	10	D46	K+888RY	C100	60157644144
8K1A1W	6.5x3x1.75	6	33	4.1	10	D76	K+921-42	C125	66260134445 [3]
2K1A1W	6.5x3x1.75	6	42	3.1	10	D76	K+921	C125	66260134718 [3]
		6	42	3.1	10	D91	K+888TY	C150	60157643974 [3]
6K1A1W	6.5x3x1.75	6	42	4.1	10	D76	K+888RY	C125	66260111088
		6	42	4.1	10	D76	K+921	C125	66260368674
1K1A1W	6.5x3x1.75	6	42	5.1	10	D76	K+920	C125	66260110241 [3]
		6	42	5.1	10	D76	K+921	C125	66260133964 [3]
1K1A1W	6.5x3x2	6	42	4.5	10	D76	KS449	C125	66260341274
1K1A1W	6.5x6x1.75	6	60	3.1	8	D76	K+888RY	C100	66260113144
2K1A1W	7x3x2	6	42	5.1	10	D76	K+921	C125	66260133966 [3]
		6	42	5.1	10	D91	K+888TY	C150	60157643957 [3]
		6	42	5.1	10	D91	K+920	C125	60157644164 [2] [3]
		6	42	5.1	10	D91	K+921	C125	60157643351 [2] [3]
K1A1W	7x6x2	6	60	3.1	8	D64	K+888RY	C100	66260134014
		6	60	3.1	8	D64	K+888RY	C125	60157644032
		6	60	3.1	8	D91	K+888TY	C150	66260134654

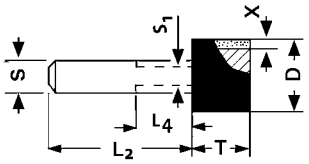
1A1W STOCK PROGRAMME



SHAPE	DxTxX (mm)	S	L_2 (mm)	S_1	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING PINS									
K1A1W	8x6x2	6	60	4.1	8	D15C	K+888RY	C100	60157643754
		6	60	4.1	8	D46	K+888RY	C100	60157643962
		6	60	4.1	8	D64	K+888RY	C100	60157644087
		6	60	4.1	8	D64	K+888RY	C125	66260134020
		6	60	4.1	8	D91	K+888RY	C100	66260134022
		6	60	4.1	8	D126	K+888RY	C100	66260134023
K1A1W	8x10x2	6	60	4.1	12	D15C	K+888RY	C100	60157644127
		6	60	4.1	12	D46	K+888RY	C100	66260134026
		6	60	4.1	12	D126	K+888RY	C100	66260134028
18K1A1W	8x10x2	6	75	4.1	12	D46	K+888RY	C100	66260100352 [2]
K1A1W	10x6x2	6	60			D46	K+888RY	C100	66260100065
		6	60			D64	K+888RY	C100	60157643781 [2]
		6	60			D64	K+888RY	C125	60157643973
		6	60			D91	K+888RY	C100	60157644098
		6	60			D126	K+888RY	C100	66260134036
K1A1W	10x10x2	6	60			D15C	K+888RY	C100	66260110355
		6	60			D46	K+888RY	C100	66260134038
		6	60			D126	K+888RY	C100	66260134040
22K1A1W	10x10x2	6	75			D15C	K+888RY	C100	66260110521
		6	75			D46	K+888RY	C100	60157644085
K1A1W	12x6x2	6	60			D46	K+888RY	C100	60157644002
		6	60			D64	K+888RY	C100	60157643710
		6	60			D64	K+888RY	C125	66260134081 [2]
		6	60			D91	K+888RY	C100	66260100327
		6	60			D126	K+888RY	C100	66260134045
K1A1W	12x12x2	6	60			D126	K+888RY	C100	66260100092
K1A1W	14x6x2	6	60			D126	K+888RY	C100	66260114956
K1A1W	15x6x2	6	60			D126	K+888RY	C100	66260134054
K1A1W	16x6x2	6	60			D46	K+888RY	C100	66260110126
		6	60			D126	K+888RY	C100	66260134059
K1A1W	18x6x2	6	60			D126	K+888RY	C100	66260127657
K1A1W	24x6x2	6	60			D126	K+888RY	C100	66260112903

[2] Available while stocks last
[3] Layer chamfer angle V° = 2°50'

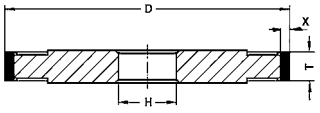
1A1W STOCK PROGRAMME



SHAPE	DxTxX (mm)	S	L_2 (mm)	S_1	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
CBN GRINDING PINS									
K1A1W	3x6x0.65	3	60	1.8	8	B126	KSSRY	V240	66260134724
K1A1W	4x6x1.15	3	60	1.8	8	B126	KSSRY	V240	66260134735
K1A1W	5x6x1.5	3	60	2.1	8	B126	KSSRY	V240	66260134743
K1A1W	6x6x1.5	6	60	3.1	8	B91	KSSRY	V240	66260133970
		6	60	3.1	8	B126	KSSRY	V240	66260133969
		6	60	3.1	8	B151	KSSRY	V240	60157643991 [2]
K1A1W	6x8x1.5	6	60	3	10	B126	KSSRY	V240	66260134754
K1A1W	7x6x2	6	60	3	8	B126	KSSRY	V240	66260133906
K1A1W	8x6x2	6	60	4	8	B91	KSSRY	V240	66260134097
		6	60	4	8	B126	KSSRY	V240	66260133918
		6	60	4	8	B151	KSSRY	V240	60157643512
K1A1W	8x10x2	6	60	4	12	B126	KSSRY	V240	66260133924
K1A1W	10x6x2	6	60	-	-	B91	KSSRY	V240	66260134124
		6	60	-	-	B126	KSSRY	V240	66260133971
K1A1W	10x10x2	6	60	-	-	B126	KSSRY	V240	66260133936
K1A1W	12x6x2	6	60	-	-	B126	KSSRY	V240	60157643978
K1A1W	12x12x2	6	60	-	-	B126	KSSRY	V240	66260133954
K1A1W	14x6x2	6	60	-	-	B126	KSSRY	V240	66260134098
K1A1W	16x6x2	6	60	-	-	B126	KSSRY	V240	60157644185
K1A1W	18x6x2	6	60	-	-	B126	KSSRY	V240	66260100280
K1A1W	20x6x2	6	60	-	-	B126	KSSRY	V240	60157644104

[2] Available while stocks last
[3] Layer chamfer angle V° = 2°50'

1A1 STOCK PROGRAMME

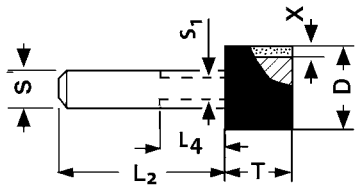


SHAPE	DxTxX (mm)	H (mm)	GRIT SIZE	BOND	CONCENTRATION	ORDER NUMBER
CBN GRINDING WHEELS						
1K1A1	10x10x2	4	B126	KSSRY	V180	66260136508
K1A1	12x10x2	6	B126	KSSRY	V180	66260135986
K1A1	15x10x2	6	B126	KSSRY	V180	66260135985
K1A1	18x10x2	6	B126	KSSRY	V180	66260136448 [2]
K1A1	20x10x2	8	B126	KSSRY	V180	66260136444 [2]
K1A1	20x15x2	8	B126	KSSRY	V180	66260135984
K1A1	25x10x2	8	B126	KSSRY	V180	66260134811 [2]
K1A1	30x10x2	10	B126	KSSRY	V180	66260136445
K1A1	30x15x2	10	B126	KSSRY	V180	66260135983
K1A1	50x10x2	20	B126	KSSRY	V180	66260134895

[2] Available while stocks last

METAL BONDED GRINDING TOOLS

Metal bonded grinding pins are distinguished by a high level of profile retention and shock resistance. In addition, they conduct heat away fast, which is of particular benefit especially when sensitive materials are being machined.



DESIGN MATRIX

C75-C150 V120-V240	DIAMETER D										
LAYER THICKNESS T	3	4	5	6	8	10	12	15	16	20	24
3	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
4	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
5	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
6	-Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
8	-	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
10	-	-	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
12	-	-	-	-	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN
15	-	-	-	-	-	-	-	Dia/ cBN	Dia/ cBN	Dia/ cBN	Dia/ cBN

SHAFT MATERIALS:

Steel	All applications
Tungsten carbide	Dimensions on request
Heavy metal	Dimensions on request

Minimum order quantity for manufacture of non-stock items: 5 pieces per item
Special geometries on reques

GRINDING PINS / GRINDING WHEELS – SUMMARY AND RECOMMENDATIONS FOR USE

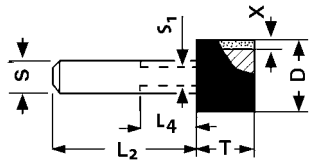
BOND TYPE	SINTERED METAL BOND
Abrasive	**Diamond (cBN on request)**
Bond designation	**BZ351** for grinding pins 1A1W
Features	Long service life, good material removal rate, great edge stability, surface roughness according to grit size and conditions of use. Suitable for wet and dry grinding, preferred for wet grinding.
Application areas	Tungsten carbide, hard short-chip materials (e.g. oxide ceramics), flat and hollow glass. On internal cylindrical and coordinate grinding machines. On high-speed manual machines.
RECOMMENDED USE	
Shape (Order number)	**1A1W grinding pins**
Grit size d_k	D64 - D91 - D126 - D151
Bond	**BZ351**
Concentration	C100
Circumferential speed v_c	15...20 m/s wet Please observe n_{perm} 12...18 m/s dry
Table feed rate v_f	0.5...5 m/min
Workpiece speed rate n_w	30...400 min^{-1}
Feed rate s (= $v_f \cdot 10^3 : n_w$)	1 to 10 mm
Infeed a_e	2 to 5% of d_k
Coolant	Emulsion Spray mist or compressed air

MPORTANT NOTES WHEN USING GRINDING PINS (SEE ALSO PAGE 100)

1A1W GRINDING PINS IN SINTERED METAL BOND						
SHAPE	D	T	CLAMPING LENGTH $L_{3\ MIN}$	N_{PERM} (1/min)	CLAMPING LENGTH $L_{3\ MAX}$	N_{PERM} (1/min)
1A1W	3.0	6.0	10.0	16.000	52.0	130.000
1A1W	4.0	6.0	10.0	15.000	52.0	138.000
1A1W	5.0	6.0	10.0	14.000	52.0	141.000
1A1W	6.0	6.0	10.0	32.000	52.0	150.000
1A1W	6.0	8.0	10.0	30.000	50.0	150.000
1A1W	8.0	6.0	10.0	30.000	52.0	120.000
1A1W	8.0	10.0	10.0	27.000	48.0	120.000
1A1W	10.0	6.0	10.0	29.000	52.0	96.000
1A1W	10.0	10.0	10.0	25.000	48.0	96.000
1A1W	12.0	6.0	10.0	27.000	52.0	80.000
1A1W	12.0	12.0	10.0	22.000	46.0	80.000
1A1W	15.0	6.0	10.0	25.000	52.0	64.000
1A1W	15.0	15.0	10.0	18.000	43.0	62.000
1A1W	20.0	6.0	10.0	22.000	52.0	48.000
1A1W	24.0	6.0	10.0	20.000	52.0	40.000

n_{perm} (rpm) according to clamping length L_3

1A1W STOCK PROGRAMME

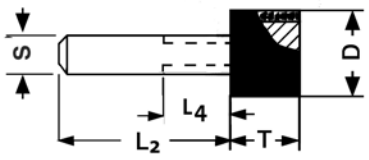


SHAPE	DxTxX (mm)	S	L_2 (mm)	S_1	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING PINS									
3BZ1A1W	3x6x0.75	3	60	2.1	8	D126	BZ351	C100	66260100307
BZ1A1W	4x6x1	3	60	-	-	D91	BZ351	C100	66260100317 [2]
BZ1A1W	5x6x1	3	60	-	-	D91	BZ351	C100	60157644066 [2]
		3	60	-	-	D126	BZ351	C100	60157643774
BZ1A1W	6x6x1	6	60	-	-	D126	BZ351	C100	66260100322 [2]
BZ1A1W	8x6x1	6	60	-	-	D91	BZ351	C100	60157644100 [1]
BZ1A1W	10x10x1	6	60	-	-	D126	BZ351	C100	60157644096

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

ELECTROPLATED GRINDING PINS

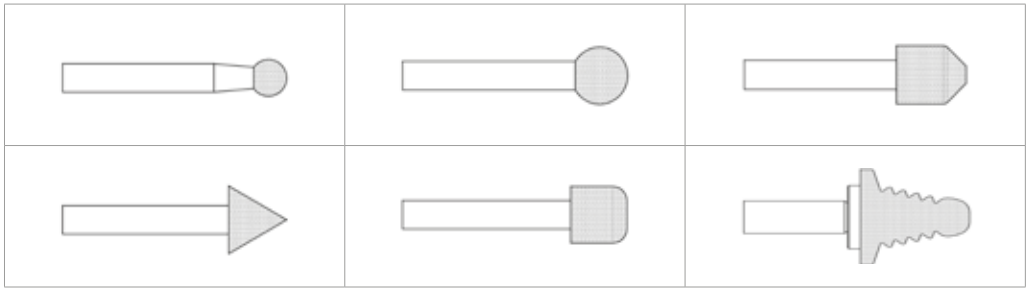
Electroplated grinding pins have three distinct advantages. Various special profiles can be manufactured to customer specifications and small head diameters from 0.4 mm are producible. Furthermore, distinct grain protrusion of diamond and cBN grits ensure high material removal rates. Apart from the extensive stock programme, various profile pins are available at short notice (see profile examples below). Please include the dimensions for D, T, S, S1, R, V and L_2, when ordering. For spherical pin, the head length 'T' should be specified as '0'. The front face of the head of electroplated grinding pins from 6 mm diameter and above is specially designed to reduce the contact area.
Minimum order quantity for manufacture of non-stock items: 5 pieces per item.



GRINDING PINS / GRINDING WHEELS - SUMMARY AND RECOMMENDATIONS FOR USE

BOND TYPE	ELECTROPLATED SINGLE-LAYER METAL BOND	
Abrasive	DIAMOND	CBN
Bond designation	**Norton WINTER S** for grinding pins **1A1W** and grinding wheels **1A1**	**Norton WINTER GSS** for grinding pins **1A1W** and grinding wheels **1A1**
Features	High material removal rate, surface roughness according to grit size and wear level, special shapes possible. Dry and wet grinding	High material removal rate, uniform surface roughness after an initial running-in period, special shapes possible. Dry and wet grinding
Application areas	Carbide, hard short-chip materials (e.g. ceramic oxide), pre-sintered carbide. On ID and coordinate grinding machines.	HSS and high-alloyed hardened steel. On ID and coordinate grinding machines.
RECOMMENDED USE		
Shape (Order Number)	**1A1W grinding pins and 1A1 grinding wheels**	**1A1W grinding pins and 1A1 grinding wheels**
Grit size d_k	D46 - D64 -D91 D126 - D181	B46 - B64 - B91 B126 - B151 -B252
Bonds	**G820**	**G825**
Concentration	S33	S33
Circumferential speed v_c	...20 m/s wet Please observe n_{perm} ...15 m/s dry	...30 m/s wet Please observe n_{perm} ...20 m/s dry
Table feed rate v_f	0.5...5 m/min	0.5...5 m/min
Workpiece speed rate n_w	100...1000 min^{-1}	100...1000 min^{-1}
Feed rate s (= $v_f \cdot 10^3 : n_w$)	1 to 5 mm	1 to 5 mm
Infeed a_e	20% of d_k	20% of d_k
Coolant	Dry, emulsion or oil	Dry, emulsion or oil

EXAMPLES OF COMMON PROFILE PINS

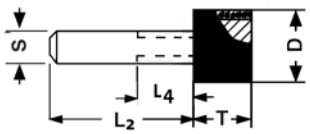


MPORTANT NOTES WHEN USING GRINDING PINS (SEE ALSO PAGE 100)

1A1W SINGLE LAYER ELECTROPLATED GRINDING PINS						
SHAPE	D	T	CLAMPING LENGTH $L_{3\ MIN}$	N_{PERM} (1/min)	CLAMPING LENGTH $L_{3\ MAX}$	N_{PERM} (1/min)
S1A1W	0.5	2.0	10.0	12.000	33.0	27000
S1A1W	0.6	2.0	10.0	18.000	33.0	41000
S1A1W	0.6	4.0	10.0	18.000	33.0	45000
S1A1W	0.7	2.0	10.0	23.000	33.0	57000
S1A1W	0.7	4.0	10.0	24.000	33.0	62000
S1A1W	0.8	2.0	10.0	24.000	31.0	50000
S1A1W	0.8	4.0	10.0	30.000	31.0	70000
S1A1W	0.9	2.0	10.0	30.000	31.0	66000
S1A1W	0.9	4.0	10.0	30.000	31.0	70000
S1A1W	1.0	2.0	10.0	35.000	31.0	82000
S1A1W	1.0	4.0	10.0	36.000	31.0	88000
S1A1W	1.1	4.0	10.0	42.000	28.0	91000
S1A1W	1.2	4.0	10.0	45.000	28.0	106000
S1A1W	1.3	4.0	10.0	48.000	28.0	120000
S1A1W	1.4	4.0	10.0	50.000	28.0	134000
S1A1W	1.5	4.0	10.0	50.000	28.0	134000
S1A1W	1.6	4.0	10.0	52.000	28.0	147000
S1A1W	1.7	4.0	10.0	53.000	28.0	150000
S1A1W	1.8	4.0	10.0	54.000	28.0	150000
S1A1W	1.9	4.0	10.0	54.000	28.0	150000
S1A1W	2.0	4.0	10.0	57.000	24.0	138000
S1A1W	2.2	4.0	10.0	57.000	24.0	143000
S1A1W	2.4	4.0	10.0	56.000	24.0	145000
S1A1W	2.5	4.0	10.0	56.000	24.0	146000
S1A1W	2.6	4.0	10.0	55.000	24.0	146000
S1A1W	2.8	4.0	10.0	54.000	24.0	145000
S1A1W	3.0	5.0	10.0	55.000	20.0	106000
S1A1W	3.5	5.0	10.0	51.000	20.0	96000
S1A1W	4.0	5.0	10.0	29.000	35.0	132000
S1A1W	4.5	5.0	10.0	28.000	30.0	83000
S1A1W	5.0	7.0	10.0	28.000	40.0	85000
S1A1W	6.0	7.0	10.0	39.000	40.0	150000
S1A1W	7.0	8.0	10.0	39.000	40.0	136000
S1A1W	8.0	10.0	10.0	38.000	40.0	120000
S1A1W	10.0	10.0	10.0	36.000	40.0	96000
S1A1W	12.0	10.0	10.0	33.000	40.0	80000
S1A1W	15.0	10.0	10.0	30.000	40.0	64000

n_{perm} (rpm) according to clamping length L_3

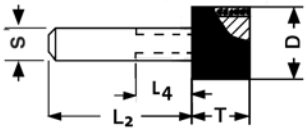
1A1W STOCK PROGRAMME



SHAPE	DxT (mm)	S	L_2 (mm)	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING PINS								
S1A1W	0.5x2	3	38	5	D91	G820	S33	60157644111 [1]
S1A1W	0.6x4	3	36	3	D91	G820	S33	66260110736 [1]
S1A1W	0.7x3	3	37	3	D91	G820	S33	60157644152 [2]
S1A1W	0.8x2	3	38	7	D91	G820	S33	60157643877
S1A1W	0.8x4	3	36	5	D91	G820	S33	60157643493
S1A1W	1x4	3	36	5	D91	G820	S33	66260134647
		3	36	5	D126	G820	S33	60157643706
S1A1W	1.2x4	3	36	8	D91	G820	S33	60157643847
		3	36	8	D126	G820	S33	60157643955
S1A1W	1.3x4	3	36	8	D126	G820	S33	60157643988 [1]
S1A1W	1.5x4	3	36	8	D91	G820	S33	66260134656
		3	36	8	D126	G820	S33	60157643944
S1A1W	2x4	3	36	12	D46	G820	S33	60157643916 [2]
		3	36	12	D91	G820	S33	66260134665
		3	36	12	D126	G820	S33	66260134666
		3	36	12	D181	G820	S33	60157643806
S1A1W	2.2x4	3	36	12	D91	G820	S33	66260134668
S1A1W	2.5x4	3	36	12	D91	G820	S33	66260134670
		3	36	12	D126	G820	S33	66260134671
S1A1W	3x5	3	35	15	D91	G820	S33	66260134675
		3	35	-	D126	G820	S33	66260134676
		3	35	-	D181	G820	S33	60157643785 [2]
S1A1W	3.5x5	3	35	-	D91	G820	S33	66260134678
		3	35	-	D126	G820	S33	66260134679 [2]
S1A1W	4x5	3	45	-	D91	G820	S33	66260134681
		3	45	-	D126	G820	S33	66260134682
		3	45	-	D181	G820	S33	66260100058 [2]
S1A1W	4x6	3	50	-	D91	G820	S33	66260110226
S1A1W	4.5x5	3	45	-	D126	G820	S33	60157643674 [2]
S1A1W	4.5x6	3	50	-	D91	G820	S33	66260110137 [2]
1S1A1W	5x6	3	50	-	D91	G820	S33	66260100334
S1A1W	5x7	3	43	-	D91	G820	S33	66260134687
		3	43	-	D126	G820	S33	66260134688
		3	43	-	D181	G820	S33	60157644114
S1A1W	6x7	6	53	13	D91	G820	S33	66260134690
		6	53	13	D126	G820	S33	66260134691
		6	53	13	D181	G820	S33	66260134692
S1A1W	6x7	6	75	-	D91	G820	S33	60157643963
S1A1W	7x8	6	52	-	D126	G820	S33	66260134694
		6	52	-	D181	G820	S33	60157643771 [2]

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

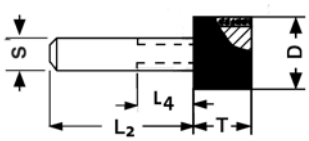
1A1W STOCK PROGRAMME



SHAPE	DxT (mm)	S	L_2 (mm)	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING PINS								
S1A1W	8x10	6	50	-	D91	G820	S33	66260134696
		6	50	-	D126	G820	S33	66260134697
		6	50	-	D181	G820	S33	66260134698
S1A1W	8x10	6	75	-	D91	G820	S33	66260110242
		6	75	-	D181	G820	S33	66260110167
S1A1W	10x10	6	50	-	D91	G820	S33	66260134699
		6	50	-	D126	G820	S33	66260134700
		6	50	-	D181	G820	S33	66260134701
S1A1W	10x10	6	75	-	D91	G820	S33	60157644175
		6	75	-	D181	G820	S33	60157644083
S1A1W	12x10	6	50	-	D126	G820	S33	66260134703
S1A1W	12x10	6	75	-	D91	G820	S33	60157643803
		6	75	-	D181	G820	S33	60157644091
S1A1W	15x10	6	50	-	D126	G820	S33	60157643885
CBN GRINDING PINS								
S1A1W	0.5x2	3	38	5	B91	G825	S33	66260110140 [2]
S1A1W	0.6x4	3	36	3	B91	G825	S33	66260134726
S1A1W	0.7x4	3	36	3	B91	G825	S33	66260100338
S1A1W	0.8x4	3	36	5	B91	G825	S33	66260134734
S1A1W	1x2	3	38	7	B126	G825	S33	66260134739
S1A1W	1x4	3	36	5	B91	G825	S33	66260134744
		3	36	5	B126	G825	S33	66260134742
S1A1W	1.2x4	3	36	8	B91	G825	S33	66260134751
		3	36	8	B126	G825	S33	66260134749
S1A1W	1.3x4	3	40	8	B91	G825	S33	66260110421 [1]
S1A1W	1.4x4	3	36	8	B126	G825	S33	66260101138 [2]
S1A1W	1.5x4	3	36	8	B91	G825	S33	66260134757
		3	36	8	B126	G825	S33	66260134755
S1A1W	1.6x4	3	36	8	B91	G825	S33	66260110135 [1]
S1A1W	1.7x4	3	36	8	B126	G825	S33	60157643451 [2]
S1A1W	1.8x4	3	36	8	B91	G825	S33	60157643816 [2]
S1A1W	2x4	3	36	12	B91	G825	S33	66260133913
		3	36	12	B126	G825	S33	66260133911
		3	36	12	B151	G825	S33	60157644057
S1A1W	2.5x4	3	36	12	B91	G825	S33	66260133920
		3	36	12	B126	G825	S33	66260133919
S1A1W	2.8x4	3	36	12	B91	G825	S33	60157643883 [2]
		3	36	12	B126	G825	S33	66260107667 [2]
S1A1W	3x5	3	35	15	B91	G825	S33	66260133929
		3	35	15	B126	G825	S33	66260133927
		3	35	15	B151	G825	S33	66260133926

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

1A1W STOCK PROGRAMME



SHAPE	DxT (mm)	S	L_2 (mm)	L_4 (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
CBN GRINDING PINS								
S1A1W	3.5x5	3	35	-	B91	G825	S33	60157643964 [1]
		3	35	-	B126	G825	S33	66260133931
		3	35	-	B151	G825	S33	66260133930 [2]
S1A1W	4x5	3	45	-	B91	G825	S33	66260133937
		3	45	-	B126	G825	S33	66260133935
		3	45	-	B151	G825	S33	60157643772
S1A1W	4.5x5	3	45	-	B126	G825	S33	66260133939
S1A1W	5x7	3	43	-	B91	G825	S33	66260133944 [1]
		3	43	-	B126	G825	S33	66260100061
		3	43	-	B151	G825	S33	60157643453
S1A1W	6x7	6	53	13	B91	G825	S33	66260133947
		6	53	13	B126	G825	S33	66260133946
		6	53	13	B151	G825	S33	60157643694
S1A1W	6x7	6	68	-	B252	G825	S33	66260100064
S1A1W	6x7	6	75	-	B126	G825	S33	60157643703
S1A1W	7x8	6	52	-	B126	G825	S33	66260133949
		6	52	-	B151	G825	S33	60157643834
S1A1W	8x10	6	50	-	B151	G825	S33	66260133952
S1A1W	8x10	6	70	-	B252	G825	S33	60157643793 [2]
S1A1W	8x10	6	75	-	B126	G825	S33	60157643605
S1A1W	10x10	6	50	-	B91	G825	S33	66260133958
		6	50	-	B151	G825	S33	66260133956
S1A1W	10x10	6	75	-	B126	G825	S33	60157644046
S1A1W	12x10	6	50	-	B126	G825	S33	66260133960 [2]
		6	50	-	B151	G825	S33	66260133959
S1A1W	12x10	6	75	-	B126	G825	S33	66260100091
S1A1W	15x10	6	50	-	B151	G825	S33	60157643797

[1] Delivery time 5 - 6 weeks
[2] Available while stocks last

SMALL GRINDING TOOLS
FOR COORDINATE GRINDING

Apart from the range of 1A1W grinding pins, Norton WINTER is also offering a programme of small grinding tools with special geometries (07B grinding pin) and 11V2 grinding wheels for coordinate grinding. Specific standard solutions are available ex stock.

APPLICATION AREAS

Grinding die sockets and beverage can ironing rings for the packaging industry on coordinate grinding machines

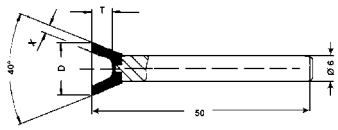
SPECIFICATION	1K07B-12-5-2-6-40 *B126 KSS10N V240
WORKPIECE	HSS DM05, EW9Co10
HARDNESS	62 – 64 HRC
MACHINING PARAMETERS	
CUTTING SPEED	v_c = 30 m/s
FEED RATE	v_f = 80...100 mm/min
INFEED	a_e = 0.02 mm
COOLANT	Oil or emulsion (1 to 4%)

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
K+888R	↑	Universal resin bond for dry grinding

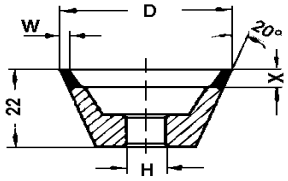
CBN GRINDING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KSS12N	↑	Standard resin bond for CNC applications
KSS10N		Universal resin bond for tool grinding

07B STOCK PROGRAMME



SHAPE	DxTxX (mm)	V (°)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
DIAMOND GRINDING WHEELS						
2K07B	15x5x2	40	D64	K+888RY	C100	60157643705
CBN GRINDING PINS						
2K07B	10x5x2	40	B126	KSS10N	V240	60157643794
1K07B	12x5x2	40	B126	KSS10N	V240	66260107661
1K07B	15x5x2	40	B126	KSS10N	V240	60157644044

11V2 STOCK PROGRAMME



SHAPE	DxWxX (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER
DIAMOND GRINDING WHEELS							
K11V2	40x2x5	10	D64	K+888R	C75	H	60157642670
CBN GRINDING WHEELS							
2K11V2	20x2x5	8	B126	KSS12N	V180	H	60157643026
K11V2	30x2x5	8	B126	KSS12N	V180	H	66260136462
K11V2	40x2x5	10	B126	KSS10N	V180	H	66260134764

DIAMOND AND CBN CUT-OFF WHEELS

Diamond cutting wheels are used for efficient cutting of hard, short-chipping and wear resistant materials such as glass, ceramics and carbide. The current trend towards sintered materials has increased the use of diamond cutting wheels. They are successfully used in the food industry and medical science, due to their clean and almost residue-free cutting ability.
cBN was developed as an addition to diamond. The specific characteristics of this cutting material permit the machining of high-performance high-speed steel and hardened steel from 55 HRC as well as magnetic materials.
The cutting wheels consist of a steel core with the cutting layer on the periphery. The cutting layer in sintered metal, resin or electroplated metal bond contains either diamond or cBN. The combination of bond, type of abrasive, concentration and grit size leads to different tool characteristics which are specified to meet the requirements of different processes and applications.

EUROPEAN STANDARD EN 13236:2000 - COMMON MAXIMUM OPERATING SPEEDS FOR CUT-OFF WHEELS

CORE		ABRASIVE SECTION	APPLICATION MODE	GRINDING MODE	MAXIMUM OPERATING SPEED IN M/S ACCORDING TO BOND TYPE		
					Resin B	Metal M	Electroplated G
Metal	metal blank, e.g. cast, rolled, forged	closed	mechanically and manually guided cut-off grinding	wet cut-off grinding	63	80	80
				dry cut-off grinding	-	80	80
		segmented	mechanically and manually guided cut-off grinding	wet cut-off grinding	-	40 [a]	50 [a]
					-	80	80
				dry cut-off grinding	-	63	80
		closed or segmented	manually guided cut-off grinding	wet and dry cut-off grinding	-	63 [b]	80
	sintered	closed	mechanically and manually guided cut-off grinding	wet cut-off grinding	63	63	-
Resin		closed	mechanically and manually guided cut-off grinding	wet and dry cut-off grinding		-	-

[a] For difficult to machine materials, like e.g. granite, diorite, quartzite, armoured concrete
[b] The abrasive section must be welded or sintered to the core for cut-off wheels for free hand cutting with metal bond abrasive sections

APPLICATION NOTES

1. WHICH MATERIALS CAN BE CUT?

As a general rule, diamond cutting wheels are used to cut hard, short-chipping materials such as glass, ceramics (fired and unfired), carbide, graphite, quartz, ferrite and semiconductor materials.

Materials with an affinity for carbon, such as iron-based alloys, are cut using cubic boron nitride (cBN). High-alloy steels such as HSS and chrome steel with 12% Cr are typical examples. Ideally, steel should have a minimum hardness of 55 HRC. Soft, long-chipping materials accumulate in the chip space, so they tend to clog. Compromises can be achieved with electroplated bonds.

2. WHICH CUTTING LAYER SPECIFICATION?

The following is indispensable for correct selection of layer specification:

- full description of workpiece material
- cutting edge quality requirements (e.g. maximum size of edge chipping) machining parameters, range of variants (e.g. speed from/to, feed rate from/to)
- details of drive power (see point 4)
- details of coolants

3. WHICH TOOL DIMENSIONS?

The tool dimensions are determined by the machine and the height of workpiece to be cut. Normally, the flange diameter should not fall below 1/3 of the cutting wheel diameter, i.e. the maximum workpiece height which can be sawn is less than one third of the blade diameter.

A stable cutting wheel core is essential for chip-free cutting edges. The directional stability of the blade can also be enhanced by increasing the flange diameter (diameter size required). Proportionately larger flanges are advisable for high cutting rates. A summary of the internationally approved designations for continuous-rim cutting wheels and the associated flanges has been compiled by FEPA.

4. WHICH MACHINE?

Generally valid principles apply to the highest possible dynamic stability, since any oscillation during the cutting operation can have a negative effect on tool behaviour. Peripheral speed plays an important role in the adaptation of the tool to the cutting operation, and should therefore be adjustable, at least by means of a change of drive pulley.

Sufficient motor drive output is essential as an undersized motor will prevent the optimum utilization of the diamond tool. Diamond and bond must be made to work hard if the self-sharpening effect is to occur. Bonds will have greater resistance to wear and will thus be more economical if the spindle drive permits high cutting rates. Cutting wheels with diameters exceeding 300 mm should be used with a drive power of at least 1.5 kW; for ganged wheels, a further 0.5 kW should be allowed for each additional cutting wheel.

5. WHICH OPERATION PARAMETERS?

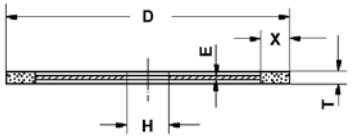
In the vast majority of cases, the full material thickness is cut in a single pass at a suitably chosen feed rate. However, step cutting rather than full cutting is used for particularly dense materials such as sapphire which wears the diamond layer without simultaneously removing a corresponding amount of the bond. The smaller the ratio of depth of cut to feed rate i.e. the shallower the cut, the greater is the sharpening effect of the cutting process. Feed rate is directly dependent on the spindle drive power and the hardness or toughness of the material to be cut. A general specification of cutting rates cannot be given in view of the large number of different materials which can be cut with the different cutting wheel types. There are optimal ranges of peripheral speed, dependent on the cutting operation. In general, low peripheral speeds (20–30 m/s) are used for dense, fine-debris materials, whereas higher speeds (30–40 m/s) are used for porous, coarse-debris materials.

6. COOLANT OR DRY CUT?

Metal bonded cutting wheels are invariably used with coolant (with the exception of the electroplated S-type), resin bond closed-rim blades can also work dry. Different coolants are used for the different workpiece materials, e.g. water, mineral based oils, emulsions, synthetic oils etc. It is important for coolant flow to be sufficient and to be accurately directed to the tool/workpiece interface. The coolant is supplied via coolant nozzles, by a special flange or by emersion.

RESIN BONDED CUT-OFF WHEELS

Resin bonded cutting wheels feature exceptionally good free-cutting characteristics due to low cutting forces and low cutting temperatures. The result is fast cutting with clean cut surfaces without edge chipping – which is particularly important for thinwalled hollow workpieces.



FEPA DESIGNATION	DxTxX (mm)	E (mm)	H (mm)	GRIT SIZE	NORMAL CONCENTRATIONS
K1A1R	100x0.6x5	0.5	Standard bore diameter 20 mm, other bore diameters on request	The following grit sizes are available: Diamond: D46, D64, D91, D107, D126, D151, D181, D213, D301 cBN: B91, B107, B126, B151, B181	The following concentrations are available: Diamond: C38, C50, C75, C100 cBN: V120, V180, V240
	100x0.8x5	0.6			
	100x1.0x5	0.8			
	100x1.2x5	1.0			
K1A1R	125x0.6x5	0.5			
	100x0.8x5	0.6			
	125x1.0x5	0.8			
	125x1.2x5	1.0			
K1A1R	150x0.6x7	0.5			
	150x0.8x7	0.6			
	150x1.0x7	0.8			
	150x1.2x7	1.0			
	150x1.5x7	1.3			
K1A1R	175x0.8x7	0.6			
	175x1.0x7	0.8			
	175x1.2x7	1.0			
	175x1.5x7	1.3			
K1A1R	200x0.8x7	0.6			
	200x1.0x7	0.8			
	200x1.2x7	0.9			
	200x1.5x7	1.2			
K1A1R	250x1.0x7	0.7			
	250x1.2x7	0.9			
	250x1.4x7	1.1			
	250x1.7x7	1.4			
K1A1R	300x1.0x7	0.7			
	300x1.2x7	0.9			
	300x1.4x7	1.1			
	300x1.7x7	1.4			
K1A1R	400x1.2x7	0.9			
	400x1.5x7	1.2			
	400x1.7x7	1.4			
	400x1.9x7	1.6			
	400x2.3x7	2.0			
K1A1R	500x2.3x7	2.0			
K1A1R	550x2.3x7	2.0			

Standard tolerances

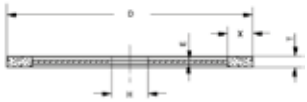
Ø < 100 mm	T ± 0.07
Ø ⩽ 250 mm	T ± 0.10
Ø ⩾ 300 mm	T + 0.20 - 0.10

SELECTION ASSISTANT FOR NORTON WINTER BOND SYSTEMS

DIAMOND CUT-OFF WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
K+4821	↑	Special resin bond for mechanically cutting of tungsten carbide
K+888RY		Universal resin bond for mechanically cutting

CBN CUTTING WHEELS	WEAR RESISTANCE	RECOMMENDATION FOR USE
KSSY	↑	Universal resin bond for mechanically cutting of HSS

1A1R STOCK PROGRAMME

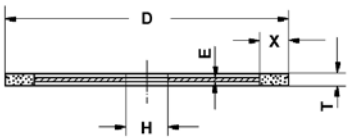


SHAPE	DxTxX (mm)	E (mm)	H (mm)	GRIT SIZE	BOND	CONCEN-TRATION	BODY	ORDER NUMBER	COMMENTS
DIAMOND GRINDING WHEELS									
K1A1R	100x1x5	0.8	20	D151	K+888RY	C50	E	69014185139 [2]	for Ceramics
		0.8	20	D151	K+4821	C100	E	69014185128	for Tungsten Carbide
2K1A1R	125x0.6x5	0.6	32	D151	K+888RY	C75	E	66260387932 [1]	for Tungsten Carbide 4 × 90° Ø6 reference circle Ø90
K1A1R	125x1x5	0.8	20	D151	K+4821	C100	E	69014185129	for Tungsten Carbide
K1A1R	150x1x7	0.8	20	D151	K+4821	C100	E	69014185130	for Tungsten Carbide
11K1A1R	150x1x7	0.8	20	D151	K+4821	C100	E	66260112766	for Tungsten Carbide 3 x 120° Ø4.5 reference circle Ø33.5
K1A1R	150x1x7	0.8	32	D151	K+4821	C100	E	69014185153	for Tungsten Carbide
K1A1R	200x1.2x7	0.9	30	D151	K+4821	C100	E	69014185154	for Tungsten Carbide
K1A1R	200x1.2x7	0.9	22	D151	K+4821	C100	E	66260386423	for Tungsten Carbide
K1A1R	250x1.2x7	0.9	25	D91	K+888RY	C50	E	66260118203 [1]	for Ceramics
K1A1R	250x1.5x7	1.2	32	D126	K+4821	C38	E	60157692084 [1]	for Tungsten Carbide manual cut-off
K1A1R	300x1.4x7	1.1	40	D181	K+4821	C75	E	69014145654	for Tungsten Carbide
CBN GRINDING WHEELS									
K1A1R	100x1x5	0.8	20	B151	KSSRY	V180	E	66260388124	for HSS
K1A1R	125x1x5	0.8	20	B151	KSSRY	V180	E	66260386108	for HSS
K1A1R	150x1x7	0.8	20	B151	KSSRY	V180	E	66260385838	for HSS

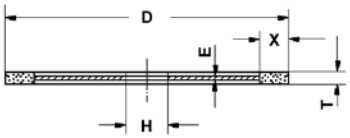
[1] Delivery time 5 - 6 weeks

METAL BONDED CUT-OFF WHEELS

These bronze bonds. developed specially for saw blades, are wear resistant and relatively insensitive to shock. They feature considerably longer life than resin bonds, yet give much greater cutting forces, higer cutting temperatures and shorter cutting times.



FEPA DESIGNATION	DxTxX (mm)	E (mm)	H (mm)	GRIT SIZE	NORMAL CONCENTRATIONS
BZ1A1R	100x0.5x5	0.4	Standard bore diameter 20 mm, other bore diameters on request	The following grit sizes are available: Diamond: D64, D91, D107, D126, D151, D181, D213, D301 cBN: B91, B107, B126, B151, B181	The following concentrations are available: Diamond: C16, C19, C23, C45, C90 cBN: V120, V180, V240
	100x0.6x5	0.5			
	100x0.8x5	0.6			
	100x1.0x5	0.8			
	100x1.2x5	1.0			
	100x1.5x5	1.3			
BZ1A1R	100x0.6x10	0.4			
	100x0.8x10	0.6			
	100x1.0x10	0.8			
	100x1.2x10	1.0			
	100x1.5x10	1.3			
BZ1A1R	125x0.5x5	0.4			
	125x0.6x5	0.5			
	125x0.8x5	0.6			
	125x1.0x5	0.8			
	125x1.2x5	1.0			
	125x1.5x5	1.3			
BZ1A1R	125x0.6x10	0.4			
	125x0.8x10	0.6			
	125x1.0x10	0.8			
	125x1.2x10	1.0			
	125x1.5x10	1.3			
BZ1A1R	150x0.6x5	0.5			
	150x0.8x5	0.6			
	150x1.0x5	0.8			
	150x1.2x5	0.9			
	150x1.5x5	1.2			
	150x1.8x5	1.5			
BZ1A1R	150x0.8x10	0.6			
	150x1.0x10	0.8			
	150x1.2x10	1.0			
	150x1.5x10	1.3			
	150x1.8x10	1.6			
BZ1A1R	175x0.8x5	0.6			
	175x1.0x5	0.8			
	175x1.2x5	0.9			
	175x1.5x5	1.2			
	175x1.8x5	1.4			
BZ1A1R	175x1.0x10	0.7			
	175x1.2x10	0.9			
	175x1.5x10	1.2			
	175x1.8x10	1.4			



FEPA DESIGNATION	DxTxX (mm)	E (mm)	H (mm)	GRIT SIZE	NORMAL CONCENTRATIONS
BZ1A1R	200x0.8x5	0.6	Standard bore diameter 20 mm, other bore diameters on request	The following grit sizes are available: Diamond: D64, D91, D107, D126, D151, D181, D213, D301 cBN: B91, B107, B126, B151, B181	The following concentrations are available: Diamond: C16, C19, C23, C45, C90 cBN: V120, V180, V240
	200x1.0x5	0.8			
	200x1.2x5	0.9			
	200x1.5x5	1.2			
	200x1.8x5	1.4			
BZ1A1R	200x1.0x10	0.7			
	200x1.2x10	0.9			
	200x1.5x10	1.2			
	200x1.8x10	1.5			
BZ1A1R	250x1.0x5	0.7			
	250x1.2x5	0.8			
	250x1.5x5	1.1			
	250x1.8x5	1.4			
BZ1A1R	250x1.0x10	0.7			
	250x1.2x10	0.8			
	250x1.5x10	1.1			
	250x1.8x10	1.4			
BZ1A1R	300x1.2x5	0.8			
	300x1.5x5	1.1			
	300x1.8x5	1.4			
BZ1A1R	300x1.2x10	0.8			
	300x1.5x10	1.1			
	300x1.8x10	1.4			
BZ1A1R	350x1.5x5	1.1			
	350x1.8x5	1.4			
	350x2.0x5	1.6			
BZ1A1R	350x1.5x10	1.1			
	350x1.8x10	1.4			
	350x2.0x10	1.6			
BZ1A1R	400x1.5x5	1.1			
	400x1.8x5	1.4			
	400x2.0x5	1.6			
BZ1A1R	400x1.5x10	1.1			
	400x1.8x10	1.4			
	400x2.0x10	1.6			
BZ1A1R	450x1.8x5	1.4			
	450x2.0x5	1.6			
	450x2.4x5	2.0			
BZ1A1R	450x1.8x10	1.4			
	450x2.0x10	1.6			
	450x2.4x10	2.0			

Standard tolerances

Ø < 100 mm	T ± 0.07
Ø ≤ 250 mm	T ± 0.10
Ø ≥ 300 mm	T + 0.20 - 0.10

DIAMOND FILES

Norton WINTER diamond files are mostly used in tool and die making for finishing form tools, die-cutting tools, drawing dies, and embossing dies. Their particular features are ease of handling, edge stability and long service life. They are available in four different grit sizes:

D181 for rough filing
D126 for universal use
D91 for finish filing
D20B and D46 for special applications
Other specifications on request.

NEEDLE FILES FOR MANUAL APPLICATIONS

PROFILE 09D		BASE BODY CROSS-SECTION	LENGTH OF DIAMOND LAYER	TOTAL LENGTH	SHAFT Ø	GRIT SIZE	ORDER NUMBER
	Flat square 2112	5×1	70	140	3	D20B	66260111899 [1]
		5×1	70	140	3	D46	66260112558 [1]
		5×1	70	140	3	D91	66260134227
		5×1	70	140	3	D126	66260134228
	Flat square with rounded corners 2112r	5x1	70	140	3	D91	66260134244 [2]
	Flat pointed 2122	5x1	70	140	3	D91	66260110341 [1]
		5x1	70	140	3	D126	66260134289 [1]
	Triangular 2132	3.5	70	140	3	D20B	66260114101
		3.5	70	140	3	D91	66260134230
		3.5	70	140	3	D126	66260134231
	Square 2142	2.5	70	140	3	D20B	66260112712 [1]
		2.5	70	140	3	D91	66260134232
		2.5	70	140	3	D126	66260134233
	Half-round 2152	5x2	70	140	3	D20B	66260114759 [1]
		5x2	70	140	3	D91	66260110230
		5x2	70	140	3	D126	66260134235

Plastic screw-on handle

[1] Delivery time 4 weeks

[2] Available while stocks last.

PROFILE 09D		BASE BODY CROSS-SECTION	LENGTH OF DIAMOND LAYER	TOTAL LENGTH	SHAFT Ø	GRIT SIZE	ORDER NUMBER
	Round 2162	Ø 3	70	140	3	D20B	66260134294
		Ø 3	70	140	3	D91	60157644163
		Ø 3	70	140	3	D126	66260134237
	Blade 2172	5x1.5	70	140	3	D91	66260134238
		5x1.5	70	140	3	D126	60157644103
	Crossing file 2192	5x2	70	140	3	D46	66260369574 [1]
		5x2	70	140	3	D91	66260107652 [2]
		5x2	70	140	3	D126	66260100060 [1]
	Crossing file 2102T	5x2	70	140	3	D20B	66260134293
		5x2	70	140	3	D91	66260100085 [2]
		5x2	70	140	3	D126	60157643993 [1]

Plastic screw-on handle

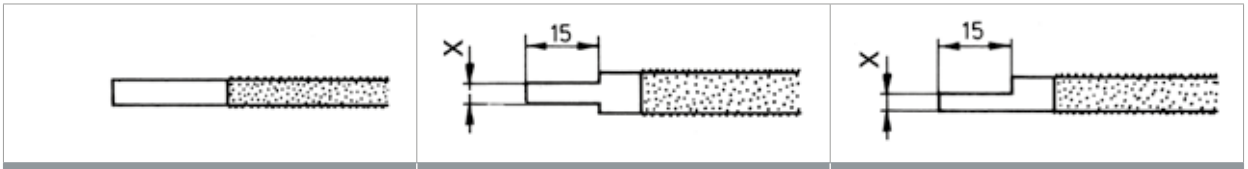
Other dimensions available at short notice on request. [1] Delivery time 4 weeks [2] Available while stocks last.

FILES FOR MANUAL AND MACHINE USE

PROFILE 09B		BASE BODY CROSS-SECTION	LENGTH OF DIAMOND LAYER	TOTAL LENGTH	SHAFT Ø	GRIT SIZE	ORDER NUMBER
	Flat 7	4.5 × 2	80	150	A	D91	66260110152
		4.5 × 2	80	150	A	D126	66260100260
	Flat 13	9 × 3.2	80	150	A	D91	66260100285
		9 × 3.2	80	150	A	D126	66260134250
		9 × 3.2	80	150	A	D181	66260100100 [2]
	Flat 16	11 × 4	120	200	A	D91	66260110317
		11 × 4	120	200	A	D126	66260110225
		11 × 4	120	200	A	D181	66260100333
	Square 22	3	80	125	A	D126	60157643682 [1]
	Square 23	4	80	150	A	D91	66260110330 [1]
	Square 25	5	80	125	A	D91	60157644206
		5	80	125	A	D126	66260110214 [1]
	Square 29	8	80	150	A	D126	60157644171 [1]
	Square 32	10	120	200	B/X = 6 mm	D126	60157644203 [2]
	Triangular 39	4	80	150	C/X = 2 mm	D91	66260110417 [1]
	Triangular 41	4.5	80	125	C/X = 3 mm	D91	66260100385 [1]
		4.5	80	125	C/X = 3 mm	D126	60157644093 [1]
	Triangular 45	8	80	150	C/X = 3.5 mm	D91	66260110441
		8	80	150	C/X = 3.5 mm	D126	66260110458
	Triangular 48	10	120	200	C/X = 4.5 mm	D91	60157644174 [1]
		10	120	200	C/X = 4.5 mm	D126	60157643782
	Round 70	Ø 3	80	125	B/X = 2 mm	D91	60157643651 [1]
	Round 76	Ø 6.3	80	150	C/X = 4 mm	D126	60157643624
	Half-round 89	5 × 3	80	125	A	D126	66260100346 [1]
	Half-round 92	8 × 3	80	150	A	D91	66260100395 [2]
		8 × 3	80	150	A	D126	60157644102 [1]
		8 × 3	80	150	A	D181	60157644010 [1]
	Half-round 96	10 × 5	120	200	A	D126	66260110435 [1]

Other dimensions available at short notice on request. [1] Delivery time 4 weeks [2] Available while stocks last. All dimensions in mm

OTHER DIMENSIONS AVAILABLE AT SHORT NOTICE ON REQUEST.



VERSION A	VERSION B	VERSION C

DIPROFILE FILES FOR HAND FILE MACHINES

PROFILE 09C		BASE BODY CROSS-SECTION	LENGTH OF DIAMOND LAYER	TOTAL LENGTH	SHAFT Ø	GRIT SIZE	ORDER NUMBER
▭	Flat, double sided 307A	5 × 2	15	50	3	D126	66260110238 [1]
	309A	5 × 2	25	60	3	D126	66260134278 [1]
○	Round 331	Ø 1	15	50	3	D91	66260134328 [1]
	339	Ø 3	15	50	3	D126	66260129612 [1]
	343	Ø 3	25	50	3	D126	60157643753 [1]
	345	Ø 4	15	50	3	D126	60157643286 [1]
△	Triangular 367	3.5	15	50	3	D91	66260100066 [1]
	375	4.5	25	60	3	D126	66260134282 [1]

Other dimensions available at short notice on request. [1] Delivery time 4 weeks [2] Available while stocks last. All dimensions in mm

SAW RODS FOR MANUAL AND MACHINE USE

PROFILE 10E		BASE BODY CROSS-SECTION	LENGTH OF DIAMOND LAYER	TOTAL LENGTH	SHAFT Ø	GRIT SIZE	ORDER NUMBER
○	Round 701	Ø 0.80	65	130	0.5	D126	66260134284 [2]
	702	Ø 1.30	65	130	1	D126	66260110148 [1]
	703	Ø 2.30	65	130	2	D126	66260100264 [1]

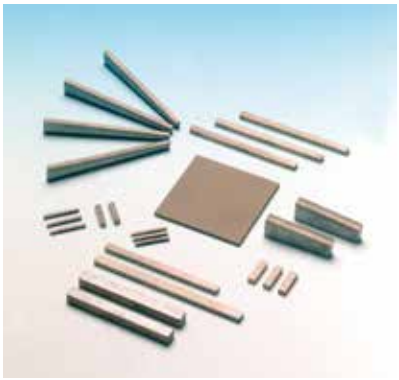
[1] Delivery time 4 weeks [2] Available while stocks last. All dimensions in mm

Clamping zone free of diamonds both sides (20 / 45 mm)
Other dimensions available at short notice on request.

HONING STICKS

Honing is classified as machining with undefined cutting edges using a tool where grits are bound together whilst maintaining continuous surface contact between workpiece and tool for improving size, form and surface.
A periodic alteration of relative movements takes place between tool and workpiece, producing surfaces with parallel, criss-crossing grooves. In some cases a particular surface finish is required, for example to prevent the rupture of the lubricating film on cylinder liners. The advantages of diamond and CBN honing stones compared to conventional honing stones are

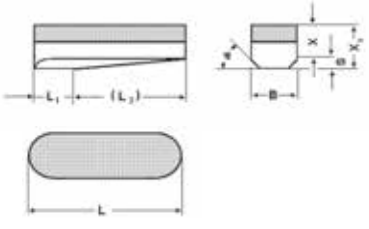
- Longer service life
- Better form stability
- Closer tolerances
- Cooler working, meaning no changes in the surface structure caused by thermal effects
- Less distortion



Diamond is exclusively used for honing workpieces, of all types of iron castings (cast iron, annealed cast iron and some cast steels).
Cylinder liners for internal combustion engines are typical examples.
cBN is primarily used for honing steel, e.g. machining steel, ball bearing steel, tool steel and alloy steel in all hardness conditions.

To achieve the required surface quality, it is important to correctly specify all process parameters: The right grit type (diamond or cBN), grit size, grit quality, the bond and the concentration must be selected according to the workpiece material and the workpiece hardness. Furthermore, the required surface quality and material removal rate will determine whether the process should be carried out in one step or several operations.

METAL BONDED HONING STICKS

	Item designation BZ08B	With diamond-free zone	Layer thickness X ≥ 1 layer width B ≥ 2 diamond-free zone S ≥ 0.5 layer length L ≤ 150
	Item designation BZ08D	Without underlayer	Layer thickness X ≥ 1 layer width B ≥ 2 layer length L ≤ 150
	Item designation BZ08E	Including strip mount	Layer thickness X ≥ 1 layer width B ≥ 2 layer length L ≤ 150 Tolerance at angle ß L_3 ≤ 12.5: ± 15° L_3 > 12.5: ± 10°

08B and 08D can only be used in conjunction with a strip mount.
08E is designed inclusive of strip mount for direct fitting.

ORDER EXAMPLE

SHAPE	L	B	X	X1	R	GRIT SIZE	BOND	CONCENTRATION
BZ08B	75	5	2	5	40	D76	BZ387	C75

APPLICATION DATA FOR REGRINDING METAL BONDED HONING TOOLS

The honing head should be ground to the diameter of the bore to be honed, in order to achieve the shortest possible running-in time after installation, i.e. soldering or gluing the stones to the honing shoes and fixing them to the honing spindle, so that a high percentage contact area is created right from the beginning.

SiC grinding wheel – resin bonded, e.g. Ø 200 mm, dry cut (uni-directional at point of contact)
Grinding speed (diamond /cBN) v_c = 15 m/s
Grinding speed (SiC) v_c = 23 m/s

GRIT SIZE OF DIAMOND AND CBN HONING STICKS	SPECIFICATIONS OF THE SIC GRINDING WHEELS
D15 / B15	400 HB3
D20 / B30	320 HB3
D46 / B46	240 HB3
D64 / B64	180 HB3
D91 / B91	120 HB3
D126 / B126	80 JB3
D151 / B151	80 JB3
D181 / B181	80 JB3

EXAMPLES OF PROVEN TOOL DESIGNS

WORKPIECE				
Workpiece material	Grey cast iron		Steel	
Hardness [HB/HRC]	HB 180-220		HRC 62 ±2	
Honing tools	Pre-honing	Finish honing	Pre-honing	Finish honing
Grit size	D91	D20B	B126	B54
Bond	BZ387	BZ387	MSS473	MSS473
Concentration	C100	C100	V120	V120
APPLICATION DATA				
Circumferential speed V_A [m/min]	52	52	51	51
Stroke speed V_H [m/min]	14	14	18	18
RESULTS				
Roughness R_t [µm]	5.8	1.8	4.5	2.2
Effective material removal rate MRR_{eff} [cm^3/min]	0.67	0.2	0.4	0.15
Material removal rate per stick surface MRR_{Ltotal} [$mm^3/mm^2 \cdot min$]	0.4	0.2	0.58	0.22
Honing ratio G [cm^3/cm^3]	4.500	3.300	1.200	650

WORKING DATA AND GRIT SIZES

HONING SPEED

The cutting speed (v_c) is based on the speed at the circumference of the honing tool (V_A) and its stroke speed (V_H).

SUGGESTED VALUES	MEDIAN PRACTICAL VALUES
v_c = 30-70 m/min	52 m/min
v_A = 20-60 m/min	49 m/min
v_H = 10-30 m/min	16 m/min

INTERSECTION ANGLE

The ratio of stroke speed (v_H) and speed at the circumference (V_A) gives the characteristic angle of intersection (α) of the honing pattern. Usually the two speeds are selected so that the intersection angle lies between 25° and 60°, with a median value in practice of 36°.

CONTACT PRESSURE RANGE

20–200 N/cm² (exceptions up to 600 N/cm²)

COOLANT

In honing, mineral oil-based honing oils and water-soluble emulsions are used. Typical fluid use is 30–150 l/min per bore.

GRIT SIZES

The abrasive grit sizes specified for this process are classified according to FEPA standards, starting with B46 / D46. It is possible to manufacture tools different from those shown in the programmes. Please do not hesitate to contact us if you require assistance. Customers' own tools can also be coated. With regard to the determination of the nominal size, the undersizes which depend on the coating must be specified based on the grit size. Grit size tables can be found in the Service section of this catalogue.

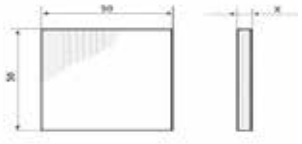
ACHIEVABLE SURFACE FINISH VALUES WHEN HONING WITH METAL BOND HONING TOOLS|

The practical values listed in the adjoining diagram serve as a quick reference. Accurate surface finish values always depend on the bond, grit size and concentration of the honing tool as well as the workpiece material, coolant and the process parameters. It is especially important to maintain a balanced ratio between grit size and concentration in order to prevent excessive levels of contact pressure. Concentration levels should be between C35 and C100 or V120 and V240 respectively, depending on grit size.

Surface finish value R_a [1] [µm]	R_z [1] [µm]	R_t [1] [µm]
1.6	10.9	12.8
1.4	9.5	11.2
1.2	8.2	9.6
1	6.8	8
0.9	6.1	7.2
0.8	5.4	6.4
0.7	4.8	5.6
0.63	4.25	5
0.5	3.4	4
0.4	2.7	3.2
0.3	2.1	2.4
0.25	1.7	2
0.2	1.4	1.6
0.15	1.02	1.2
0.13	0.85	1
0.1	0.7	0.8
0.08	0.54	0.64
0.063	0.43	0.5

*Norton WINTER grit sizes
1) Calculation base $1R_a = 8R_t = 0{,}85\ R_z$

RESIN BONDED HONING STICKS

	Item designation K08D-50-50-X	Without underlayer	Layer thickness X = 1.5 - 5 mm This blank has no base layer. It consists merely of a resin bonded diamond or cBN layer. The reference notes below show how these blanks are used.

BLANKS CAN BE CUT INTO INDIVIDUAL HONING STICKS BY USING EITHER

a) Hand- or fretsaw

b) Faster and cleaner cutting is achieved with a diamond cutting wheel, model BZ

Diameter:	100 - 150 mm
Thickness of cut:	0.6 - 0.8 mm
Layer specification:	D151 BZ309 C45

BOND THE STICK TO THE STRIP MOUNT E.G. WITH

a) UHU-Plus

b) Technicoll 2000 (Beiersdorf, Hamburg)

c) Loctite 307 / Activator T No. 747

The stick can subsequently be removed from the strip mount by heating to ~ 300 °C in an oven.

ORDER EXAMPLE

SHAPE	L	B	X	GRIT SIZE	BOND	CONCENTRATION
K08D	50	50	3	B126	KSSTY	V120

NORTON WINTER DIAPLAST® & NORTON WINTER DIAPLAST® SUSPENSION

Apart from bonded abrasives, Norton WINTER also offers an unrivalled range of diamond pastes and suspensions. Norton WINTER Diaplast® and Norton WINTER Diaplast® suspension are the ideal lapping and polishing materials for lab and industrial application.

NORTON WINTER DIAPLAST® MEANS QUALITY:

- Fast removal from the workpiece, meaning economic machining times
- Relief and distortion-free samples
- Outstanding edge definition; optimum surface quality
- Economical in use in conjunction with Norton WINTER Diaplastol thinners

DIAMOND GRIT SIZE AND GRIT DISTRIBUTION

Norton WINTER has extensive know-how in the preparation of diamond grits and the manufacture of diamond tools and diamond preparations. Grit sizes D25 to D0.7 are micro grits which are not classified by sieving but by special techniques. Norton WINTER has developed in-house processes with high precision requirements, especially for this purpose. The classification of micron powders carried out by Norton WINTER has closer tolerances than those stipulated by DIN and FEPA.

Up-to-date measuring systems and selection procedures are used for inspection and selection of individual diamond lots according to size and shape, thus ensuring a consistent level of quality.

It is important not only to keep within the specified grit size tolerances but also to maintain the particle size distribution within these limits. Even slightly oversized particles could cause surface scratches, whereas an excessive quantity of fines is uneconomical.

APPLICATIONS AND PRODUCT SPECIFICATIONS

DIAMOND BOND SYSTEM AND SOLUBILITY

The special characteristics of the paste and liquid carriers developed by Norton WINTER guarantee uniform diamond distribution and thus constant concentration. This provides optimum distribution of the individual particles avoiding the formation of agglomerates.

The viscosity of Diaplast® suspension is carefully controlled to ensure that the suspended state of the diamond particles is maintained over a long period.

In conjunction with our thinner Norton WINTER Diaplastol, it is important that a thin cooling lubricant film is formed to support the material removal rate provided by the diamond particles. The carriers used by Norton WINTER have unlimited shelf life and a high degree of temperature stability.

Norton WINTER Diaplast® diamond compounds types SS, N, M, E and Norton WINTER Diaplast® suspension are supplied in alcohol/water and/or oil soluble form as standard. They are colourless, have unlimited shelf life and a high degree of temperature stability. All constituents are either biodegradable or do not pose a threat to the environment (special waste disposal procedures are required for larger quantities).
Diaplast® Type T is universally-soluble.

PLEASE NOTE:
For preparatory machining tasks, for example

- diamond cutting wheels (catalogue No. 3, flat and crystal glass)
- diamond grinding wheels (from this catalogue)

are used. Why not make the experience of a leading diamond and cBN tool manufacturer work for you? Norton WINTER is the right partner for lapping and polishing jobs in industry and the laboratory.

DIAMOND CONCENTRATION

The decisive parameters for material removal rate are number and size of the cutting edges of the diamond grit that engage the workpiece at any one time. The number of particles per unit of weight decreases with increasing grit size.

The diamond content increases with increasing grit size in Norton WINTER diamond compound types SS and N and Norton WINTER Diaplast® suspension. Diamond concentration is always the same for types T and E.

OVERVIEW OF NORTON WINTER DIAMOND PASTES

SS	For very fast material removal, extremely short machining times, top quality surface finish and geometric accuracy. Application on very hard material such as carbide and ceramics; materials with constituents of differing hardnesses; high-precision measuring and sensor surfaces.
N	For producing polished surfaces for metallographic, mineralogic and similar investigations. Applications on special steels, stainless steels.
T	The most economical paste for standard use in production. Application on large areas, in tool and die making as well as surface machining of rollers made of hardened steel, carbide, hard cast iron etc.
E	Economy paste for universal use. Machining of mass-produced parts and repairs and for when paste is frequently changed.

APPLICATIONS IN THE INDUSTRIAL FIELD:

- Aeronautics and astronautics
- Engine construction
- Hydraulics
- Plant manufacturing
- Tools Industry
- Automotive industry
- Engineering
- Manufacture of fittings
- Pump and mixer industry
- Turbine construction
- Electronics
- Glass and plastics
- Medical technology
- Rolling industry
- etc.

EXAMPLE APPLICATIONS

Typical examples of workpieces successfully lapped and polished with Norton WINTER-Diaplast® diamond paste and Norton WINTER-Diaplast® suspension

- Auditory ossical implants
- Die-cast molded pieces
- Ignition electrodes
- Measuring and sensor tools
- Plungers
- Sapphire windows
- Sliding-ring seals
- Slide rollers
- Wire and thread guides
- Ball bearings
- Drawing dies
- Implants (hip replacements)
- Molded parts
- Pump vanes
- Sealing gaskets
- Slideways
- Switch contacts/-balls
- Wire-drawing dies
- Dental implants
- Embossing punches
- Injection molds
- Pistons for pumps
- Rollers with smooth surfaces
- Sealing surfaces
- Slide bearings
- Valve tapers, balls and seatings
- etc

DIAPLAST® DELIVERY PROGRAMME

TYPE	DIAMOND GRIT SIZES										SOLUBILITY OF THE BOND *)
	D0.25	D0.7	D1	D3	D7	D15	D25	D54	D91	D126	
SS	x	x	x	x	x	x	x	x	-	-	A / O
N	x	x	x	x	x	x	x	x	x	x	A / O
E	x	x	x	x	x	x	x	x	x	x	A / O
T	-	-	x	x	x	x	x	x	-	-	U
Colour recognition	Silver	White	Yel-low	Green	Red	Blue	Brown	Black	Orange	Lilac	*) A = soluble in alcohol-water U = universally soluble O = soluble in oil
Available as dosing syringe in sizes 5 g / 10 g / 20 g Other sizes on request											

Order example: Norton WINTER Diaplast®-Paste - SS - D7 - 10 g - A

DIAPLAST® SUSPENSION

100 ml as combi-system
Flexible bottle with standard screw closure, suitable for use on dosing devices for automatic polishing processes

Accessories (additional pack):

- spray-head with eco-friendly mechanical pump system for uniform distribution of the diamonds on large polishing plates or on larger areas for machine polishing
- drip-feed fitting for precisely directed feeding by hand

250 ml with drip-feed fitting

500 ml and 1000 ml as refill bottle

TYPE	DIAMOND GRIT SIZES								SOLUBILITY OF THE BOND *)
	D0.25	D0.7	D1	D3	D7	D15	D25	D54	
Suspension	x	-	x	x	x	x	-	-	A / O
Colour recognition	Silver	-	Yellow	Green	Red	Blue	x	x	A / O
Available in the following sizes: 100 ml / 250 ml / 500 ml / 1000 ml Other sizes on request									*) A = soluble in alcohol-water O = soluble in oil

Order example: Norton WINTER Diaplast®-Suspension - 100 ml - D3 - A

DIAPLASTOL THINNER DELIVERY PROGRAMME

			SOLUBILITY OF THE BOND *)
Diaplastol	Bottle with drip-feed fitting	100 ml	A / O
	Refill bottle	1000 ml	*) A = soluble in alcohol-water O = soluble in oil
	Canister	4500 ml	
Other sizes on request			

Order example: Norton WINTER Diaplastol - 100 ml - A

DIAPLAST® PROGRAMME

TYP SS Highest concentration	IDENTIFICATION COLOUR	SOLUBILITY	5 gramme	10 gramme	20 gramme
D0.25	Silver	Soluble in wateralcohol	60157643984	60157643724 [2]	66260100076
D0.7	White	(Soluble in oil on request)	66260100265	66260100627 [2]	60157667492 [1]
D1	Yellow		66260110146	66260110232	60157644154
D3	Green		66260100287	60157644084	66260113334
D7	Red		66260110467	66260110535	66260110495
D15	Blue		66260110248	60157644016	66260116707
D25	Brown		60157644020	60157644176 [1]	66260114624
D54 FEPA	Black		66260110601	60157643824	69014166621 [1]

TYP N Highest concentration	IDENTIFICATION COLOUR	SOLUBILITY	5 gramme	10 gramme	20 gramme
D0.25	Silver	Soluble in wateralcohol	66260112531 [1]	66260107643 [1]	66260114891
D0.7	White	(Soluble in oil on request)	66260134316 [1]	69014166017 [1]	69014166357 [1]
D1	Yellow		60157643805	60157644162 [2]	60157643751
D3	Green		66260133498	60157643608	60157644170
D7	Red		66260133500	66260110340	66260100087
D15	Blue		66260110307	66260100292 [2]	60157643708
D25	Brown		66260110180	66260110143	60157644184
D54 FEPA	Black		66260110461	66260100256	66260113661

[1] Delivery time 2 -3 weeks
[2] Available while stocks last

DIAPLAST® PROGRAMME

TYP T Medium concentration	IDENTIFICATION COLOUR	SOLUBILITY	5 gramme	10 gramme
D1	Yellow	universal	66260100257 [1]	66260100291 [1]
D3	Green	universal	66260100365	66260110407
D7	Red	universal	60157644173	66260164645
D15	Blue	universal	60157643981	66260164646 [1]
D25	Brown	universal	66260100098 [1]	60157643431 [1]
D54 FEPA	Black	universal	60157643905	66260110448 [1]

TYP E Medium concentration	IDENTIFICATION COLOUR	SOLUBILITY	5 gramme	10 gramme
D1	Yellow	Soluble in wateralcohol	66260110438	69014169230 [1]
D3	Green	(Soluble in oil on request)	66260134307	66260110657 [1]
D7	Red		66260134308	66260113462 [1]
D15	Blue		66260134309	66260115252 [1]
D25	Brown		60157644070 [2]	66260114556 [1]
D54 FEPA	Black		60157644187	-

[1] Delivery time 2 -3 weeks
[2] Available while stocks last

DIAPLAST® SUSPENSION PROGRAMME

SUSPENSION 100 ml	IDENTIFICATION COLOUR	SOLUBILITY	ORDER NUMBER
D1	Yellow	Soluble in water-alcohol (Soluble in oil on request)	66260110642
D3	Green		66260100250
D7	Red		66260110667

DIAPLASTOL THINNER PROGRAMME

DIAPLASTOL	CONTENTS	SOLUBILITY	ORDER NUMBER
Spray bottle	100 ml	Soluble in water-alcohol (Soluble in oil on request)	66260118433 [1]
Refill bottle	1 litre		66260195804 [1]
Canister	4.5 litre		66260195809 [1]

POLISHING CLOTHS PROGRAMME

POLISHING CLOTHS	APPLICATION	DIAMETER (mm)	ORDER NUMBER
Polishing cloth soft	for diamond grit size D0.25 - D0.7	120	66260384527
		200	66260195806
		300	66260100068 [2]
Polishing cloth 31	for diamond grit size D1 - D3	120	66260387665
		200	66260195796 [2]
		300	66260381705 [2]
Polishing cloth 1007	for diamond grit size D7 - D54	200	66260386538 [2]
		300	66260100054 [2]

[1] Delivery time 2 -3 weeks
[2] Available while stocks last

APPLICATION NOTES FOR THE PREPARATION OF SPECIMENS FOR MICROSCOPIC EXAMINATIONS

PRACTICAL EXECUTION

Specimen preparation starts with mounting of the workpiece if applicable. Depending on the state of the specimen, it is rough-ground with silicon carbide abrasive paper or with Norton WINTER diamond grinding wheels.
The specimen is then polished with Norton WINTER Diaplast® compound or Norton WINTER Diaplast® suspension.

SAMPLE MOUNTING

In most cases. the standard mounting media are plastics, which are processed either hot or cold. It is important that the mounting medium should bond to the specimen without any gaps, otherwise abrasive or polishing agents may be deposited between the specimen and the mount. The hardness of the mounting medium should be matched to the hardness of the specimen in order to avoid edge rounding.

GRINDING

The surface state of the specimens before polishing is critical for the economic efficiency of polishing with Norton WINTER Diaplast® and for the quality of the final polish. Proper rough grinding can greatly reduce polishing time, enabling economical application of Norton WINTER Diaplast® and giving good surface quality. It is important to ensure that any unevenness caused by sawing is completely removed by the grinding operation.

POLISHING

Polishing with Norton WINTER Diaplast® diamond compound or Norton WINTER Diaplast® suspension can be effected on both manual and automatic polishing machines. A separate polishing disc with polishing cloth must be used for every diamond grit size. Norton WINTER polishing cloths can be used on commercial standard machines. Before starting polishing, slightly moisten the polishing cloth and distribute the polishing agent evenly on the polishing cloth. There are some cases where Norton WINTER diamond suspensions are easier to handle than diamond compounds, as diamond distribution on the polishing cloth is more even. Diamond suspensions are preferable for automated polishing operations as feeding during the process is possible. Norton WINTER Diaplast® diamond compound is soon saturated with the swarf of the material being machined, so that a little Norton WINTER Diaplastol thinner must be applied in order to maintain the cutting action of the diamond grit. A thin cooling and lubricating film must be maintained.

The polishing pressure to be applied is dependent on the specimen material and the diamond grit size. As a rule, high polishing pressure can be used with hard materials, and lower pressure should be used for finer diamond grits.

The selection of the grit sizes to be used depends mainly on the hardness of the specimens and their individual structural constituents. The greater the hardness of the material to be polished the coarser the grit to be used at the beginning. The finest grit sizes (D0.25 to D1) are generally not used with very hard materials. Remember that the polishing process not only removes the scratch marks of the last grinding operation, but it may be required to remove sufficient material from the specimen surface to expose an undamaged microstructure. This means it is often necessary to start with a larger diamond grit size than would be necessary for removal of the scratch marks from the last grinding operation.

NOTE

When polishing with Norton WINTER Diaplast® it is important to avoid any transfer of coarser grit to the next finer polishing operation. It is essential not only to keep the polishing device clean, but also to clean the specimens between the individual polishing stages. This may be done under running water with the aid of a brush (for coarser grit sizes) or with a cotton pad (for finer grit sizes). It is also recommended to use an ultrasonic cleaning bath between each polishing step.

POLISHING RECOMMENDATIONS

MATERIAL	SPECIMEN PRE-MACHINING	Norton WINTER DIAPLAST® AS PASTE OR SUSPENSION	POLISHING UNDERLAY	NOTES
Carbides Stellite	Diamond wheel/ foil D126 or D91.	D15 D7 D3 D1*	1007 1007 31 31*	* Polishing stage may in some cases be dispensed with
Ferritic Pearlitic Martensitic Austenitic steels Cast Iron of all types	Wet grinding on diamond foil D46 and/or SiC paper to 600 grit	D15* D7 D3** D1 D0.25***	1007 1007 or 31 31** 31 Soft cloth***	* Only for hardened steel ** Can in some cases be dispensed with ***Not required In hard castings and martensitic steels. Intermediate etching with 1% alcohol. HNO_3 before Diaplast® D1 is advanta- geous
Aluminium and aluminium alloys	Wet grinding on diamond foil D46 and/or SiC paper to 1000 grit	D7 D3 D1 D0.25	1007 or 31 31 31 or cloth soft Soft cloth*	Use little pressure * Can in some cases be dispensed with
Lead alloys	Wet grinding on SiC paper to 1000 grit	D3 D1 D0.25	31 31 Soft cloth	Use little pressure Samples sensitive to water! Clean only with Alcohol Grinding lubricant: petroleum jelly
Copper and copper alloys	Wet grinding on diamond foil D46 and/or SiC paper to 1000 grit	D7 D3 D1 D0.25*	1007 or 31 31 31 Soft cloth*	* For ultra-pure copper or very soft copper alloys, machining with D0.25 can be dispensed with; instead, use alumina on a soft polishing cloth and give a brief second polish
Magnesium alloys	Wet grinding on SiC paper to 1000 grit	D7 D3 D1 D0.25	1007 or 31 31 31 Soft clotht	Clean samples with alcohol
Nickel and nickel alloys	Wet grinding on diamond foil D46 and/or SiC paper to 1000 grit	D15 D7 D3 D1 D0.25	1007 1007 or 31 31 31 Soft cloth	
Silicon and germanium	Wet grinding on diamond foil D46 and/or SiC paper to 1000 grit	D7 D3 D1 D0.25	1007 31 31 or cloth soft Soft cloth	
Zinc and zinc alloys	Wet grinding on SiC paper to 1000 grit	D7 D3 D1 D0.25	1007 or 31 31 31 Soft cloth	A brief second polish with alumina 3 on a soft cloth may be required. Rinse with methanol. Intermediate etching with 5% alcoh. HNO_3 before Diaplast® D1 recommended. Use little pressure

POLISHING RECOMMENDATIONS

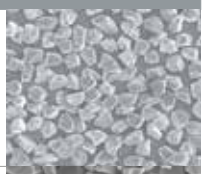
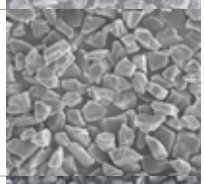
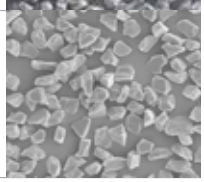
MATERIAL	SPECIMEN PRE-MACHINING	Norton WINTER DIAPLAST® AS PASTE OR SUSPENSION	POLISHING UNDERLAY	NOTES
Ore samples (of various compositions)	Diamond wheel/foil D126 or D91 or wet grinding to 1000 grit	D15 D7 D3 D1*	1007 1007 31 31*	* Whether machining with Norton WINTER Diaplast D1 and D0.25 is necessary depends on the respective materia hardness. In samples with constituents of differing hardnesses this is normally necessary.
Ceramic samples	Diamond wheel D126 Diamond foil D64 or D46	D25 D15* D7 D3 D1 D0.25**	1007 1007* 1007 31 31 Soft cloth**	* Dispensed with in samples with constituents whose hardness differences are only slight. ** Is only necessary in samples also containing softer constituents
Carbon	Saw-cut	D7 D3 D1 D0.25*	1007 31 31 Soft cloth*	* Is only necessary in soft types of carbon.

These recommendations have been compiled on the basis of our experience with common materials.
Due to the large variety of alloys and material compositions, optimal results may require slight deviations from the above table in some cases.

It is possible, in principle, to miss out individual grit sizes, but this mostly results in longer polishing times which may cause relief formation. Our metallographic laboratory is available for consultation in difficult cases.

MICRON POWDER

Norton WINTER micron powders consist of synthetic diamond, natural diamond and cBN with specific characteristics adapted to different industrial applications. The compounds are divided into the following types:

TYPE	HARD MATERIAL	COLOUR	SHAPE AND SURFACE	
Type M	Synthetic diamond	Greenish-yellow to pale yellow	Monocrystalline, predominantly blocky, distinct cutting edges, flat cleavage planes, defined structure.	
Type R	Synthetic diamond	Greenish-grey	Monocrystalline, irregular, blocky, many cutting edges, fragile structure. This type of grit is also available with metal coating. Its designation is then RC.	
Type P	Synthetic diamond	Black to dark grey	Polycrystalline, blocky shapes, many cutting surfaces, no platelets, no needle-shaped particles.	
Type N	Natural diamond	Colourless to pale grey	Monocrystalline, blocky to splintery, irregular, defined structure, many cutting edges.	
Type B	cBN	Black	Monocrystalline, blocky, distinct cutting edges This type of grit is also available with metal coating. Its designation is then BC.	

MICRON POWDERS WITH METAL COATING

For special applications, the use of metal-coated micron powders has proved to be advantageous, for instance in resin bond grinding wheels. Norton WINTER micron powders with metal coating are available in sizes 15–25 µm, 20–30 µm and 25–37 µm. Grit size relates to the size of grit excluding the metal coating.

QUALITY

Due to the high quality standards Norton WINTER imposes on classification, checking and packing under clean room conditions, a consistent level of grit quality is guaranteed.

MEASUREMENT OF GRIT SIZE

There is no universal procedure yet for determinati on of grit size. The method recommended by FEPA as 'Standard for Diamond Micron Powder Sizes' provides guidelines for grit size determination but they are not universally applied.

Norton WINTER uses optical image analysis for measuring grit size. This method permits the additional determination of the form factor (ratio of width to length of the measured particles) of the grit. The results are comparable with those obtained by FEPA.

Up-to-date methods for chemical purity checking such as energy dispersive analysis (EDA) and atomic absorption spectroscopy (AAS) are also applied.

MICRON POWDERS STANDARD PROGRAMME

DESIGNATION TYPE M [µm]	ORDER NUMBER
M 0-0.50	130003280
M 0.50-1	130003281
M 0.5-2	130003282
M 1-3	130003283
M 2-4	130003353
M 2-5	130003350
M 3-7	130003351
M 4-8	130003352
M 5-10	130003621
M 6-12	130003622
M 8-12	130003354
M 10-20	130003355
M 15-25	130003356
M 8-25	130003357
M 20-30	130003358
M 25-37	130003359
M 30-40	130003360
M 40-60	130003361
M 50-70	130003630

DESIGNATION TYPE R [µm]	ORDER NUMBER
R 2-5	130003262
R 5-10	130003264
R 6-12	130003591
R 8-15	130003265
R 10-20	130003266
R 15-25	130003267
R 8-25	130003268
R 20-30	130003269
R 22-36	130003270
R 30-40	130003514
R 40-50	130003204

DESIGNATION TYPE P [µm]	ORDER NUMBER
P MYPOLEX 5.5-8	130003290
P MYPOLEX 10-20	130003291
P MYPOLEX 20-30	130003292
P MYPOLEX 25-37	130003293

LAPPING TOOLS

MANUAL LAPPING TOOLS

Norton WINTER manual lapping tools are used for sharpening, beveling and breaking off edges on tungsten-carbide tools directly on the machine. Resin bonded laps are used for finer cutting edges, i.e. for wood and metal mills or small cutting chisels. The metal bonded, more wear resistant laps are preferred for robust applications like larger cutting chisels or milling heads.

STOCK PROGRAMME

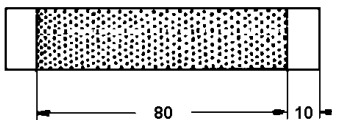
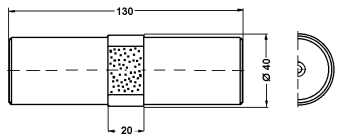
	SHAPE	L (mm)	B (mm)	X (mm)	GRIT SIZE	BOND	ORDER NUMBER
	K11C Blue Handle	30	9	2	D7	Resin	60157644068
		30	9	2	D15	Resin	66260134295
		30	9	2	D46	Resin	66260110338
		30	9	2	D64	Resin	66260107646
		30	9	2	D91	Resin	60157644054
	BZ11C Red Handle	30	9	1	D46	Bronze	66260110195
		30	9	1	D64	Bronze	60157644202
		30	9	1	D91	Bronze	60157644110
		30	9	1	D126	Bronze	66260134302

DRESSING TOOLS

ELECTROPLATED & SINTERED - METAL BONDED DRESSING TOOLS

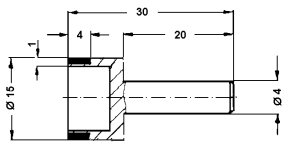
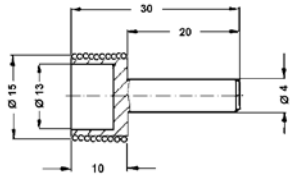
For dressing vitrified and resin bonded diamond and cBN grinding wheels Norton WINTER offers you suitable dressing tools. Thus electro-plated and sinter-metal bonded dressing tools are always available ex stock. Further details will be found in our catalogue No. 5 'Dressing Tools'.

STOCK PROGRAMME

	SHAPE	SPECIFICATION	ORDER NUMBER	APPLICATION
	NORTON WINTER DRESSING BLOCK			
	1S09H-80-20-8	D301 / S11	66260134287	For dressing resin bond cBN grinding wheels on surface grinders. If used with coolant, subsequent sharpening with WA150GV sharpening stone or Norton WINTER stone No. 2 is required.
	**NORTON WINTER DRESSING CYLINDERS**			
	1S44B-40-20	D301 / S11	60157642712 [1]	For dressing resin bond cBN grinding wheels on OD grinders. If used with coolant, subsequent sharpening with WA150GV sharpening stone or Norton WINTER stone No. 2 is required.

[1] Delivery time 5 - 6 weeks

07B STOCK PROGRAMME

	SHAPE	DxTxX (mm)	GRIT SIZE	BOND	CONCEN-TRATION	ORDER NUMBER
	DIAMOND DRESSING PINS METAL BONDED					
	4BZ07B	15x4x1	D301	BZ 387.1	C135	66260100343
	DIAMOND DRESSING PINS ELECTRO-PLATED					
	50S07B	15x10x4	D426	G825	S33	60157644198

APPLICATION
For dressing vitrified bonded cBN grinding wheels

STATIONARY DRESSING TOOLS

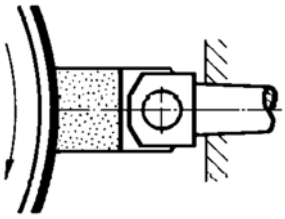
EXAMPLES OF STATIONARY DRESSERS

Please refer to our Catalogue No. 5 'Dressing Tools' for our comprehensive product range of stationary dressers

DIAMOND FLIESEN® TOOLS

Universal dressing tool for profiling and straight dressing.
Diamond Fliesen® are characterized by consistent behaviour throughout their service life.

SPECIFICATION	GRIT SIZE FLIESE®	DIMENSIONS		ORDER NUMBER
		DIAMOND SECTION	FLIESE®	
TFAS90-20-15-33 D711 T645-J3 E Furioso	D711/J3	20 × 15	20.5 × 33	60157693885 [1]
TFAS90-20-15-33 D711 T645 E	D711	20 × 15	20.5 × 33	69014185720 [2]

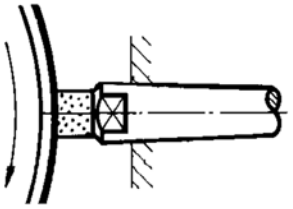


[1] For grinding wheels such as Quantum, Vortex (SG, TG, XG, ES, special corundum etc.), of grit size 80 - 120
[2] For grinding wheels made of fused alumina abrasives, grit size 80 - 120

IGEL® / PRO-DRESS®

A robust dressing tool for straight dressing of peripheral and plane surfaces.
Igel® are easy to handle and very economical in use. Their main advantage is higher dressing feed speeds.

SPECIFICATION	ct	DIMENSIONS		GRIT SIZE IGEL®	ORDER NUMBER
		DIAMOND SECTION	HOLDER		
HIG3.5-8-11-MK1-40 D711 H710	3.5	Ø 8 × 11	MK1 × 40	D711	66260195960 [3]



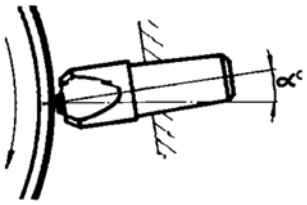
[3] For grinding wheels made of fused alumina abrasives, grit size 60 - 80

Pro-dress® is of similar design to Igel®. Its area of application is straight dressing peripheral and plane surfaces with fine and finest grinding wheel grit sizes.
The low cutting pressure makes this dressing tool ideally suited for OD grinding and surface grinding.

PROFILE DIAMOND TOOLS

Profile diamonds are tools which have to meet highest demands.
These tools are used in areas where highest profile accuracy is required.

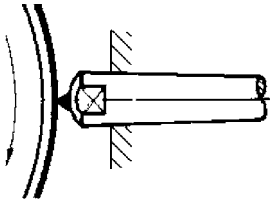
SPECIFICATION	ct	DIMENSIONS				ORDER NUMBER
		α	R	LENGTH	DIAMETER	
40/250 L	0.33	40°	0.250	45.5	Ø 9.52	66260339381



SINGLE POINT DRESSING TOOLS

Single point dressing tools are suitable for straight grinding wheels and simple profiles. Depending on quality, the diamonds have several usable points which can be rotated. This is not possible for single-use diamonds with only one point.

SPECIFICATION	DIAMOND QUALITY	ct	WORKING POINTS	HOLDER	ORDER NUMBER
LEA-1-VATOM-MK1-40	Vatom	1	3	MK1 × 40	66260382005



NORTON WINTER DRESSING DEVICE

Dressing device (centrifugal clutch) and dressing wheels for dressing diamond and cBN grinding wheels.

ITEM	FOR GRIT SIZES	ORDER NUMBER
Dressing device		69014151167
Dressing wheel 39C60-MV	D64 to D126	66253051624
Dressing wheel 39C802-IV	⩽ D64	66253052726
Accessories	1 set consisting of: 3 clutch segments, 3 springs and 3 screws	66260274670

All dimensions in mm

Only use dry; subsequent sharpening with Norton WINTER stone previously soaked in water only as necessary.

CLEANING AND SHARPENING STONES FOR DIAMOND AND CBN GRINDING WHEELS

CLEANING AND SHARPENING STONES	NORTON SAINT-GOBAIN WINTER	ORDER NUMBER
Norton WINTER stone No. 1AW (100×20×20)	White corundum, vitrified bonded, 360 mesh Sharpening of resin bonded grinding wheels Grit size < D46	66260395639
Norton WINTER stone No. 2 (100×24×13)	White corundum, vitrified bonded, 180 mesh Sharpening of resin bonded and metal bonded grinding and cutting wheels Grit size ⩾ D46	66260195816
Norton WINTER stone No. 3 (100×40×15)	Silicon carbide, rubber-bonded, 80 mesh Cleaning and sharpening of electro-plated and vitrified bonded grinding wheels and pins	66260195817
Norton WINTER stone No. 3A (80×15×10)	see Norton WINTER stone No. 3	66260389357
Norton WINTER stone No. 3B (100×50×25)	see Norton WINTER stone No. 3	66260386167
Norton WINTER stone No. 4 (90×70×20)	Ruby allumina, vitrified bonded, 60 mesh Sharpening of metal bonded grinding wheels Grit size ⩾ D251	60157642665
WINTER stone No. 5 (100×50×25)	see WINTER stone No. 2	66260389054

CLEANING AND SHARPENING STONES	flexovit	ORDER NUMBER
Stone WA150GV (25×25×150)	Cleaning and sharpening of vitrified and resin bonded grinding wheels ⩾ D54 Recommended for sharpening Q-Flute[2]	69936621643
Stone WA220GV (25×25×150)	Cleaning and sharpening of vitrified and resin bonded grinding wheels	69936621630
Stone WA320GV (25×25×150)	Cleaning and sharpening of vitrified and resin bonded grinding wheels ⩽ D46	69936651380

TECHNICAL INFORMATION

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The Norton WINTER brand represents over 160 years of heritage and grinding experience. Many companies worldwide involved in industrial production benefit from this expertise.

We know our customers' requirements and help you with our technological expertise and competence. This way, your grinding process becomes more effective and profitable.

SERVICE

Competition is keen, and cost pressures are acute. To improve productivity and technical capability, you need a supplier who co-operates efficiently. Norton WINTER not only provides high performance grinding tools but can also assist in analysing your processes, to identify the best solution, and then to implement it together with you.

ADVICE:

Our field service engineers and customer service team are here to help, and can offer advice on all Norton WINTER products and grinding processes. Together with product management and our application engineering team, customised solutions will be found which meet your needs.

PRODUCT DEVELOPMENT

Norton WINTER, as the grinding industry's technology leader, invests heavily in Research and Development. Basic research supports new customer-specific product and application developments at our global Technology Centres. Our EGTC (European Grinding Technology Centre) with the R&D Department in Norderstedt, closely co-operate with our Research and Technology Centres in the USA, France and China.

PROCESS OPTIMISATION

At our EGTC (European Grinding Technology Centre), we can evaluate your grinding processes using sophisticated sensing and measurement systems which you may not have access to. So we can demonstrate improvements to your process without interrupting your production. On your factory floor, our application and development engineers continue to support you. Our dedicated specialists are expert in the field of complex grinding systems, and can advise on new production strategies with the help of innovative process diagnostic technology. The result for customers is a fine-tuned production process, and optimised day-to-day operations. Technology Centre) with the R&D Department in Norderstedt, closely co-operate with our Research and Technology Centres in the USA, France and China.

TRAINING AND CONTINUING EDUCATION

We offer regular seminars on current issues and developments at our European Grinding Technology Centre (EGTC) in Norderstedt. Economic and advanced production processes are reviewed with top-class experts from different parts of the industry. We invite internal and external consultants on specific subjects to comment on the technological state-of-the-art and development trends.

Ask your field salesman for the latest calendar of scheduled seminars and get yourself registered. Specific training programmes can also be arranged according to your individual requirements. Just contact us - we will gladly make an offer that meets your needs.

NORTON WINTER OFFERS SEMINARS ON TOPICS SUCH AS:

- Tool Grinding Technology Forum (expert panel discussion)
- Grinding (basic training)
- Grinding fluids (focused technology review)
- Dressing technology (focused review)

FIELD INSTRUMENTATION SYSTEM (FIS)

OPTIMISE YOUR PRODUCTION PROCESS

Have us make a **FIS process analysis** and optimise your production process: field instrumentation system is a portable system to monitor and measure your grinding process. Exact and comparable data is obtained and can contribute to increase your performance:

- Process optimisation, reduction of cycle time
- Prolongation of tool life time
- Machine and process studies
- Analytical determination and benchmarking

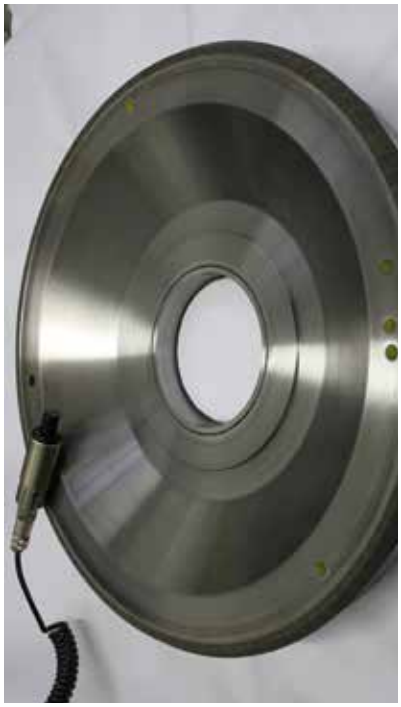
GIVE IT A TRY!

MDRESS - MOBILE DRESSING UNIT

FOR BETTER GRINDING RESULTS

Almost every CNC grinding machine can be upgraded by MDress, the mobile rotary diamond dressing unit. Using MDress ensures highly precise reconditioning of grinding wheel profiles. The grinding wheel achieves its ultimate axial and radial running truth directly on the main spindle. Our customers are enabled to test, for example, vitrified bonded grinding wheels, on the CNC grinding machine and obtain a more economic grinding result. Our application engineers will give you support, to demonstrate an optimised dressing process with the MDress dressing system on your machine at your premises.

JUST CONTACT US.



RFID – RADIO FREQUENCY IDENTIFICATION

This technology makes it possible to transfer stored data from the grinding wheel to the grinding machine. The advantages are

THE INCREASED LEVEL OF TRANSPARENCY

- Integrated tool-life monitoring
- Automated scanning and storage of tool use

SHORTER SET-UP TIMES

- Direct access to grinding wheel data by the machine control system
- Elimination of operator error in manual recording and entry of data

IMPROVED PROFITABILITY

- Reduced machine downtime by automatic data transfer between machine and grinding whee

GLOSSARY

For your reference: a short explanation of grinding terms

BONDS

To meet the challenges of the wide diversity of grinding applications, it is inevitable that a wide range of bond systems is required. Bonds are categorised according to the fundamental material type used, and many variations exist within each type.

RESIN BOND SYSTEMS

These are based on either phenolic or polyimide resins, usually together with added fillers, as well as the abrasive grains. Resin bonds are at the lower end of the hardness scale, and are used in a wide range of applications due to their fast and cool grinding behaviour.

SINTERED METAL BONDS

Most metal bonds are based on bronze, although harder systems may be based on steel or even hardmetal. Sintered bronze bonds are relatively soft and at their softest can overlap the hardest resin bonds. Steel and hardmetal bonds are more wear resistant, so therefore act harder and grip the abrasive grains more strongly, leading to longer tool life, although the abrasive can sometimes appear blunt.

Metal bonded grinding wheels generally grind more slowly, in most applications acting harder, and more grinding heat is developed than in resin bonded wheels. However, metal bonds can also readily dissipate heat, which also impacts the grinding process. Metal bonds are ideal for grinding wheels with sharp edge profiles, and for machining abrasive materials that would otherwise wear the bond. Furthermore, metal bonds are shock-resistant, and are suitable for very aggressive operating conditions. Metal bonds are mostly used in wet grinding. Special variants are crushable, brittle metal bonds that can be dressed on the machine in a special crushing process. These bonds are especially useful in creep feed grinding.

ELECTROPLATED BONDS

In this bond system, the metal bond is deposited electrolytically onto a bronze or steel body. The grit is tenaciously achored by the bond, and grain tips can protrude from the bond layer by 30 - 50% of the grain diameter. This leads to a grinding layer with a very high material-removal-rate capability. However, only the outermost grain layer acts in this way, which is why these tools are mainly designed in single-layer versions. Such single layer bond systems are suitable for profiled wheel bodies of all kinds; profile accuracy is dependent on the grit size specified.

VITRIFIED BONDS

Vitrified bonds are based on fusible glasses combined with fillers and the abrasive grains. While resin and metal bonds are generally fully dense, vitrified bonds are usually produced with a defined porosity, and are available in different hardness levels. This variation in porosity and hardness is analogous to the vitrified bonds of conventional grinding wheels. The main features of vitrified bonds are:

- Good dressability and profileability
- Free-cutting due to the porosity and self sharpening behaviour
- Fluid availability, due to porosity, in the grinding zone allows cool grinding at low grinding forces
- High cutting speeds and material removal rates are possible.

CONCENTRATION

According to the Norton WINTER system, the concentration value defines the volume fraction of diamond or cBN in the abrasive layer as follows:

DIAMOND		
Concentration	Carat / cm³	Volume %
C50	2.2	12.5
C75	3.3	18.75
C100	4.4	25
C125	5.5	31.25

cBN		
Concentration	Carat / cm³	Volume %
V120	2.09	12
V180	3.13	18
V240	4.18	24
V300	5.22	30

These definitions are not applicable for single layer electroplated tools.

CONDITIONING

Conditioning of a grinding wheel consists of dressing and cleaning:

DRESSING		CLEANING
PROFILING	SHARPENING	
Influences macrostructure	Influences microstructure	Influences microstructure
Produces concentricity and grinding wheel profile	Generates topography and grain exposure by eroding the bond	Removes chips from chip space
Need: Shape or re-shape the wheel surface	Need: Create grit protrusion	Need: No change in the surface

CUBIC BORON NITRIDE (CBN)

Boron nitride is found in two structural modifications: Cubic boron nitride (cBN) has the zinc-blende crystal structure equivalent to diamond, and has a hardness just a little below that of diamond. The graphite-like hexagonal modification of boron nitride (hBN) is soft and is used as a lubricant.

Compared to diamond, cBN has technological and economic advantages when grinding materials having a chemical affinity to carbon, such as steels and ferrous alloys. Applications for cBN are becoming increasingly economic, and cBN grinding of workpieces with hardness as low as 50 HRC have been demonstrated.

DIAMOND

Diamond is one of the three carbon modifications (the others are graphite and the fullerenes) and, with a Moh's hardness of 10, diamond is the hardest material known. The grinding (Rosiwal) hardness is 140 times higher than that of alumina. Because of its hardness and wear resistance, diamond is used for grinding hard, brittle and short-chipping materials. Examples are tungsten carbide, glass, ceramics, quarz, semiconductor materials, graphite and wear-resistant thermal spray alloys as well as hard-facing alloys, plastics with glass fiber reinforcement, and other difficult to machine materials. Both natural and synthetic diamonds are used in industrial applications.

- **NATURAL DIAMOND:**
  these diamonds were created in the earth's mantle under high pressure and temperature (1200 -1400°C). Both single crystals (octahedrons, triangles...) and crushed grit (boart) are used in industrial diamond tools.
- **SYNTHETIC DIAMOND:**
  synthetic diamond grits are formed in presses in a very high pressure/high temperature (HP/HT) process, at up to 60000 bar and 1500°C, using a variety of solvent/catalyst materials which help to convert graphite into diamond.
- **MCD:**
  large synthetic diamonds that are produced in a HP/HT process similar to synthetic diamond grit.
- **PCD**:
  polycrystalline diamond pieces formed by sintering micronized diamond particles together with a binder under HP/HT conditions.
- **CVD:**
  these diamonds are manufactured by gas phase deposition (methane, hydrogen) at low pressure using a vacuum system.

DIRECTION OF ROTATION INDICATOR

Resin and metal bond diamond and cBN grinding wheels always show an indicator for the direction of rotation. At the end of the production chain of a multilayer grinding wheel is the profiling and sharpening process. In the sharpening process, a bond tail is formed behind each of the active abrasive grains. This bond tail supports the grain and prevents the grain from untimely fracture. If the wheel is mounted the wrong way round, this bond tail would precede the grains during cutting, which would lead to lower chip-space, increased grinding pressure, and early grain fracture. Therefore, it is important to adhere to the rotational direction shown by the indication arrow or to re-sharpen the grinding wheel before use, if you chose to change the direction of rotation.

DRESSING = TRUING + SHARPENING

It is necessary to distuinguish between the key wheel preparation steps of truing, sharpening and cleaning of the grinding wheel surface.

Dressing describes the processes of truing and sharpening a grinding wheel. When grinding with conventional alumina or silicon carbide wheels, "dressing" is the combined process of truing and sharpening. However, for superabrasive grinding wheels containing either diamond or cBN abrasives in a resin or metal bond, after truing, a separate sharpening step is usually required to remove some of the bond material and expose the grains. In addition, the grinding wheel surface must be cleaned (Dressing + Cleaning = Reconditioning) periodically. The dressing interval depends upon the grinding process parameters being used, and the type of workpiece material being ground.

Grinding wheel truing generates the correct geometric shape, develops the necessary concentricity, and also removes any surface contamination. In so doing, worn blunted grains are either removed or resharpened, and fresh grains are exposed. To achieve optimum results, dressing tools, dressing parameters and dressing strategy must be finely tuned to the grinding wheel and grinding process. Therefore, different tools and methods are used, such as either alumina-based or SiC sharpending stones, SiC grinding wheels, the Norton WINTER brake-dressing device, CNC rotary dressers, diamond dressing sticks, rotary profile dressers, etc.

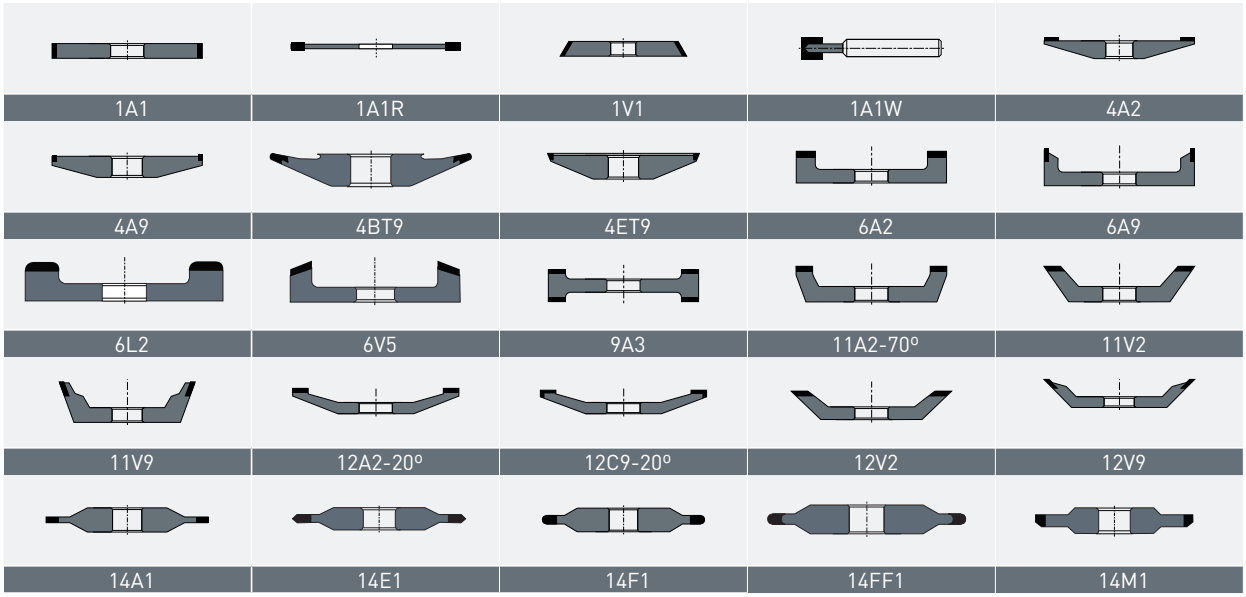
Our engineers can offer advice to help you chose the best method for your application.

FEPA

The Federation of European Producers of Abrasives (FEPA) is a non-profit European organisation which publishes safety guidelines and standards for conventional and superabrasive (diamond and cBN) grinding tools as well as loose abrasive grain (see grit sizes). It also provides standards for the most common grinding wheel shapes and dimensions.

FEPA-SHAPES

These drawings show the most important grinding wheel geometries:



GRINDING

According to DIN 8589, grinding is defined as material removal using geometrically undefined cutting edges. All grinding wheels with either diamond or cubic boron nitride (cBN) are grinding tools according DIN 8589. The "cutting edges" are composed of the diamond or cBN grit.

GRINDING RATIO (G-RATIO)

The grinding-ratio is calculated as a ratio of the ground workpiece volume V_w to the wheel wear volume V_s.

GRINDING WHEEL BODIES

The body of a grinding wheel provides the static and dynamic stiffness to the tool. Dependent on the kind of grinding layer, it may consist of aluminium, filled resin, brass, steel or ceramics. The body significantly influences the vibration behaviour and the thermal conductivity of the grinding wheel; the following table shows examples for superabrasive grinding wheel bodies.

BODY MATERIAL TYPE	LABEL	VIBRATION ABSORBTION	HEAT TRANSMISSION	MECHANICAL STIFFNESS
Resin with metal fillers	H	medium	sufficient	good
Resin with non-metallic fillers	B or D	good	bad	satisfactory (not sufficient with thinwalled bodies)
Aluminium	A	bad	good	very good
Steel	E	bad	satisfactory	very good
Copper	C	bad	very good	very good
Composite material	CFK	good	bad	good

GRIT SIZES

The seive-sizes for diamond and cBN range according to FEPA standards (also ISO 6106) and are shown in the following table. As abrasives always contain a range of grit sizes, the values given for average grit sizes and particles per carat are approximations. D-prefix indicates diamond, while B-prefix refers to cBN.

FEPA GRIT SIZE D OR B	STANDARD [Mesh]	AVERAGE GRIT SIZE [µm]	PARTICLES PER CT
1181	16/18	1100	60
1001	18/20	930	100
851	20/25	780	160
711	25/30	660	270
601	30/35	555	450
501	35/40	465	760
426	40/45	395	1200
356	45/50	330	2100
301	50/60	280	3500
251	60/70	233	6000
213	70/80	197	10000
181	80/100	167	16000
151	100/120	140	28000
126	120/140	118	46000
107	140/170	99	80000
91	170/200	83	135000
76	200/230	72	200000
64	230/270	63	300000
54	270/325	55	460000
46	325/400	47	750000
39	400/500	38	1400000
33	500/600	33	2100000

Norton WINTER has its own classification for fine and microgrit sizes. FEPA standards are similar (M 63...M1.0).

NORTON WINTER DIAMOND CLASSIFICATION	GRIT SIZE [µm]
D 25	40 - 60
D 20 C	34 - 45
D 20 B	25 - 37
D 20 A	20 - 30
D 15	8 - 25
D 15 C	15 - 25
D 15 B	10 - 20
D 15 A	8 - 15
D 10	6 - 10
D 7	5 - 10
D 5	3 - 7
D 3	2 - 5
D 1	0.5 - 2
D 0.7	0 - 1
D 0.25	0 - 0.5

HARDNESS OF ABRASIVES

The hardness value of a material is generally influenced by the method of measurement. Different measuring methods and equipment result in different scales and units which cannot easily be compared. Thus several scales exist, for example:

Moh's hardness: abrasion behaviour (measure of scratch resistance)
Rosiwal hardness: stock removal behaviour (measure of resistance to stock removal)
Vicker's Microhardness: indentation behaviour (resistance to penetration)

In the following table, different hardness values for abrasives are given and compared to some reference materials:

MATERIAL	MOH'S HARDNESS	ROSIWAL HARDNESS	VICKERS MICROHARDNESS (HV)
Diamond	10	140.000	10.000
cBN	9.9		9.000
Silicon carbide	9.6		2.600
Corundum	9	1.000	2.060
Quarz	7	120	1.120
Manganese	5	6.5	540
Gypsum	2	1.25	36
Talc	1	0.03	2.6

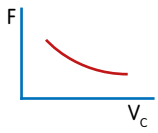
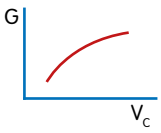
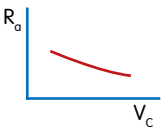
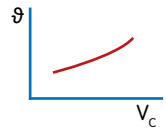
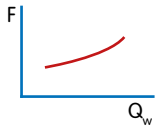
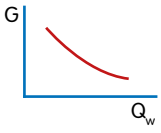
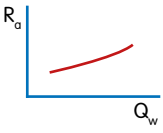
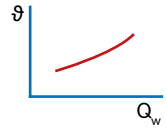
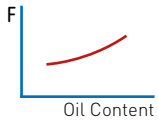
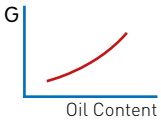
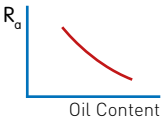
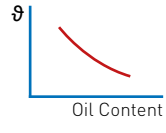
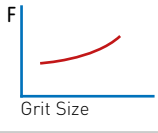
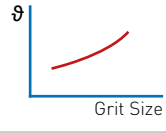
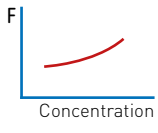
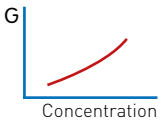
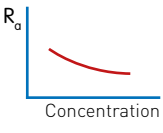
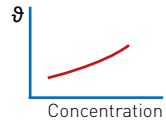
Diamond's stock removal resistance (Rosiwal hardness) is 140 times higher than corundum (alumina), even though its penetration hardness (Vickers) is only 5 times higher.

MATERIAL REMOVAL RATE

The material removal rate, MRR or Q_w, is expressed in mm^3/s and defines the volume of workpiece material ground per unit time (second).
The specific material removal rate, MRR' or Q'_w, refers to the removal rate per millimetre of wheel contact width and is expressed in units of [$mm^3/(s.\ mm)$].

PARAMETERS INFLUENCING GRINDING RESULTS

The table shows some correlations between process variables and the grinding results.

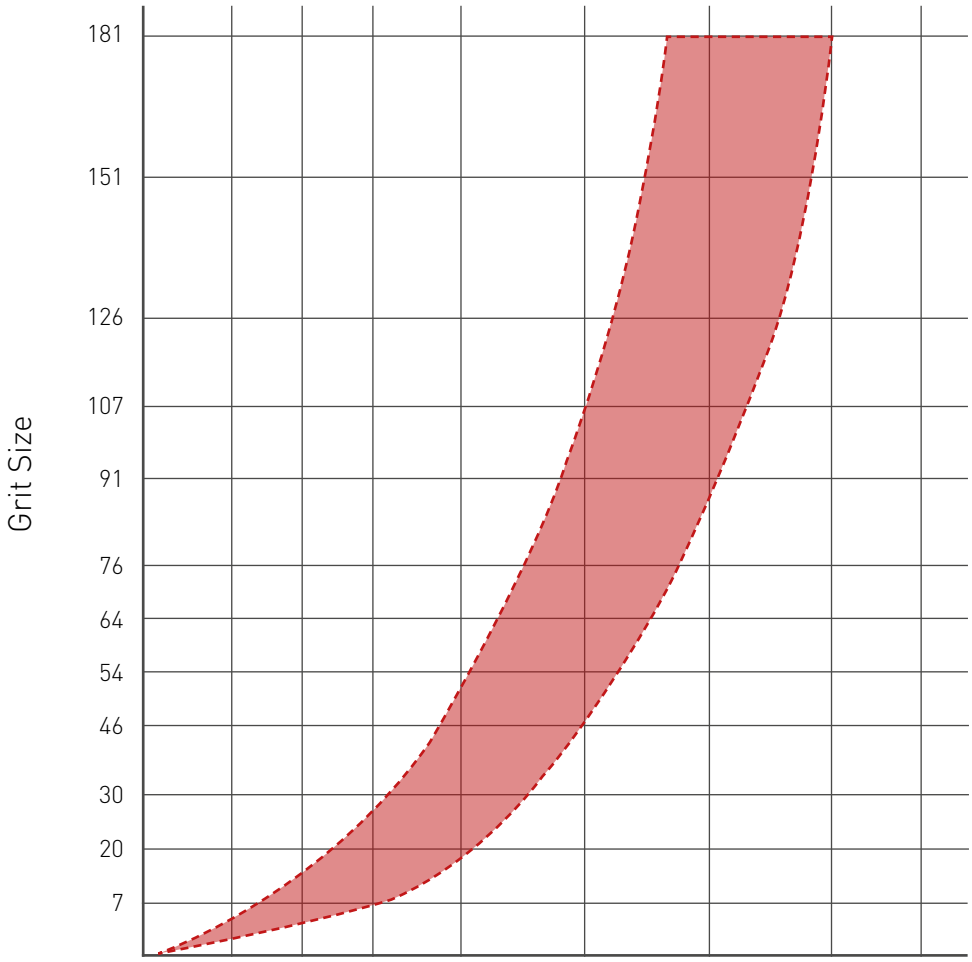
INFLUENCING PARAMTERS / APPRAISAL CRITERION		CUTTING FORCE F F = F(...)	GRINDING RATIO G G = F(...)	ROUGHNESS R_A R_A = F(...)	TEMPERATURE ϑ ϑ = F(...)
Machine- and Operation Paramters	Cutting Speed v_c (m/s)				
	Material Removal Rate Q_w (mm^3/s)				
	Coolant (Oil Content)				
Grinding Wheel	Grit Size (µm)				
	Concentration ($Carat/cm^3$)				

ROUGHNESS

The surface roughness of a ground workpiece is influenced by many diverse parameters:

- Grit size of abrasive grain
- Concentration of abrasive grain
- Specification of bond system
- Type and hardness of work piece
- Grinding process
- Grinding parameters
- Dressing parameters

A general and qualitative correlation between grit size and surface roughness is shown below:



R_a [µm]	0.012	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2
R_t [µm]	0.100	0.200	0.40	1.0	1.6	2.5	6.3	10	20
R_z [µm]	0.050	0.100	0.20	0.6	1.0	1.6	3.8	6	15

SPECIFICATION

The specification is the general description of the grinding tool and contains all relevant information concerning the product's features. In general, the specification always contains the following details:

EXAMPLE:

11V9	100-2-10-20	D126	K+888R	C75	A
Shape	Dimension	Grit Size	Bond	Concentration	Body Material

Furthermore, the specification can contain additional information regarding drawing index, production method, structure, and other details.

SUPERABRASIVES

Diamond and cubic boron nitride are the hardest materials existing in industry today, according to the current state of knowledge. The levels of hardness of diamond and cBN are significantly higher than those of conventional abrasives like alumina (corundum) and silicon carbide (see hardness).

WEAR EFFECTS ON DIAMOND AND CBN

The hardness of an abrasive grit type alone is not sufficient to determine the grinding tool's grinding behaviour. Diamond and cBN grains can wear in many ways, causing different effects.

Primarily, there are two main types of wear.

MECHANICAL WEAR:

Abrasion, micro-chipping of cutting edges, grit macrofracture, and breakout of grain from the bond.

CHEMICAL AND THERMAL WEAR

Carbon diffusion, graphitization, oxidation, and reaction with grinding fluids.

Diamond not only reacts with iron (above a certain threshold temperature), but also with chromium, vanadium and tungsten. cBN does not show chemical reaction with iron or other metals.
Therefore, cBN has proven to give better tool performance when machining, for example, high speed steel, although it is not as hard as diamond.
An outward sign of the occurance of thermo-chemical wear is the rapid appearance of wear flats on the grains, when no grain chipping from mechanical wear is present.

CONTACT

Whom to ask first? Who is my nearest contact person?
Where can I get quick and easy help on grinding tools and grinding processes?

For your inquiries please ask you sales engineer:

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2020