

Catalogue No. 4

# Precision Optics & Ophthalmics



Precision Grinding Solutions

**WINTER**  
SAINT-GOBAIN

# A good Connection

Always close to the customer and customer-focused, our diverse market presence worldwide reflects the strength of a global player. Saint-Gobain's businesses are spread over 45 countries and new locations are being added frequently. Activities are clearly structured to ensure operational leadership. In Abrasives alone, over 16,000 people are employed. The company is the only manufacturer to offer a comprehensive product range of abrasives and dressing tools for almost all fields of industry. WINTER, as the premium brand for diamond and cBN grinding products, is one of the most well established and respected names in the market. Our combination of quality products, expertise and service, together with the international network of the parent company Saint-Gobain, is the key to success; WINTER grinding tools go with you worldwide, and lead you to your goals.

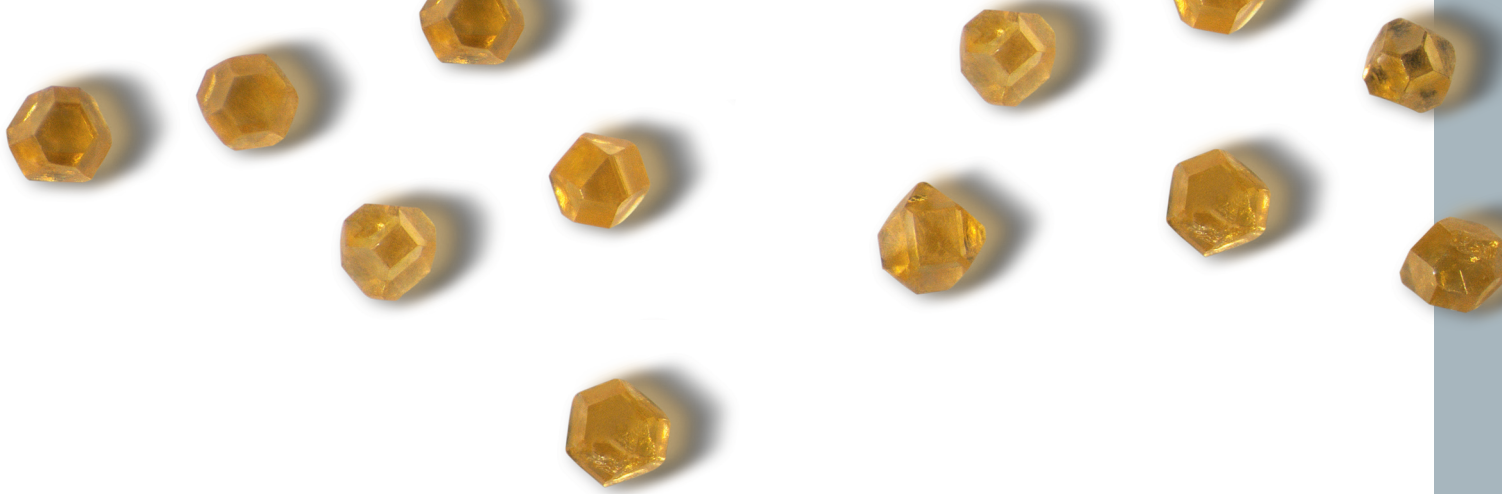
## Saint-Gobain...

- ...was established in 1665 to supply glass for the Hall of Mirrors in the Palace of Versailles.
- ...kits out every second car in Europe with window glass
- ...establishes or acquires a new sales location every day
- ...inaugurates a new plant or a new production line every month
- ...presently has 206,000 employees
- ...generates € 43.4 billion annual turnover

<p>High Performance Materials <b>WINTER</b> Grinding Tools SAINT-GOBAIN No. 1 Worldwide</p>	<p><b>Flat Glass</b> freeglass No. 1 in Europe, No. 3 Worldwide</p>	<p><b>SAINT-GOBAIN</b> SEKURIT</p>
<p><b>NORTON</b> Industrial Super Abrasives SAINT-GOBAIN</p>	<p><b>Glass Packaging</b> No. 1 in Europe, No. 3 Worldwide</p>	<p><b>GLASSOLUTIONS</b> DEUTSCHE GLAS SAINT-GOBAIN</p>
<p><b>BAYSTATE</b> Coated Abrasives SAINT-GOBAIN</p>	<p>Bonded Abrasives</p>	<p><b>Construction Products</b> Insulating Materials No. 1 Worldwide</p>
<p><b>flexovit</b> Thin Wheels SAINT-GOBAIN</p>	<p>Construction Products</p>	<p><b>ISOVER</b> SAINT-GOBAIN Plaster/Plaster Boards No. 1 Worldwide</p>
<p>Ceramics and Plastics No. 1 Worldwide for Thermal and Mechanical Applications</p>	<p><b>SAINT-GOBAIN</b></p>	<p>Pipes No. 1 Worldwide in Cast Iron Pipes</p>
<p><b>Vetrotex</b> Reinforcement Materials SAINT-GOBAIN No. 1 Worldwide</p>	<p>Industrial Mortar No. 1 Worldwide in Tile Adhesives</p>	<p><b>PAM</b> SAINT-GOBAIN</p>
<p><b>raab karcher Building Distribution</b> No. 1 Worldwide in Tiles, No. 1 in Europe in Construction Materials and Industrial Woodworking</p>	<p>Exterior Siding No. 1 in USA for Exterior Siding, No. 3 in USA for Roofing</p>	<p><b>weber</b> SAINT-GOBAIN</p>

## Worldwide Expertise

Saint-Gobain is in the top one hundred largest industrial groups in the world and is leading in the production of glass, high performance materials and construction products. Two major milestones stand out in the Saint-Gobain Group's long history; it was established in 1665 by Colbert under Louis XIV, then, over 300 years later, Saint-Gobain and Pont-à-Mousson merged in 1970. WINTER joined the group in 1996. Today, the group invests € 390 million per year in research and development and files around 300 patents per year, to support its reputation for innovation and discovery.



## The WINTER Brand:

For over 160 years WINTER has been a worldwide synonym for high-quality diamond and cBN grinding tools for industrial production. As pioneer and trend-setter, WINTER has been actively involved in the development of the success story of grinding, as well as in the production of synthetic diamonds.

### Custom-made Solutions - the key to success

Over 75% of all WINTER products are developed in close cooperation with our customers. The results are tailored grinding solutions that perfectly fit your special requirements. Our expert teams would also like to help you. Together we will meet your technical challenges.

### Market Leader - in front through quality

In Superabrasives, WINTER is No. 1 in Europe with quality products and services. In Europe, over 500 employees in four production sites take care of our customers' needs. Worldwide, over 2,000 people are employed in our global business.

#### INNOVATIONS

To this day, the WINTER philosophy is closely connected to innovation and technical progress. We thank our customers for over 160 years of momentum, challenges and confidence. **And in the future our next generation of innovations will ensure your success.**

#### PERFORMANCE

The WINTER performance package contains top quality precision grinding tools, comprehensive service and individual customer care - which ranges from best grinding tool selection through to process optimisation. **Benefit from our full service, and make use of our leading technical expertise to increase your profitability.**

**WINTER**  
SAINT-GOBAIN

#### PRECISION

From ACCURACY to Z-AXIS - the WINTER precision alphabet spells the suitable solution for your needs. Profile accuracies below 1 µm and a surface finish in the nanometer range are achieved regularly. **You can trust WINTER.**

#### QUALITY

Since the foundation of the company, WINTER has stood for quality at the highest level. It begins with the first customer contact, and covers the identification of appropriate tool specifications, manufacturing, customer support and the final optimisation of your production process. **WINTER quality: Satisfaction guaranteed!**

### Quality, Environmental Protection and Safety

As a responsible manufacturer of quality grinding tools, WINTER production is eco-friendly and avoids waste of precious resources according to the latest international standards and certification requirements. WINTER is certified to ISA 9001 (Quality Management), ISO 14001 (environmental management) and OHSAS 18001 (health and safety management). All rotating WINTER tools bear the OSA safety seal (OSA: Organization for the Safety of Abrasives), granting WINTER the customers' highest safety tool in application.



Organization  
for the Safety  
of Abrasives (oSa)

# Snapshots of a long history

WINTER was established in 1847 by Ernst Winter as a family-owned company. We still adhere to the original goal of developing ultra-hard crystal tools of the highest quality. Our claim is to be the best. In numerous fields of application for diamond and cBN grinding tools we have been pioneers, and today we still follow this way as trend-setters and the technology leader.



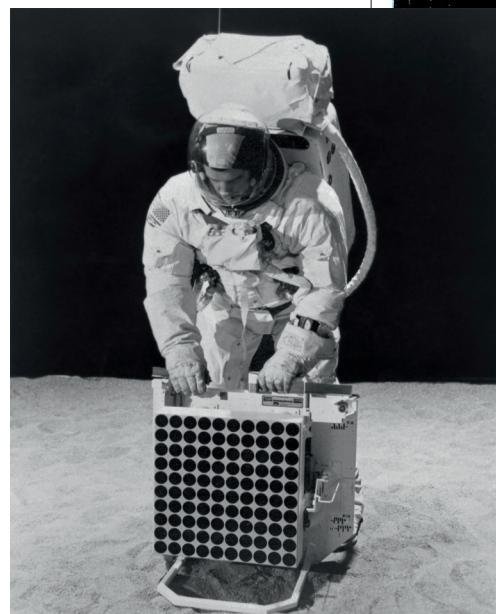
**Ernst Winter**  
Goldsmith and diamond-taire, started his diamond tool workshop in 1847.



**WINTER in Hamburg**  
1872: WINTER's first company building in Hamburg.



**With WINTER to Outer Space**  
Laser reflectors ground with WINTER diamond tools enable the most accurate astronomic and geographic measurements.



History

WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact



# Innovations: Yesterday's vision of

WINTER bridges the combination of inventive skills, creativity, identification of challenges and the ambition to meet our customers' expectations: WINTER developments of the past are found in industrial museums. Yesterday's vision of the future is today's standard. We are committed to over 160 years of company history: Today and in the future, we work hand in hand with our customers on innovations and their economical implementation

**1847**

WINTER produced lithography diamonds, replacing the conventional steel tips.

**1969**

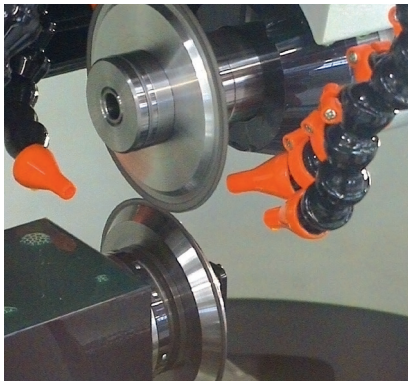
As the first grinding tool manufacturer worldwide, WINTER presented cBN grinding tools with a special resin bond (KSS) for HSS tool grinding..

**2008**

WINTER offered metal bonded tools with internal cooling for creep-feed glass edging.

**1935**

WINTER produced the first phenolic bond grinding wheel to replace previously used grinding wheels with loose, hammered or rolled-in grain



**2006**

With Q-Flute® Dress, WINTER offered the first resin bonded grinding wheel dressable with a diamond rotary dresser.

**1975**

WINTER DMC diamond grinding wheels and BMC cBN grinding wheels came into the market: WINTER MC grinding wheels allow cost-effective profile grinding for difficult to machine work pieces. They also reduce thermal effects of the near-surface microstructure and assure extremely long profile lifetime. WINTER DMC and BMC grinding wheels can be profiled by crushing directly on the grinding machine.

**2001**

WINTER introduced special cutting wheel products for slicing advanced ceramics like SiC.



**1993**

WINTER SG-CNC rotary dressers conquered the market. They have made dressing of vitrified cBN grinding wheels possible..

**1958**

WINTER was the first in Europe producing grinding tools with synthetic diamonds. In combination with WINTER special resin bonds, full performance benefits were achieved..

# In|no|

1548. from L. innovatus, pp. of innovare "to renew or change", from in- "into" + novus "new".

**1988**

New super-light cutting wheels with carbon fibre bodies were patented.

# the Future

**1971**

At the European Machine Tool Exhibition WINTER showed for the first time a novel grinding wheel type that met the demand for short grinding cycle times. The structure of metallic and non-metallic bond components allows the efficient grinding of tungsten carbide and steel combinations. (M+789).



**2003**

WINTER developed the DDS (Diamond Dressing System), permitting the dressing of vitrified and resin bonded grinding wheels directly on the production machine. Until then, it was performed on external machines. Due to its free standing layer, outstanding profile grinding capability is achieved.

**1992**

New standards are set with the "34SG" series in the field of laminated safety glass and fire-resistant glass machining.

**1929**

WINTER beginnt mit der Herstellung von Diamant-Mikrokörnungen im Sedimentierverfahren.

**1875**

Delivery of WINTER diamond particles to Zeiss Jena, enabling the engraving of 150 lines per millimeter.

**2006**

N7 as a glass-ceramic bond system was introduced to the market. This bond can be precisely engineered to meet individual customer application requirements: Very high bond-hardness, optimised wetting of the grains and perfect development of bond bridges enable the creation of very high porosity for cool grinding and extremely long tool life.

**1950-1954**

WINTER developed a large variety of electroplated tools: Files, grinding pins, cutting wheels, drills...

**1982**

The patented dressing process "TDC" (Touch Dressing cBN) was developed by WINTER.

**1977 / 78**

WINTER presented the special bond "VF/ VFF" for grinding and finishing polycrystalline diamond and cBN materials.

**1996**

For four generations the company, founded by Ernst WINTER in 1847, was family-owned. In 1996 it was taken over by the French Saint-Gobain group.



**2008**

WINTER tools "Ti-Tan" and "Furioso" are a new generation of extremely wear-resistant stationary dressers.



**2001**

"Tiger" caused a stir with a new revolutionary grinding wheel geometry for narrow tooth gaps in saw manufacturing.

# v|a|l|t|j|o|n

In general linguistic usage as a nonspecific term in the sense of new ideas and inventions and their conversion to economic use.

# Your best solution

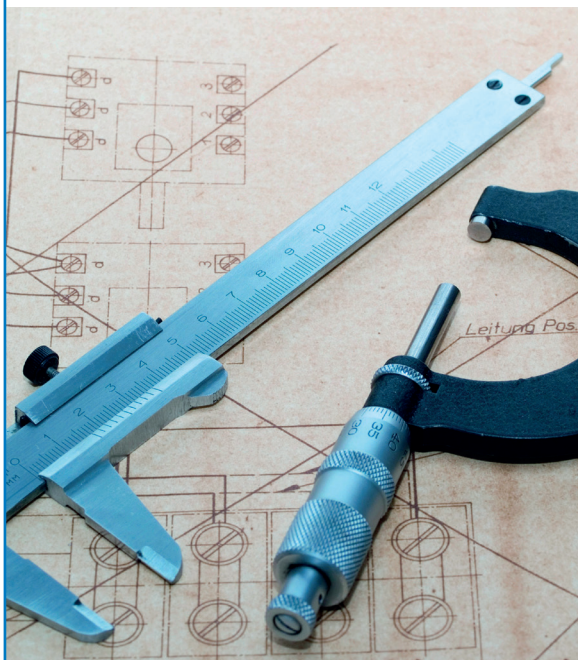
WINTER diamond tools gain great recognition in the fields of quality, performance and cost effectiveness. This is no coincidence, as WINTER is not limited to manufacturing excellent grinding tools: more than 75% of the cases are tailor-made solutions, developed in close cooperation with the customer. This successful engineering is based on a modular performance package, specifically equipped according to individual needs

## Tailor-made products

Optimised grinding solutions for your specific application provide the greatest benefit: In the end, you generate cost savings through more productivity, less down time, and better quality.

Each one of your technological challenges is an incentive for our product managers and our application engineers to achieve the best grinding results. Please contact us.

Besides the high percentage of custom-made solutions, WINTER offers a comprehensive range of stock products - and can supply these short term straight to your production line.



## Focused on the goal ahead

Comprehensive technical advice in all questions about WINTER products and grinding processes. Our field sales force and our customer service are at your disposal.



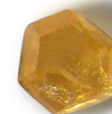
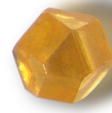
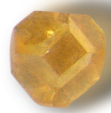
## Advice

## Expertise

Advantage in accumulated knowledge: Seminars about current grinding issues as well as training programs matching our customers requirements.







Product Development



**The cream of the crop**

In order to meet your production-oriented challenges, take advantage of our dedicated specialists: In the R&D department and the European Grinding Technology Centre about 50 scientists are at your disposal for developing grinding tools and processes.

Solution



Trainings

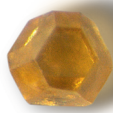
Process Optimisation



**Fine Tuning**

Our application engineers and our product developers will help you. Either at your premises, or in our EGTC (European Grinding Technology Centre), where we can optimise your production process, without interfering with your workflow.

Please ask your sales advisor - contact details on the last page.



Solutions

WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact

# Precision Optics



In optics, the important step on the road to efficiency and the upgrading of quality was taken when diamond tools were introduced and every effort was made to exploit their outstanding grinding performance, their long and reliable life and the exact shaping that can be achieved with them. These three factors are the pre-conditions for repeatable results from the individual operations which have to be performed in the grinding of optical components of all kinds.

WINTER diamond tools are available for all stages of processing which have to be performed in the production of optical components. Standard tools can be adapted to meet customer-specific requirements.

- 12 The right specification for your individual requirements**
- 13 Innovative ideas and new strategies
- 14 Surface grinding**
- 14 Generating tools (Cup wheels)
- 18 Machine connections and body lengths for generating tools
- 30 Technical notes on the use of generating tools
- 31 Diamond pellets for fine grinding
- 32 Technical notes on the use of pellets
- 33 Centering**
- 33 Centering wheels
- 36 Bevelling wheels
- 38 One-piece centering/ bevelling wheels
- 40 Technical notes on centering
- 41 Edge grinding**
- 41 Chamfering tools
- 44 Cutting**
- 44 Diamond cut-off wheels
- 47 Drilling**
- 47 Diamond core drills
- 48 Technical notes on drilling
- 49 Checklist - Precision Optics**



# The right specification for your individual requirements – the key to success

The crucial claim we make is that we offer innovative solutions to meet the individual challenges faced by our customers. These solutions take the form of optimised high-performance grinding tools using diamond as abrasive – exactly matched to the particular customer-specific demands and requirements. Therefore, you will not find many standard off-the-shelf products in this catalogue. Instead it is an overview of grinding tools which can be used for the work usually done on optical components but which can be tailored to meet your needs and requirements.

When complex applications have to be analysed and the most up-to-date technology is needed for product optimisation, then WINTER are the right people to come to. We see ourselves as a provider of highly sophisticated grinding solutions. However, our services cover much more than just the supply of the grinding tool itself. We also include our willingness to collaborate with our customers as partners to ensure a continuous improvement in their existing grinding processes, to increase productivity and to bring down costs. Attributes such as trustworthiness, expertise and reliability are the foundation on which this is based.



Success has said it all for us for more than 160 years. In the field of tailor-made solutions for customers, what we rely on today is the same as we did then, namely innovation, accuracy, high performance and quality and thus, with our peak technological achievements, the ability to follow the trends and provide unique grinding solutions in all the industrial markets.

## WINTER grinding tools are the right choice...

- ... if you are grinding soft or hard glass,
- ... if you are using oil or emulsion,
- ... if you are generating, centre grinding or lapping,
- ... if you are rough grinding or fine grinding,
- ... if you are looking for a unique special solution, or
- ... if you are carrying out high volume production.

The WINTER solutions developed for your application give you economical production, higher productivity and better quality and put you in a position to meet the sharp rise in the requirements that have to be met in your market.

# Innovative ideas and new strategies

## Basic research

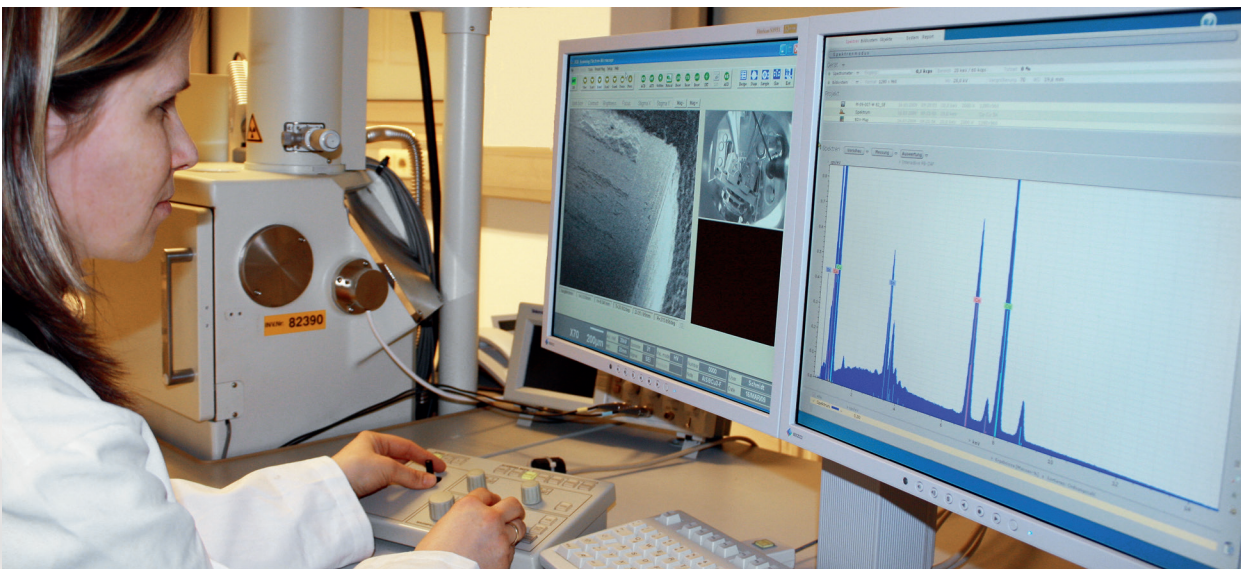
WINTER puts its trust in certified production and planning processes and in the long-term ongoing development of abrasives. At the same time, as part of the world famous abrasives manufacturer Saint Gobain Abrasives, WINTER also has the advantage of belonging to a group operating all over the world. A global network of centres of expertise, one of which is the production site at Norderstedt, Germany, gives WINTER's specialists access to a vast, world-wide pool of knowledge on grinding technology. Basic research focussed on the needs of the practical user and targeted collaboration between laboratories specialising in different fields again and again enabling improved grinding tools to be developed.

## Development of applications

In many industries, the EGTC (European Grinding Technology Centre) plays an important part in WINTER's market focus and customer orientation. Under constraints close to those operating in practice, new tools are developed, produced as prototypes and checked and optimised for their suitability and fitness for the market.

## Optimising processes and products in house with the customer

You are faced with new grinding challenges? Our product managers will be happy to find tailor-made solutions by working jointly with you. Our applications engineers are here to help with any questions you may have on any aspects of the grinding process.

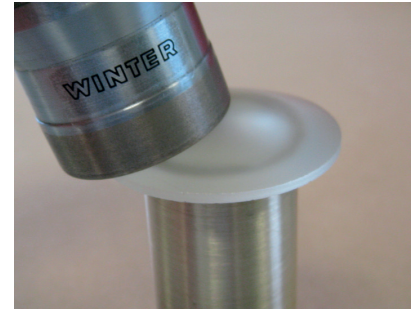


We are market leaders in the field of customer-specific superabrasive grinding solutions!

# Surface grinding

The purpose of surface grinding glass is to shape workpieces to the required geometrical form and to adjust it to the desired dimensions, whilst producing a surface finish, that the subsequent polishing process is minimized.

Shown below are diamond-coated cup wheels which are used in the production of optical components for grinding the surfaces of hard, brittle materials. They are intended for use on suitable grinding machines which are able to run at the required cutting speeds.

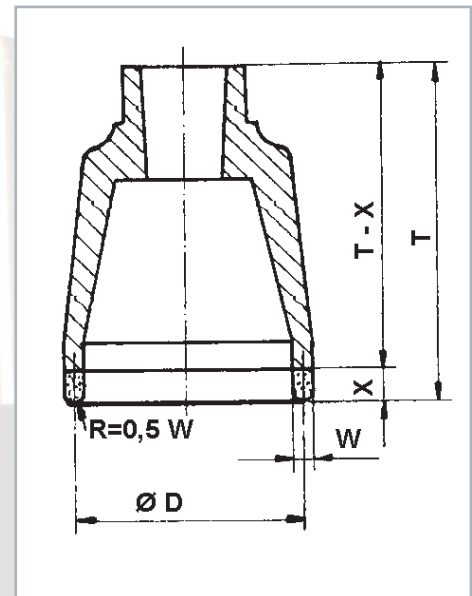


## Generating tools (Cup wheels)

**Sintered metal-bond diamond generating tools for grinding spherical, aspherical and toric surfaces.**

### Geometry

WINTER:	2F2
FEPA:	2F2
DIN:	58741



### Guide to find the right specification

Selecting your wheel:

1. Please first select the shape, diameter, rim width and abrasive layer depth from the table below.
2. Next determine the length of body required (this is the overall length minus the abrasive layer depth)
3. We have provided an overview table on pages 18-29 to help you determine the machine connection.
4. Then select the grit size, concentration and bond you require. The table below will also help you with this.

Please keep in mind that the grinding parameters are just as important as the grinding tool to achieve the desired results. You will find a checklist on page 49 or on our web site [www.winter-superabrasives.com](http://www.winter-superabrasives.com) as an interactive pdf.

**Ordering example**

Shape	Middle diameter D	Rim width W	Usable layer depth X	Length of body T-X	Machine connection A	Diamond grit size	Bond	Concentration
2F2	20	2,5	10	50	L1	D126	BZ335	C50
						(L1 = connection for LOH RF1 or DAMA FS100)		

**Ordering designation for diamond generating tools for curved surfaces**

Shape	D	W	X	T-X	A	Guide to finding the right specification																												
2F2	5	2	4-6	T-X = Please state length of body when ordering; if no length is stated, standard length will be supplied according to machine type	A = Please state machine connection when ordering. see tables on pages 18-29	<p><b>Rough grinding</b></p> <table border="1"> <thead> <tr> <th>Tool size</th> <th>Diamond grit</th> </tr> </thead> <tbody> <tr> <td>Tools ≤ 50 mm in diameter</td> <td>D64 &lt;--&gt; D126 in metal bond and C50 concentration</td> </tr> <tr> <td>Tools &gt; 50 mm in diameter</td> <td>D107 &lt;--&gt; D151 in metal bond and C50 concentration</td> </tr> <tr> <th>Bond</th> <th>Application</th> </tr> <tr> <td>BZ486</td> <td>Metal bond for grinding non-silicate glass</td> </tr> <tr> <td>BZ335</td> <td>Metal bond for grinding silicate glass</td> </tr> <tr> <td>BZ536-24</td> <td>Metal bond for grinding quartz glass</td> </tr> <tr> <td>BZ366</td> <td>Metal bond for grinding glass ceramics</td> </tr> </tbody> </table> <p><b>Fine grinding</b></p> <table border="1"> <thead> <tr> <th colspan="2">Metal bond</th> </tr> </thead> <tbody> <tr> <td>Diamond grit</td> <td>D15A – D20A and C35 concentration</td> </tr> <tr> <td>Bond</td> <td>BZ355 (standard) BZ536 (freer cutting)</td> </tr> <tr> <th colspan="2">Resin bond</th> </tr> <tr> <td>Diamond grit</td> <td>D15A – D20B and C100 concentration</td> </tr> <tr> <td>Bond</td> <td>W+3083T-23 (standard) K+777R (freer cutting)</td> </tr> </tbody> </table>	Tool size	Diamond grit	Tools ≤ 50 mm in diameter	D64 <--> D126 in metal bond and C50 concentration	Tools > 50 mm in diameter	D107 <--> D151 in metal bond and C50 concentration	Bond	Application	BZ486	Metal bond for grinding non-silicate glass	BZ335	Metal bond for grinding silicate glass	BZ536-24	Metal bond for grinding quartz glass	BZ366	Metal bond for grinding glass ceramics	Metal bond		Diamond grit	D15A – D20A and C35 concentration	Bond	BZ355 (standard) BZ536 (freer cutting)	Resin bond		Diamond grit	D15A – D20B and C100 concentration	Bond	W+3083T-23 (standard) K+777R (freer cutting)
	Tool size						Diamond grit																											
	Tools ≤ 50 mm in diameter						D64 <--> D126 in metal bond and C50 concentration																											
	Tools > 50 mm in diameter	D107 <--> D151 in metal bond and C50 concentration																																
	Bond	Application																																
	BZ486	Metal bond for grinding non-silicate glass																																
	BZ335	Metal bond for grinding silicate glass																																
	BZ536-24	Metal bond for grinding quartz glass																																
	BZ366	Metal bond for grinding glass ceramics																																
	Metal bond																																	
	Diamond grit	D15A – D20A and C35 concentration																																
	Bond	BZ355 (standard) BZ536 (freer cutting)																																
	Resin bond																																	
	Diamond grit	D15A – D20B and C100 concentration																																
	Bond	W+3083T-23 (standard) K+777R (freer cutting)																																
	6																																	
	7																																	
	8	2	4-6-10																															
	9																																	
	10																																	
11																																		
12																																		
12,5	2,5	4-6-10																																
14																																		
16																																		
17																																		
18																																		
19																																		
20	3	4-6-10																																
22																																		
25																																		
28																																		
30																																		
32																																		
35																																		
36	4	4-6-10																																
40																																		
45																																		
50																																		
50																																		
55																																		
65																																		
60																																		
63																																		

Ordering designation for diamond generating tools for curved surfaces

Shape	D	W	X	T-X	A	Guide to finding the right specification
2F2	70	4	4-6-10	T-X = Please state length of body when ordering; if no length is stated, standard length will be supplied according to machine type	A = Please state machine connection when ordering; see tables on pages 18-29	Please refer to page 15
	71					
	75					
	80					
	90					
	100	5	4-6-10			
	110					
	125					
	140					
	160					
	180					
	200					
	225					
	240					
	250					

Other versions available on enquiry

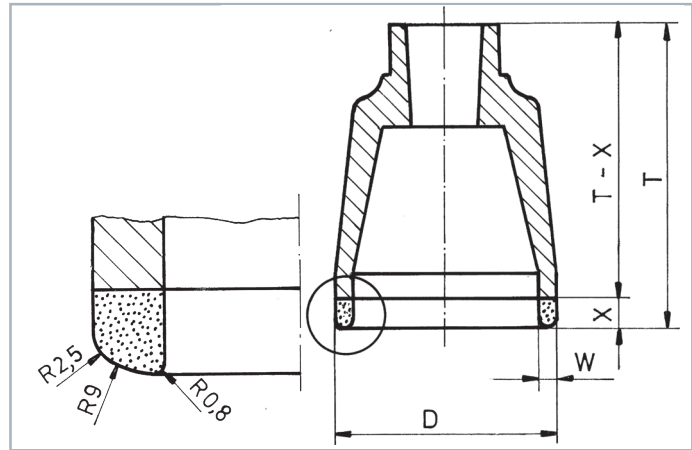




**Sintered metal-bond diamond generating tools for grinding flat surfaces**

**Geometry**

WINTER: 04B  
FEPA: 2M2  
DIN: 58741



**Guide to find the right specification**

Selecting your wheel:

1. Please first select the shape, diameter, rim width and abrasive layer depth from the table below.
2. Next determine the length of body required (this is the overall length minus the abrasive layer depth)
3. We have provided an overview table on pages 18-29 to help you determine the machine connection.
4. Then select the grit size, concentration and bond you require. The table below will also help you with this.

**Ordering example**

Shape	Diameter D	Rim width W	Usable layer depth X	Length of body T-X	Machine connection	Diamond grit size	Bond	Concentration
04B	50	4	10	50	L2	D126	BZ536-24	C50

Ordering designation for diamond generating tools for flat surfaces									
Shape	D	W	X	T-X	A	Grit size	Bond	Concentration	Remarks
04B	40	5	4-6-10	T-X = Please state length of body when ordering; if no length is stated, standard length will be supplied according to machine type	A = Please state machine connection when ordering; see tables on pages 18-29	<b>Rough grinding</b>			
	45					<b>Tool size</b>	<b>Diamond grit</b>		
	55					Tools ≤ 50 mm in diameter	D76 <--> D126 in metal bond and C50 concentration		
	60					Tools > 50 mm in diameter	D107 <--> D151 in metal bond and C50 concentration		
	65					<b>Bond</b>	<b>Application</b>		
	75					BZ560	Metal bond for grinding optical glass		
	85					BZ536-24	Metal bond for grinding quartz glass		
	105					<b>Fine grinding</b>			
	125					<b>Bond</b>	<b>Diamond grit</b>		
155	BZ335	D25 <--> D54 in metal bond and C40 concentration							

Other versions available on enquiry

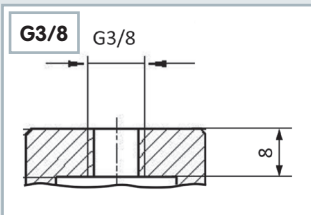
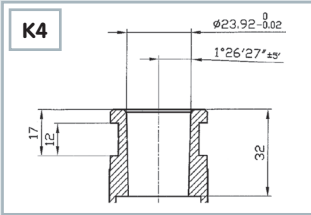
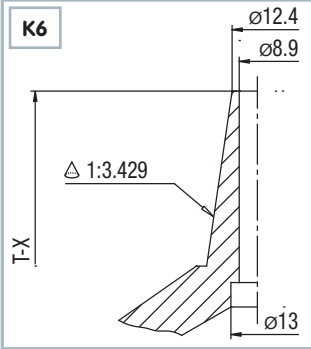
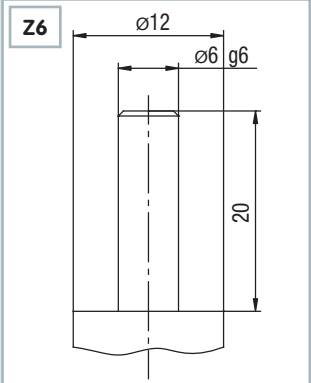
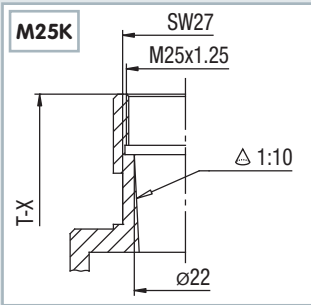
# Machine connections and body lengths for generating tools

T-X: Body length (standard lengths as shown in table; other lengths can be produced at customer's request)

A: Machine connection; please state when ordering

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
AUTOFLOW	200	All	62	K8	
AUTOFLOW	Toric generating: Supermatic MK3 Hyline Radmaster	86 or 92	50	M25K	
AUTOFLOW	AT1	40-120	70	K11	

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
BOTHNER	B 15/60 B 25	All	10-160 10-63	M35K	
BOTHNER	B 15/80 B 16 B 22/350 B 26 B 27 B 29	4-160 80-315 63-200 10-63 10-63 40-140	all	M35K M35K M35K M35K / M22K M35K / M22K M35K / M22K	
CMV	100 130 for spherical surfaces	40-80	26	M30K	

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
CMV	For bevels	30	all	G3/8	
CMV	For toric surfaces	36,5 83	62	K4	
COBURN	Manumatic 112 AW for toric surfaces	All	80	K6	
COMES DAMA	Genmatic Gentronic	23	30	Z6	
COMES DAMA	Genmatic Gentronic TSA	30 - 47	50	M25K	

WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
COMES DAMA	TGM TGA	80	16	L6	
COMES DAMA	FS100 Mikro FS100	≤100	50	L1	
COMES DAMA	FSA80 FSA100 FSK200	≤ 80 ≤ 100 ≤ 200	60	KM16	
COMES DAMA	≤ 100 ≤ 200	≤ 25	60 85	K3 K9	
Galli	G313	all	all		

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
Jingbor	For spherical surfaces	≤70	all	G53/64	
JINGBOR	For toric surfaces	All	All	M25K	
JINGBOR	for toric surfaces	All	All	W25K2	
OPTIBEL	MD/MDM MC/MCM including for toric surfaces	All	50	M25K	
OPTIBEL	GMD MTA including for toric surfaces	All	33	W15K	

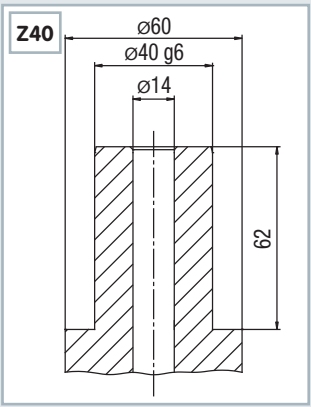
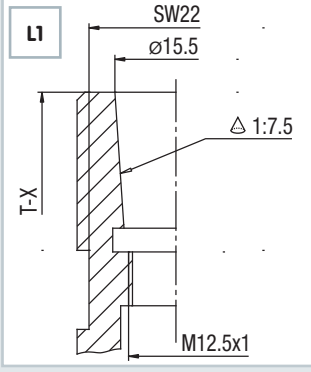
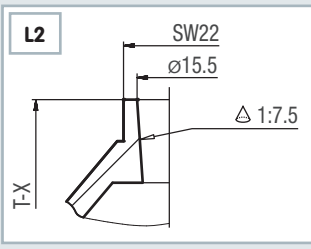
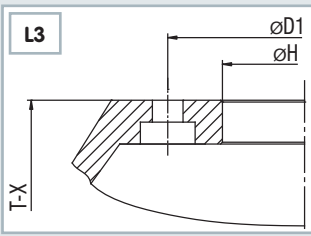
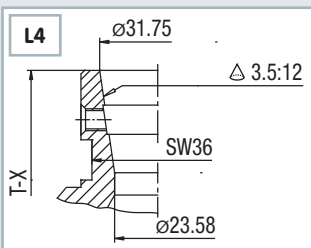
WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
OPTOTECH	SM20 CNC SM30 Digital SM40 CNC	3-28	34	Z6	
OPTOTECH	SM20 CNC SM40 CNC	3-32	44	Z12	
OPTOTECH	SM50 CNC SM100 CNC	5-140	89	Z25	

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
OPTOTECH	SM200 CNC SM500 CNC	63-250	121	Z40	
SATISLOH	RF1	≤ 25	50	L1	
SATISLOH	RF1	25-60	50	L2	
SATISLOH	RF2	60-125 140 160 180-200 225-250 280	54 59 64 69 79 89	L3	
SATISLOH	RXT Toromatic CNC (for toric surfaces) RFSA SPM100	60-100 16-80 16-80 16-80	66	L4	

WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact



Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
SATISLOH	SPM35	16-30	36	L5	
SATISLOH	RF1S RF3 UFM	50	50	M22K	
SATISLOH	UFMS	150	54 59 64 69 79 89	L3	<p>H=35mm for <math>\varnothing \leq 100\text{mm}</math> H=45mm for <math>\varnothing \geq 100\text{mm}</math></p>
SATISLOH	SPM200 SPM300	30-140 60-180	39 49	$\varnothing \leq 50$ L4 $\varnothing \geq 50$ L6	 

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
SATISLOH	SPM/SPS 20 SPM/SPS 25	3-25	26	Z6	
SATISLOH	SLT	5-35	44	Z12	
SATISLOH	SPM 120/SLT	16-100	70-80	Z25	

WINTER  
Facts

Precision  
Optics

Ophthalmics

Service  
Glossary  
Contact

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
SATISLOH	SPM 120/SLT	63-250	117	Z40	
SCHNEIDER	SLG 50	6,3-40	44	Z12	
SCHNEIDER	SLG 100 SLG 120	10-12,5 14-20 22-28 30-50 63-71 80-125	70 78 80 85 95 96	Z25	

Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
SCHNEIDER	SLG 120	10-40	20	M14	
SCHNEIDER	SLG 120	10-71	30-45	M20	
SCHNEIDER	SLG 200 SLG 300	50-200	116	Z40	
SCHNEIDER	SLG 301	80-250	32-52	MK25K	

WINTER Facts

Precision Optics

Ophthalmics

Service Glossary Contact

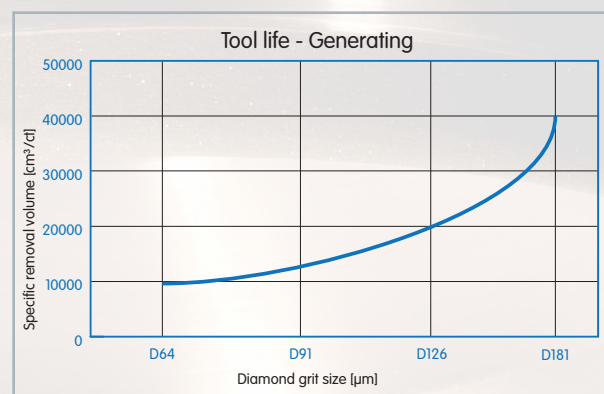
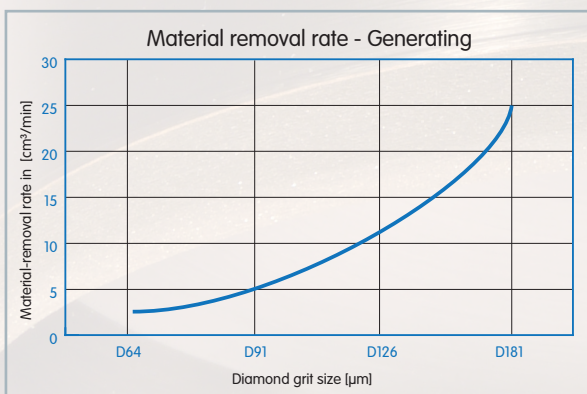
Machine manufacturer	Machine model	Range of cup wheel diameters	Standard body length	Machine connection	Drawing of machine connection
		D	T-X	A	
SIKO	For spherical surfaces	All	All	W25K	
SIKO	For spherical surfaces	All	All	H24	
SHURON	Continental for toric surfaces	60 - 150	80	K7	

# Technical notes on the use of generating tools

## Geometries

WINTER: 2F2 / 04B  
FEPA: 2F2 / 2M2

Recommendations		2F2	04B
		Spherical and toric surfaces	Flat surfaces
Tool diameter D	mm	$(0,55 \dots 0,75) \cdot d_w$ ( $d_w$ = workpiece diameter)	40...155
Grit size	FEPA	D20B..D91..D151	D46...D151
Bond		BZ335 (standard) BZ303 (freer cutting) BZ486 (higher wear resistance)	BZ335 (standard) BZ536 (freer cutting)
Concentration	C100 = 4,4 ct/cm <sup>3</sup>	(C25)...C40...C50...(C75,C90)	C50...C75
Cutting speed	m/s	20...30...(50)	20...30...(50)
Axial infeed	mm	Coarse grinding: 1/3 of grit size	Full depth
		Finish grinding: 1/10 of grit size	
Feed rate	mm/min	0,15...5,0 depending on $n_w$	-
Material removal rate	cm <sup>3</sup> /min	Coarse grinding: 10...100	25...100
		Fine grinding: 5...10	
RPM of workpiece $n_w$	1/min	60...240	-
Results			
Grinding ratio	cm <sup>3</sup> /cm <sup>3</sup>	5000-25000, depending on specification	
Specific removal volume	cm <sup>3</sup> /ct	10000...25000	
Surface roughness $R_z$	$\mu\text{m}$	4...15	6...15
		depending on grit size, cutting speed, overlap and spark-out time	



The above graph shows the average material removal rate (volume abraded per unit of time) of diamond grinding tools when used for grinding optical glass. The graph is a plot of the material removal rate in cm<sup>3</sup>/min against the FEPA grit size.

The above graph shows the average lifetime of diamond grinding tools. The graph is a plot of the volume of glass abraded in cm<sup>3</sup>/carat of diamond against the FEPA grit size.

# Diamond pellets for fine grinding

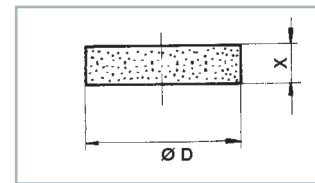
Pellets are metal-bond diamond tools for fine grinding, in the form of cylinders ranging in diameter from 4 mm to 10 mm. They have to be cemented or brazed to supports before they are used. Their surface geometry has to be adjusted to the desired shape and tolerances by face grinding.

We recommend the FS and BZ versions of WINTER 06B pellets for the economical high-precision production of components of optical glass.



## Geometry

WINTER: 06B  
DIN: 58745

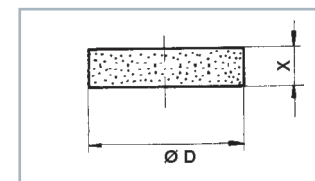


### Fully permeated 06B pellets, FS version Ex-stock range for standard optical glass

Version	Shape	D	X	Grit size	Order number
FS	06B	10	3	D7	66260131089 <sup>1)</sup>
FS	06B	10	3	D15A	66260132490 <sup>1)</sup>
FS	06B	10	3	D15B	66260133134 <sup>1)</sup>
FS	06B	10	3	D15C	66260132527 <sup>1)</sup>
FS	06B	10	3	D20B	66260130502 <sup>1)</sup>

<sup>1)</sup> Available ex-stock

WINTER can supply a wide range of other pellets for special applications in the field of precision optics. The exact specifications are determined by the nature of the application and by the material.

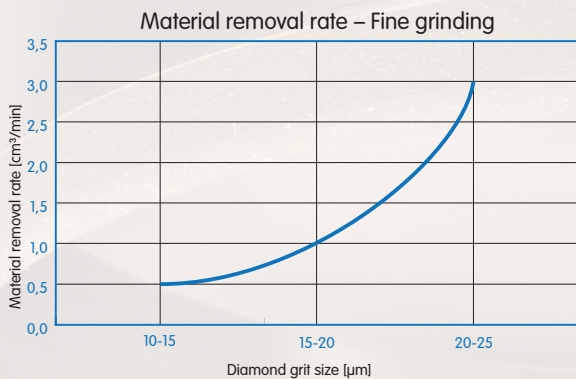


### Fully permeated 06B pellets, BZ version Range for special applications in precision optics

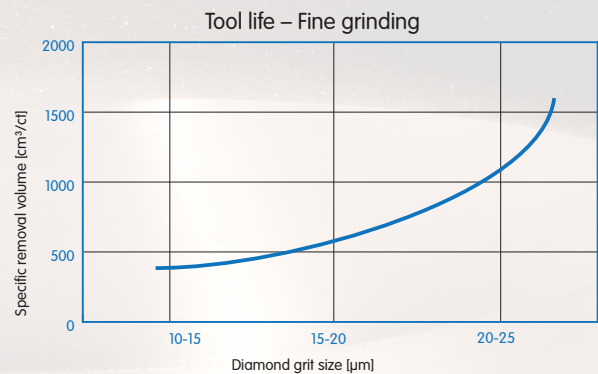
Version	Shape	D	X	Grit size
BZ	06B	4	2	D7 - D151
BZ	06B	5	2	D7 - D151
BZ	06B	6	2	D7 - D151
BZ	06B	6	3	D7 - D151
BZ	06B	8	2	D7 - D151
BZ	06B	8	3	D7 - D151
BZ	06B	10	2	D7 - D151
BZ	06B	10	3	D7 - D151

# Technical notes on the use of pellets

Recommendations on the use of WINTER 06B pellets for fine grinding							Remarks
Lens diameter	mm	20	40	60	80	≥120	
Pellet diameter	mm	4	5	6	8	10	When in doubt, select the smaller pellet diameter
Grit size	FEPA	Precision optics D7...D20B					Finer grit sizes reduces the time for subsequent polishing, which improves the geometric accuracy of the workpiece
		Ophthalmic optics: D7...D15C					
Bond		Precision optics: FS499 and BZ488; ophthalmic optics: FS499 and X-104					
Concentration	100 = 4,4 ct/cm <sup>3</sup>	(C23) ... C35 ... (C45)					
Application data							
Pellet coverage	%	35-40	25-30		15-20		The tool configuration (number and position of pellets) affects the grinding rate and the accuracy of the shape.
Lens radius	mm	<85	<150		>150		
RPM of workpiece	1/min	200...1000					Doubling the speed increases the grinding rate by more than 50%
Cutting speed	m/s	4...10					
Applied pressure	N/cm <sup>2</sup>	15...20					
Rate of infeed	mm/min	D7	D15A	D15B	D15C		Depends on workpiece rotation speed and tool specification
		0,07	0,15	0,45	0,70		
Material removal rate	cm <sup>3</sup> /min	0,1	0,5...1,0	1,5...3,0	2,5...4,0		
Results							
Specific removal volume	cm <sup>3</sup> /ct	155...200	200...300	1000...1500	2000...2500		Cannot be improved to any major degree by machine settings. Depends on workpiece rotation speed and tool specification.
Surface roughness R <sub>z</sub>	µm	2...3	2...3	3...4	5...7		



The above graph shows the average material removal rate (volume abraded per unit of time) of pellets. The graph is a plot of the stock-removal rate in cm<sup>3</sup>/min against the FEPA grit size.



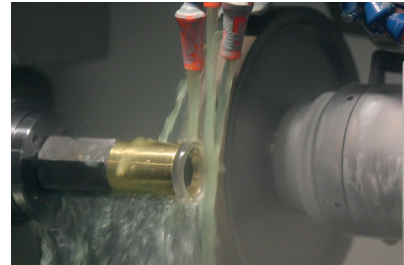
The above graph shows the average life of pellets. The graph is a plot of the volume of glass abraded in cm<sup>3</sup>/carat against the FEPA grit size.



# Centering

Grinding the edges of workpieces in the final stages of lens production is done by centering. This is a particular type of grinding which is comparable to external cylindrical grinding in the grinding of metal parts. In the centering process:

- optical and geometrical centers are aligned
- the wedge angle error is removed
- the workpiece is ground to the final diameter
- a final surface roughness is obtained on the lens edge



## Centering wheels

Diamond-coated centering and profiling wheels are intended for use on centering machines which allow close dimensional, shape and positional tolerances to be obtained on the workpieces. The WINTER wheels shapes 02C (p. 34), 1Y1 (p. 38) and 700 (p. 39) are used as one piece tools, whereas the shapes 02D (p. 35) and 02E (p. 36) are combined to multi piece centering wheels called 02B (p. 37).

### Guide to finding the right specification

Selecting your wheel:

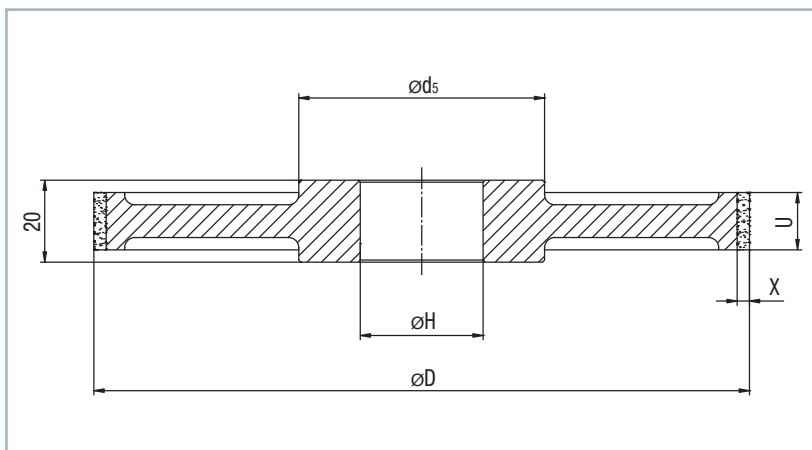
1. Please first select the shape, diameter (D), width (U) and depth (X).
2. Next determine the bore diameter (depends on the machine) and grit size which are suitable for your application and requirements.
3. Then select the bond and concentration. On the following pages the most widely used combinations are shown, but other specifications are of course available.

Please keep in mind that the grinding parameters are at least as important as the grinding tool to achieve the desired results. You will find a checklist on page 49 or on our web site [www.winter-superabrasives.com](http://www.winter-superabrasives.com) as an interactive pdf.

## Centering wheels without adapting collar

### Geometry

WINTER: 02C  
 DIN: 58742 type D  
 (Bevelling wheels shape 02E cannot be fitted)



### Ordering example – version without adapting collar

Shape	Diameter D	Width of layer U	Usable layer depth X	Bore H	Diamond grit size	Bond	Concentration
02C	100	10	2	20	D46	BZ335	C90

#### Ordering designation for centering wheels 02C

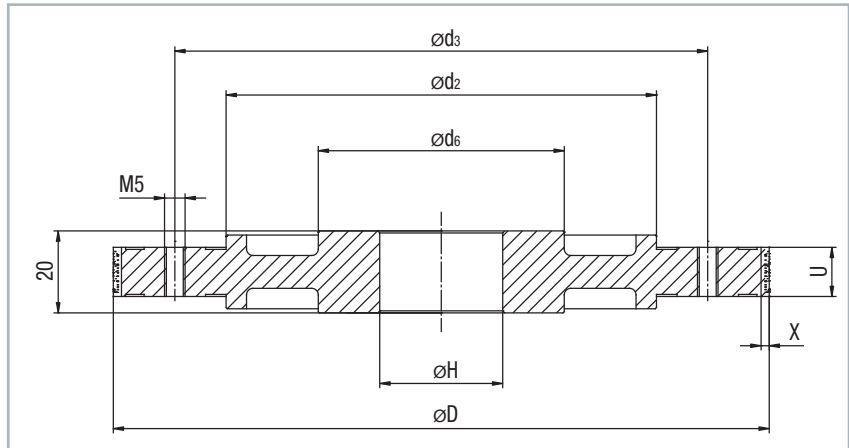
Shape	D	U	X	H	Grit size	Bond	Concentration	Remarks
02C	100	4	1 or 2	20	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C90	$D_5 = 40\text{mm}$
		6,3						
		8						
		10						
	160	5	30	$D_5 = 60\text{mm}$				
		6,3						
		8						
		10						
		12,5						
		14						
		15						
		16						
		18						
		20						
		25						
		31,5						

Other versions available on enquiry

**Centering wheels with adapting collar**

**Geometry**

WINTER: 02D  
DIN: 58742 type E  
(Bevelling wheels type 02E can be fitted)



**Ordering example – version with adapting collar**

Shape	Diameter D	Width of layer U	Usable layer depth X	Bore H	Diamond grit size	Bond	Concentration
02D	160	12,5	1	30	D46	BZ335	C90

Ordering designation for centering wheels 02D								Remarks		
Shape	D	U	X	H	Grit size	Bond	Concentration	$d_2$	$d_3$	$d_6$
02D	100	4	1 or 2	20	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C90	65	80	40
		6,3								
		8								
		10								
	160	5		30				105	130	60
		6,3								
		8								
		10								
		12,5								
		14								
		15								
		16								
		18								
		20								
		25								
31,5										

Other versions available on enquiry

# Bevelling wheels

Bevelling (also known as faceting) is usually combined with centering. The finished surfaces may cover several functions:

- providing protection against chipping
- serving as a mating surface for assembly purposes
- limiting the effective diameter of a lens
- increasing the durability of coatings

## Guide for finding the right specification for shape 02E bevelling wheels

Selecting your wheel:

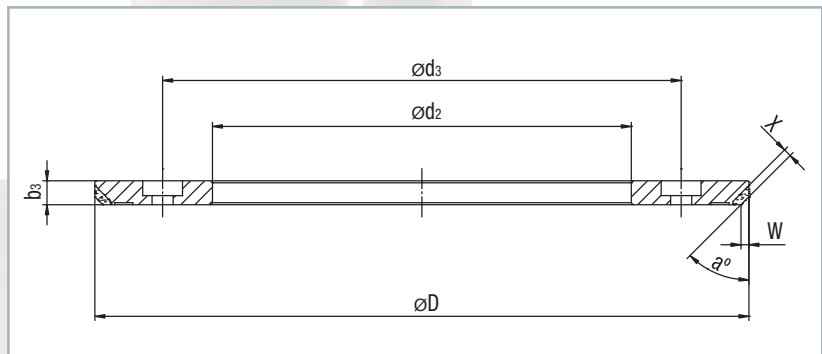
1. Please first decide on the diameter required ( $\varnothing D$  of shape 02E =  $\varnothing D$  of shape 02D +  $2x W$  of shape 02E).
2. Then define the usable layer depth  $X$ .
3. Next determine the angle required, measured relative to the wheel axis.
4. Then select the grit size, bond and concentration. On the following pages the most widely used combinations are shown, but other sizes and specifications are of course available.

Please keep in mind that the grinding parameters are at least as important as the grinding tool to achieve the desired results. You will find a checklist on page 49 or on our web site [www.winter-superabrasives.com](http://www.winter-superabrasives.com) as an interactive pdf.

## Geometry

WINTER: 02E  
DIN: 58742 type F

fits 02D type centering wheel with adapting collar according to DIN58742 type E



## Ordering example

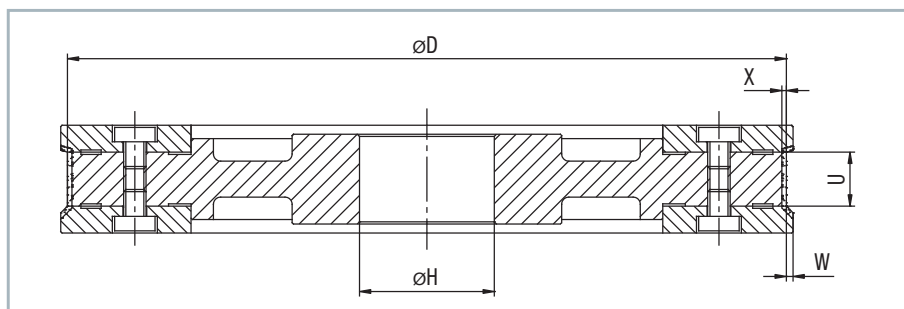
Shape	Diameter D	Width of layer U	Usable layer depth X	Angle $V^\circ$	Diamond grit size	Bond	Concentration
02E	103	1,5	1	60°	D20A	BZ444	C135

Ordering designation for bevelling wheels 02E								Remarks		
Shape	D	W	X	V	Grit size	Bond	Concentration	d <sub>2</sub>	d <sub>3</sub>	b <sub>3</sub>
02E	101	0,5	1 or 2	30-45-60-90	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ444	Recommended concentration: C135	65	80	6
	102	1								
	103	1,5								
	104	2								
	105	2,5								
	106	3								
	161	0,5						105	130	8
	162	1								
	163	1,5								
	164	2								
	165	2,5								
	166	3								
	167	3,5								
	168	4								
	169	4,5								
	170	5								

Other versions available on enquiry

**02B multi piece centering wheel**

The example shown below is a tool set consisting of a centering wheel with an adapting collar shape 02D (DIN 58742, type E), fitted with two faceting wheels shape 02E (DIN 58742, type F). This tool set is supplied assembled and precision balanced.



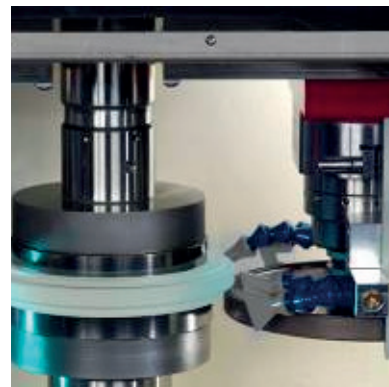
**Ordering example for complete unit 02B-100-8-1-1.5-3M-20**

consisting of 1 piece  
02D-100-8-1-20/D46/BZ335/C90  
and 2 pieces  
02E-103-1.5-1-30°-65/D20A/BZ444/C135

Shape	Diameter D	Width of layer U	Usable layer depth X	Overhang of faceting wheel W	Quantity code	Bore H	Diamond grit size	Bond	Concentration
02B	100	8	1	1,5	3M	20	D20A	BZ444	C135
							D46	BZ335	C90
							D20A	BZ444	C135

# One-piece centering/bevelling wheels

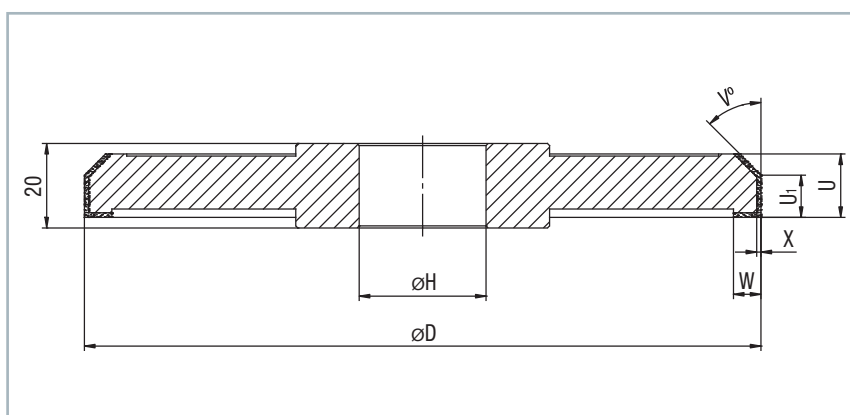
On CNC-machines, the centering with or without recesses can be combined with the grinding of safety or functional bevels. For this, one piece centering wheels, e.g. DIN 58742 type H, can be used. These precision tools are supplied to high accuracy and precision balanced for your type of machine.



## One piece centering wheels

### Geometry

WINTER: 1Y1  
 FEPA: 1Y1  
 DIN: 58742 type H



## Ordering example

Shape	Diameter D	Width of layer U	Width of layer U1	Layer depth X	Width of layer W (face side)	Angle V°	Bore H	Diamond grit size	Bond	Concentration
1Y1	160	20	15	1	6	45°	30	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135

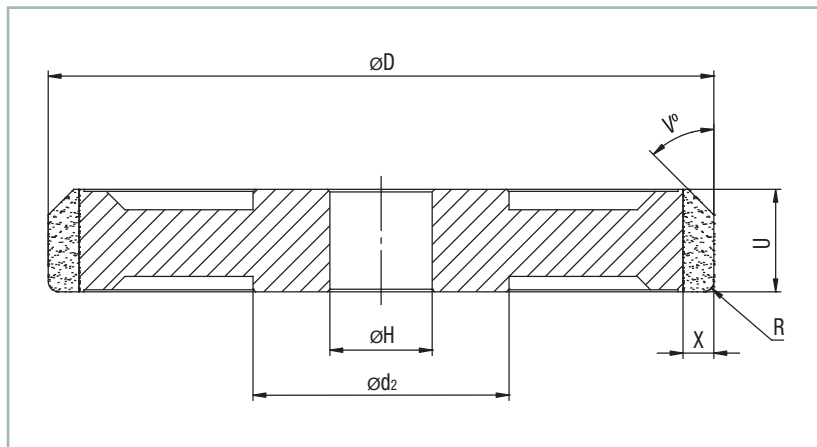
### Ordering designation for one piece centering/bevelling wheels 1Y1

Shape	D	U	U1	X	W	V°	H	Grit size	Bond	Concentration	Remarks
1AY1	100	15	10	1-2	6	45	20	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet
1AY1	100	20	15	1-2	6	45	20	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet
1AY1	100	25	20	1-2	6	45	20	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet

Ordering designation for one piece centering/bevelling wheels 1Y1											
Shape	D	U	U1	X	W	V°	H	Grit size	Bond	Concentration	Remarks
1AY1	160	15	10	1-2	6	45	30	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet
1AY1	160	20	15	1-2	6	45	30	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet
1AY1	160	25	20	1	6	45	30	D20A D64 D20A	BZ335 BZ335 BZ335	C135 C90 C135	45° facet Cylindrical part 90° facet

**One piece centering/bevelling wheel**  
**Geometry**

WINTER: 700  
DIN: 58742 Type H



**Order example**

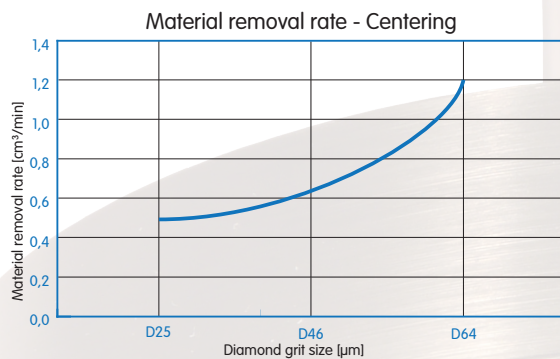
Shape	Diameter D	Width of layer U	Usable layer depth X	Bore H	Diamond grit size	Bond	Concentration
700	100	10	2,5	20	D46	BZ335	C90

Ordering designation for one piece centering/bevelling wheels 700							
Shape	D	U	X	H	Grit size	Bond	Concentration
700	100	10	2,5 or 4	Depends on machine. Please state when ordering.	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C90
		15					
	120	10					
		15					
	140	10					
		15					
	180	10					
		15					

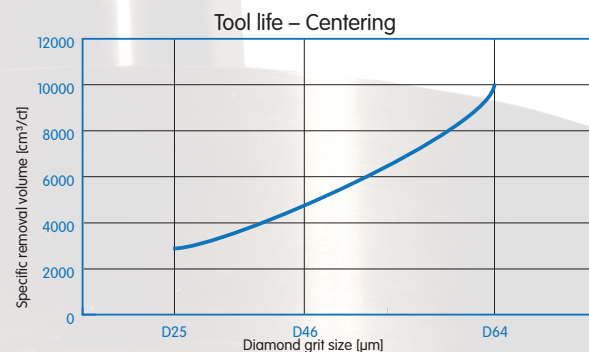
Other versions available on enquiry

# Technical notes on centering

Recommendations for the use of centering/bevelling wheels			Centering wheel	Bevelling wheel
			02C-02D	02E
Diameter of grinding wheel	D	mm	100...160	101...185
Width of abrasive layer	U/W	mm	4...31,5	0,5...12,5
Abrasive layer depth	X	mm	1 or 2	1 or 2
Grit size	D	FEPA	D46 - D91	D20A - D25
Bond	BZ		BZ335 (standard) BZ444 (higher wear resistance)	BZ444
Concentration	C	100 = 4,4 ct/cm <sup>3</sup>	C90	C135
Grinding speed	v <sub>c</sub>	m/s	20...30	20...30
Infeed	a <sub>e</sub>	mm	Continuous	Continuous
Material removal rate	Q <sub>w</sub>	mm <sup>3</sup> /min	0,5...1	0,01...0,5
Grinding ratio	G	mm <sup>3</sup> /mm <sup>3</sup>	2000...10000	1000...5000
Specific removal volume	V <sub>w</sub>	cm <sup>3</sup> /ct	3000...10000	3000...10000
Surface roughness	R <sub>z</sub>	μm	≤ 5	≤ 5
Grinding time	t <sub>p</sub>	min	4...10	4...10



The above graph shows the average material removal rate (volume abraded per unit of time) for centering. The graph is a plot of the stock-removal rate in cm<sup>3</sup>/min against the FEPA grit size.



The above graph shows the average life for centering. The graph is a plot of the volume of glass abraded in cm<sup>3</sup>/carat against the FEPA grit size.



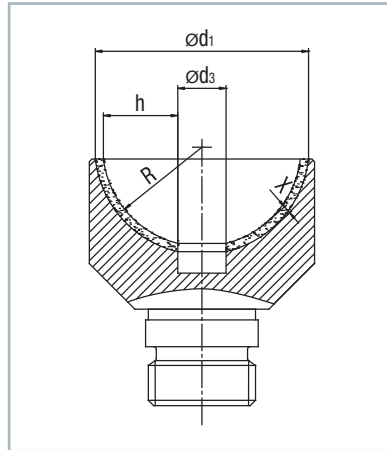
# Edge grinding

These grinding tools are used in the production of optical components for grinding edges and thus for producing facets which are not subject to any special tolerances – preferably on optical lenses and similar optical components. These faceting tools can be used as manual tools or on machines.

## Chamfering tools

### Geometry

WINTER: 05B  
DIN: 58723 type A



### Ordering example

Shape	Diameter D	Width of layer B	Usable layer depth X	Radius R	Connection	Diamond grit size	Bond	Concentration
05B	48,5	16,75	1	25	M20	D15	BZ335	C90 E

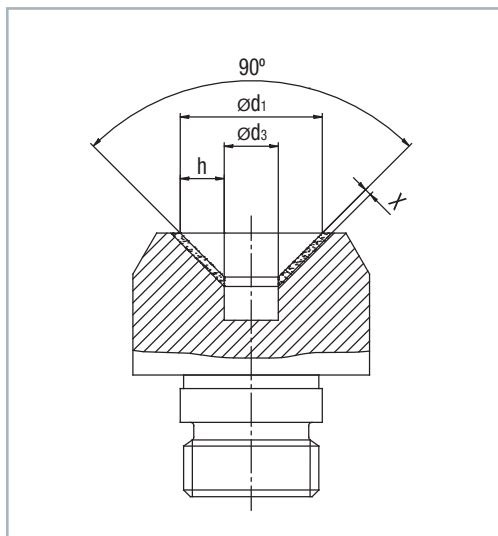
### Ordering designation for faceting tools 05B

Shape	D	B	X	R	Connection	Diamond grit size	Bond	Concentration
05B	6	2,5	1	2	Depends on machine. Please state when ordering.	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C75
	7	2,75		2,5				
	8,3	3,15		3,15				
	10	3,75		4				
	12	4,5		5				
	14,5	5,5		6,25				
	18	6,75		8				
	22	8		1 or 2				
	27	9,75	12,5					
	34	12,25	16					
	42	15	20					
	52	18,5	25					
	65	23,5	31,5					
	82	29	40					
	104	36	2					
	129	45		62,5				
	164	57		80				
	204	71		100				

Other versions available on enquiry

## Geometry

WINTER: 05D  
DIN: 58723 tpye B



## Ordering example

Shape	Diameter d1	Width of layer	Usable layer depth	Angle	Connection	Diamond grit size	Bond	Concentration
05D	50	17	1	90	M20	D15	BZ335	C75

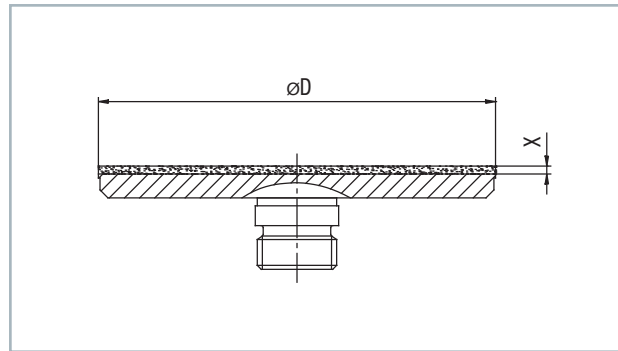
### Ordering designation for faceting tools 05D

Shape	d <sub>1</sub>	B	X	Angle	Connec- tion	Diamond grit size	Bond	Concentration
05D	12,5	5,25	1 or 2	90	Depends on machine. Please state when ordering.	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C75
	25	8,5						
	50	17						
	100	30	2					
	200	60						

Other versions available on enquiry

**Geometry**

WINTER: 222  
DIN: 58723 type C



**Ordering example**

Shape	Diameter D	Width of layer W	Usable layer thickness X	Connection	Diamond grit size	Bond	Concentration
222	150	65	2	M18	D15C	BZ335	C50

**Ordering designation for faceting tools 222**

Shape	D	d3	$W = (D - d3)/2$	X	Connection	Diamond grit size	Bond	Concentration
222	40	12	14	1 or 2	Depends on machine. Please state when ordering.	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335	Recommended concentration: C100
	50	15	17,5					
	63	18	22,5					
	75	20	27,5					
	80	24	28					
	100	30	35	2				
	125	37	44					
	150	40	55					
	160	48	56					
	175	50	62,5					
200	60	70						

Other versions available on enquiry

# Cutting

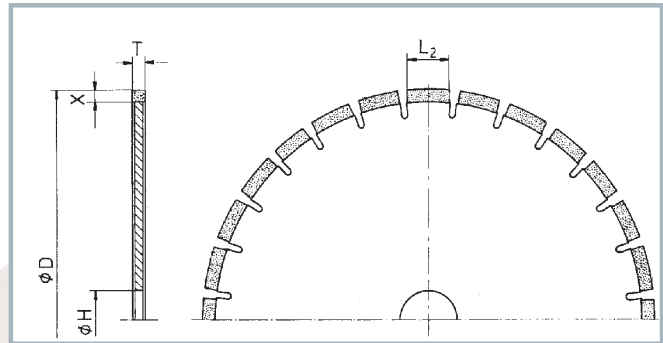
For cutting large blocks of optical glass, predominantly segmented cut-off wheels (1A1RSS shape) are used. The slots between the segments improve coolant supply and swarf removal from the cutting zone. For cutting small parts from thin slabs of optical glass, we recommend continuous rim cutting wheels (1A1R type). The maximum outside diameter and bore of cutting wheels depend on the machine being used. We offer cut-off wheels with standardized outside diameters, with the bore diameter being adapted to your needs.

## Diamond cut-off wheels

### Segmented cutting wheels for optical glass

#### Geometry

WINTER: 1A1RSS  
DIN: 1A1RSS



#### Ordering example

Shape	Diameter D	Seg. Length	Layer width T	Usable layer thickness X	Core thickness E	No. Of Segments	Bore Diameter H	Specification
1A1RSSOG-E	450	40	2	5	1,3	28	30	BZ339 A04 K1 20

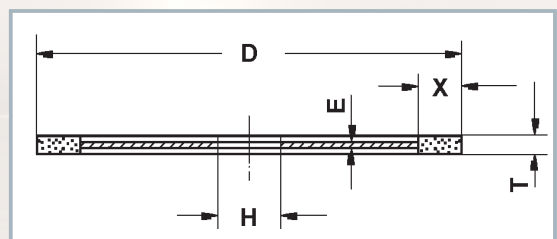
Ordering designation for segmented cut-off wheels								
Shape	D	Segment length	T	X	E	Number of segments	H	Specification
1A1RSS-OG-E	300	40	2	5	1,3	21	Depends on machine. Please state when ordering	BZ339 A04 K1 20
	400		1,8			28		
	450		2			28		
	500		2			36		
	600		2,6		2,0	42		
	700		3,2			50		

Other versions available on enquiry

### Continuous rim cutting wheel for optical glass

#### Geometry

WINTER: 1A1R  
DIN: 1A1R



**Ordering example for metal bond diamond cutting wheels**

Shape	Diameter D	Layer width T	Usable layer depth X	Core thickness E	Bore H	Diamond grit size	Bond	Concentration
1A1R	150	0,6	5	0,5	20	D107	BZ309	C23

**Order designation for continuous rim version in metal bond**

Shape	D	T	X	E	H	Grit size	Bond	Concentration
1A1R	150	0,6	5	0,5	Depends on machine, please state when ordering	Please state the grit size appropriate to your application and requirements	Recommended WINTER bond: BZ335 for flat glass; BZ309 for optical glass	Recommended Concentrations: C16, C19, C23, C45
		0,8		0,6				
		1,0		0,8				
		1,2		0,9				
		1,5		1,2				
		1,8		1,5				
		0,8	10	0,6				
		1,0		0,8				
		1,2		1,0				
		1,5		1,3				
	250	5	1,0	0,7				
			1,2	0,8				
			1,5	1,1				
			1,8	1,4				
		10	1,0	0,7				
			1,2	0,8				
			1,5	1,1				
			1,8	1,4				
	300	5	1,2	0,8				
			1,5	1,1				
			1,8	1,4				
		10	1,2	0,8				
			1,5	1,1				
			1,8	1,4				
	400	5	1,5	1,1				
			1,8	1,4				
			2,0	1,6				
		10	1,5	1,1				
1,8			1,4					
2,0			1,6					

Other versions available on enquiry

## Ordering example for resin-bond diamond cutting wheels

Shape	Diameter D	Layer width T	Usable layer depth X	Core thickness E	Bore H	Diamond grit size	Bond	Concentration
1A1R	300	1,7	7	1,4	20	D91	K+888RY	C38

### Order designation for continuous rim version in resin bond (for specially high quality edges)

Shape	D	T	X	E	H	Grit size	Bond	Concentration
1A1R	150	0,6	7	0,5	Depends on machine, please state when ordering	Please state the grit size appropriate for your application and requirements	Recommended WINTER bond: K+888RY	Recommended concentration: C19, C23, C38, C50
		0,8		0,6				
		1,0		0,8				
		1,2		1,0				
		1,5		1,3				
	250	1,0	0,7					
		1,2	0,9					
		1,4	1,1					
		1,7	1,4					
	300	1,2	0,9					
		1,4	1,1					
		1,7	1,4					
		2,3	2,0					

Other versions available on enquiry



# Drilling

The drilling of holes is a particularly challenging task in the optical industry: hard brittle materials such as glass, quartz and ceramics need to be drilled with as little edge chipping as possible. There are a large number of applications, some of them highly specific – ranging from the drilling of fixing holes to core bores through lenses – which call for individual technical solutions and carefully targeted tool designs.

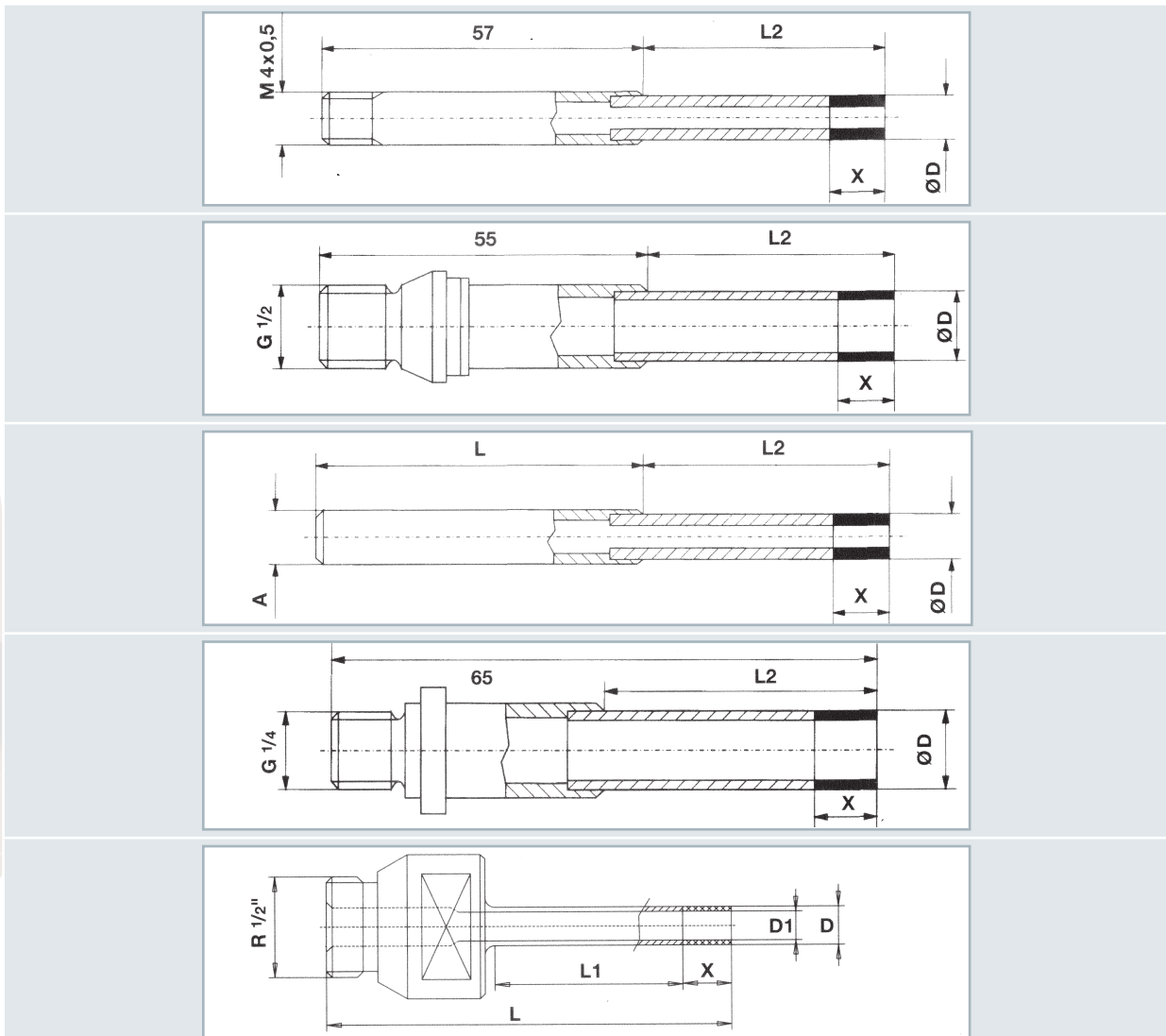


## Diamond core drills

Internally cooled diamond core drills are available in diameters ranging from 0.7 mm to 100 mm. NH drill bits with a multi-layer electroplated bond are suitable for drilling small diameter holes up to 5 mm. For diameters of 4 mm and above diamond core drills with a sintered metal bond (BZ drills) are used. WINTER BZ and NH drills operate with a very low grinding pressure to ensure that only minimal edge chipping is caused at the exit of the bore.

For an individual tool solution, what needs to be stated apart from the diameter are the length of the drill bit and the drill bit connection. We have provided you with a checklist on page 49 for this purpose.

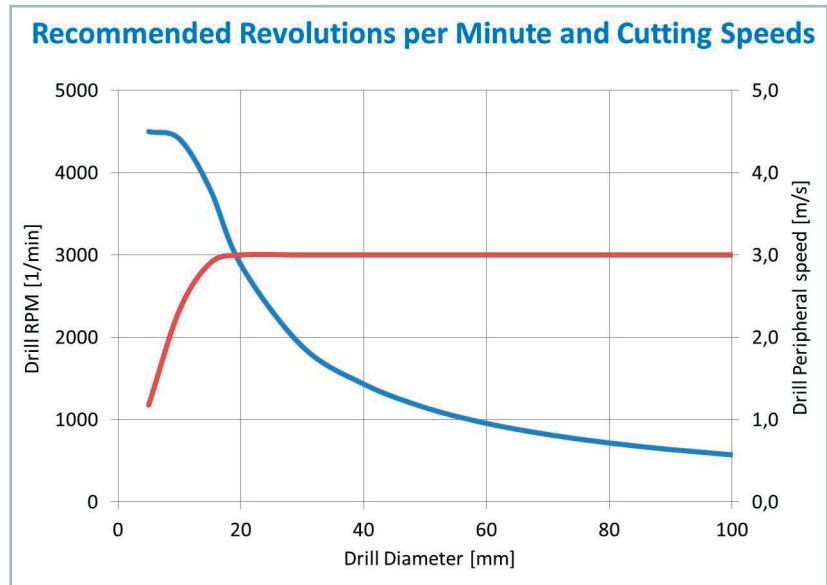
### Examples of different designs of core drills



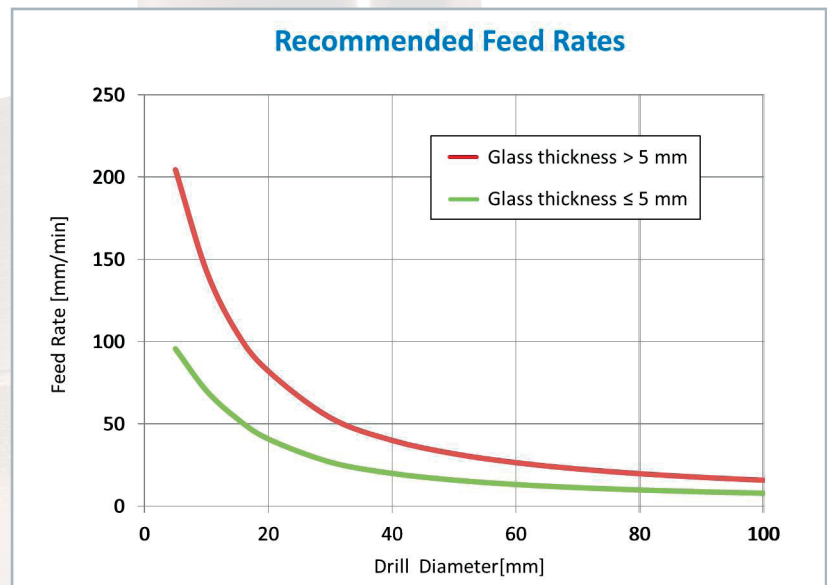
# Technical notes on drilling

Diamond core drills must always be used with internal cooling so that the water travels through the grinding zone and not only provides cooling but also carries the swarf away. Core drills should be sharpened before they are used. For this, we recommend WINTER stone No. 2 or No. 5 – please see the “Accessories” section on page 77 of this catalogue. If the cutting action of the drills diminishes, the sharpening process should be repeated.

The speed of the core drill must be adjusted to suit its diameter. The graph on the right will serve as a guide



The recommended speed of infeed depends on the thickness of the glass: the forces applied rise as the speed of infeed increases and for that reason the speed should be kept low when the glass is thin. It is advisable to increase to full infeed speed only after the initial cut has been made. This will minimise the risk of edge chipping.





# Checklist - Precision Optics

Company \_\_\_\_\_

Telephone No./e-mail address for any questions \_\_\_\_\_

Technical advice for improving results

Quotation

Order

1. Application:

Generating/Surfacing

Centering

Drilling

2. Workpiece material \_\_\_\_\_

3. Machine (this must be stated for generating/surfacing and centering)

3.1 Manufacturer \_\_\_\_\_

3.2 Machine type \_\_\_\_\_

3.3 Coolant \_\_\_\_\_

4. Tool diameter in mm (middle diameter in the case of 2F2 tools) \_\_\_\_\_

5. Grinding wheel width in mm (only for centering) \_\_\_\_\_

6. Total stock removal (mm/Ø) \_\_\_\_\_

7. Diamond grit size (if known) \_\_\_\_\_

8. Only for drills:

8.1 Depth of drilled hole \_\_\_\_\_

8.2 Connection \_\_\_\_\_

Please fill in the above list and send it, with a drawing if possible, to your expert adviser or direct to our Product Management Department at [metal@saint-gobain.com](mailto:metal@saint-gobain.com).

SAINT-GOBAIN Diamantwerkzeuge GmbH  
Schützenwall 13-17, D-22844 Norderstedt, Tel.: +49 (0)40 5258-0, Fax +49 (0)40 5258-215  
[www.winter-superabrasives.com](http://www.winter-superabrasives.com)

# Ophthalmics



Ophthalmics covers the range of all lens types which assist one of the most important senses: vision.

For 150 years now, WINTER has been working in the field of ophthalmics with a close customer focus and a concentration on high precision and economy. This has given us a wide range of experience in all grinding applications that are called for whether you are;

- grinding organic or mineral glass
- producing spherical, aspherical, toric or multifocal lenses
- grinding surfaces or edges
- carrying out coarse grinding, fine grinding or polishing operations

WINTER high-performance tools are your best choice

## **52 Points to remember**

### **54 Surface grinding of mineral glass**

- 54 Generating tools (cup wheels)
- 57 Peripheral grinding wheels
- 58 Fine grinding pellets
- 59 Fine grinding diamond pads
- 60 Special tools

### **62 Surface machining of organic lenses**

- 62 Generating tools
- 63 PCD milling tools
- 68 MCD turning tools

### **71 Edge grinding**

- 72 Rough edging
- 73 Fine bevelling
- 74 Flat or bevel polishing
- 75 Counterchamfering & Grooving
- 76 Edging with PCD tools

### **77 Accessories**

- 78 Cleaning and sharpening stones
- 79 Adhesive Edging Pads

### **80 Checklist - Ophthalmics**



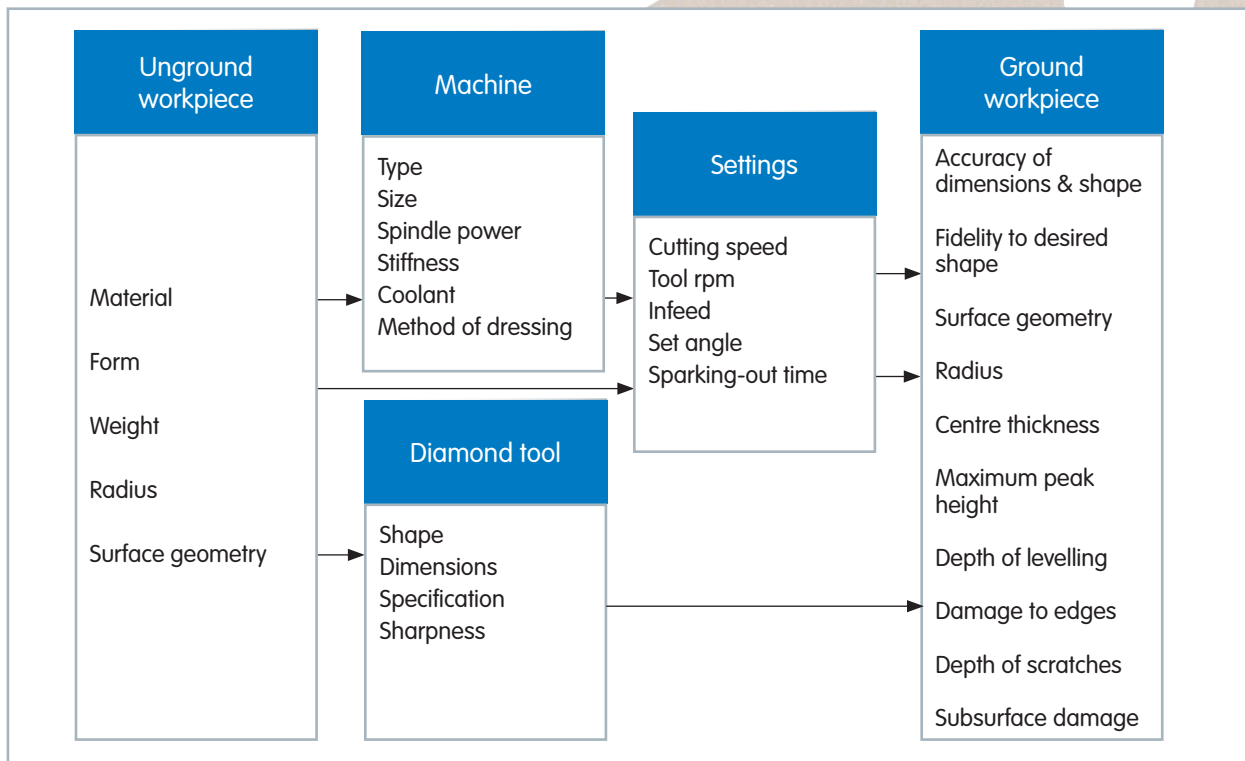
# Points to remember

There are different types of lenses which are used for sunglasses and spectacles and other vision aids;

- different raw materials: mineral, CR39, high index, polycarbonate, Trivex, etc.
- different colours: transparent (clear), tinted, phototropic (brown or grey).
- different refractive indexes: technical innovations are continually raising the refractive indexes of lenses. The higher the index, the thinner the lens.
- different coatings: Spectacle lenses are often coated to produce non-reflecting, coloured, water-repellent and/or hardened lenses.

You will find a table of grit sizes in the glossary at the end of this catalogue. There is no FEPA standard for fine grit sizes so the table at the bottom of the page gives the exact grit sizes indicated by the WINTER designations.

## Factors affecting the results of grinding operations



## Fine grit sizes

Diamond designation by mean grit size	WINTER diamond designation	Main grit size diameter (µm)
M50	D25	40 / 60
M45		36 / 54
	D20C	34 / 45
M35		30 / 40
M30	D20B	25 / 37

Points to remember

WINTER Facts  
Precision Optics  
Ophthalmics  
Service Glossary Contact

Diamond designation by mean grit size	WINTER diamond designation	Main grit size diameter (µm)
M25	D20A	20 / 30
M20	D15C	15 / 25
	D15	8 / 25
M22		15 / 30
M20		15 / 25
M18		15 / 20
M15	D15B	10 / 20
M12	D15A	8 / 15
M9		6 / 12
M7	D7	5 / 10
M6		4 / 8
M5		3 / 6
M3	D3	2 / 5



WINTER  
Facts

Precision  
Optics

Ophthalmics

Service  
Glossary  
Contact

# Surface grinding of mineral glass

The first step in the production of spectacle lenses is surface grinding. The process used for generating concave and convex lens surfaces consists of three parts; coarse grinding, fine grinding and polishing. In this process the lens surface is first given the required geometrical shape (dioptrics), then smoothed and finally polished.

WINTER can supply an extensive selection of tools for coarse and fine grinding of mineral glass. The geometry of the tools and how they operate is determined by the design of the machine. On the following pages you will find a selection of the usual tool designs, however specific customer requirements can be made upon request.

## Generating tools (cup wheels)

WINTER metal-bond diamond cup wheels are tools used for the coarse grinding of spherical and toric surfaces. Different geometries are possible to suit the design of the surface and the machine connection.

These cup wheels are produced with diamond layers of three different forms:

- with a radius profile (WINTER 2F2 Type) for grinding spherical surfaces
- with a bevel dropping to the wheel center (WINTER 04D Type) for grinding convex toric surfaces
- with a bevel dropping to the outside of the wheel (WINTER 04C Type) for grinding concave toric surfaces

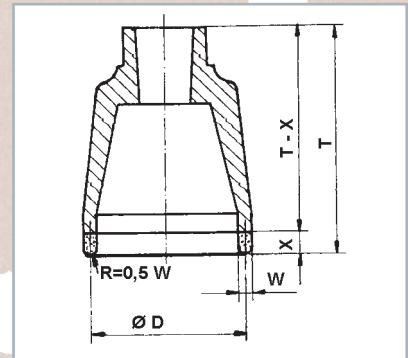


In addition to cup wheels with a continuous abrasive layer, you can also obtain WINTER cup wheels with a segmented layer, which allows an increase in stock removal and cutting ability.

### Generating tools for spherical surfaces

#### Geometries

WINTER:	2F2
	2F2S (segmented)
FEPA:	2F2
DIN:	58741



### Guide to find the right specification

Selecting your wheel:

1. Please first select the shape, diameter, rim width and abrasive layer depth from the table on the next page.
2. Next determine the body length required (this is the overall length minus the layer depth).
3. We have provided an overview table on pages 18-29 to help you determine the connection to the machine.
4. Then select the grit size, concentration and bond you require. The table on page 79 will also help you with this.

Please keep in mind that the grinding parameters are just as important as the grinding tool to achieve the desired results.

**Ordering example**

Shape	Middle diameter D	Rim width W	Usable layer depth X	Body length T-X	Machine connection A	Diamond grit size	Bond	Concentration
2F2	65	4	10	50	L4	D151	BZ335	C50

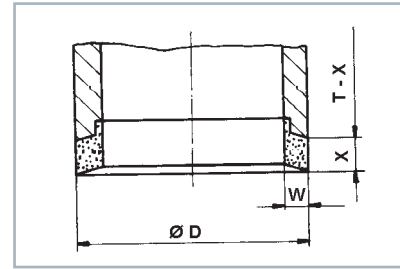
**Ordering designation for metal bond generating tools for grinding spherical surfaces**

Shape	D	W	X	T-X	A	Grit size	Bond	Concentration
2F2	38	3	15	T-X = Please state body length when ordering; if no length is stated, standard length will be supplied, depending upon machine type.	A = State machine connection when ordering; see tables on pages 18-29	Standard is D151, other grit sizes are available (D46 - D213)	Recommended WINTER bond: BZ335	recommended concentration: C30 - C50
	39	2	15					
	41	3	15					
	45	3	10					
	45	3	10					
	47	3	10					
	47	3	15					
	48	2	10					
	50	3	10					
	50	3	15					
	50	4	10					
	55	3	10					
	60	4	10					
65	4	10						
2F2S	34	2,5	8					
	68,5	4,5	8					
	78,5	4,5	8					
	82,2	6,5	13					

## Generating tools for toric surfaces

### Geometry

WINTER: 04C (for concave surfaces)  
04D (for convex surfaces)



### Ordering example

Shape	Diameter D	Rim width W	Usable layer depth X	Body length T-X	Machine connection A	Diamond grit size	Bond	Concentration
04D	90	6,5	12	66	L4	D181	BZ5414-27	C25

### Ordering designation for generating tools for toric surfaces

Shape	D	W	X	T-X	A	Grit size	Bond	Concentration
04D	60	6,5	10	Please state body length when ordering, if no length is stated, standard length will be supplied, depending upon machine type.	State machine connection when ordering; see table on pages 18-29	D181	BZ5314-27	C25
	70	6,5	10			D181	BZ5314-27	C25
	80	6,5	12			D181	BZ5314-27	C25
	90	6,5	12			D181	BZ5314-27	C25 <sup>1)</sup>
	100	6,5	12			D181	BZ5314-27	C25
04C	90	6,5	12			D181	BZ5314-27	C25
	100	6,5	12			D181	BZ5314-27	C25

<sup>1)</sup> Available ex-stock



# Peripheral grinding wheels

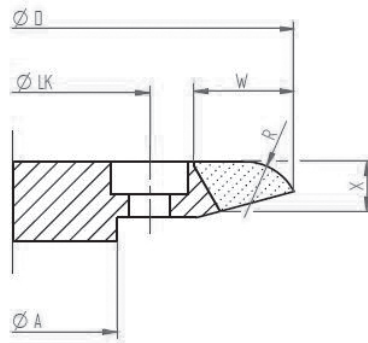
WINTER produces metal-bond edge grinding wheels for use on modern-day CNC machines. They are available in different diameters, grit sizes and concentrations, these diamond grinding wheels can be individually matched to your requirements and processes.



## For spherical and toric surfaces

### Geometry

WINTER: 222  
FEPA: 3Q5B



### Ordering example

Shape	Diameter D	Width of coating W	Usable abrasive depth X	ØA	Diamond grit size	Bond	Concentration
222	70	12,5	5	26	D181	L56-5	C35

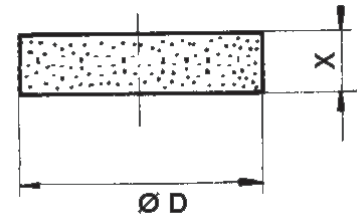
### Ordering designation for edge grinding wheels for spherical and toric surfaces

Shape	D	W	X	ØA	Grit size	Bond	Comment
222	35	10,5	5	5,5	D181	L56-5	C35
	44,5	9,5	6,4	8	D181	L56-5	C30
	70	12,5	5	26	D181	L56-5	C35 <sup>1)</sup>
	70	12,5	5	26	D126	L56-5	C35

<sup>1)</sup> Available ex-stock

# Fine grinding pellets

Fully permeated sintered diamond pellets have proved very successful for the fine grinding of lenses. The FS and X104 versions of 06B WINTER pellets are used in industrial mass production.



## Fully permeated 06B pellets, FS and X104 versions Ex-stock range for standard applications

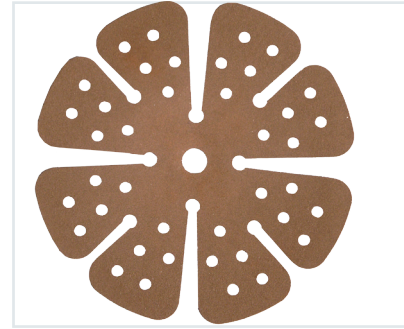
Version	Shape	D	X	Grit Size	Order Number
FS	06B	10	3	D7	66260131089
FS	06B	10	3	D15A	66260132490 <sup>1)</sup>
X104	06B	10	3	M12	60157682963 <sup>1)</sup>
FS	06B	10	3	D15B	66260133134 <sup>1)</sup>
X104	06B	10	3	M15	60157689971 <sup>1)</sup>
FS	06B	10	3	D15C	66260132527 <sup>1)</sup>
X104	06B	10	3	M18	60157685888 <sup>1)</sup>
FS	06B	10	3	D20B	66260130502 <sup>1)</sup>
X104	06B	10	3	M20	60157682950 <sup>1)</sup>
X104	06B	10	3	M22	60157682369 <sup>1)</sup>

<sup>1)</sup> Available ex-stock

## Fine grinding diamond pads

Full layer sintered metal bond diamond pads are an alternative to pellets. Their advantage lies in the flexible way in which they can be used for the production of small batches in production to prescription. Tool costs can be reduced in this case.

WINTER diamond pads are available in two diameters (75 and 79 mm) and are suitable for grinding glasses of all current types. The different grit sizes are specific to applications and materials.



### WINTER recommendations for use

- D15C Fine grit size, very suitable for high-index glass
- D20A Medium grit size for general purpose use, also suitable for mixed production
- D20B Coarser grit size mainly for clear glass, also suitable for high stock-removal rates

### Pads are also classified into two performance categories

- Type 3 Standard concentration of abrasive providing good stock-removal rates
- Type 7 Higher concentration of abrasive for longer tool life

### Diamond pads

Diameter [mm]	X	Grit Size	Type	Order Number
75	0,3	D15C	3	66260369976
		D20A	3	66260377695 <sup>1)</sup>
		D20A	7	66260381395 <sup>1)</sup>
		D20B	3	66260136406 <sup>1)</sup>
		D20B	7	66260345638 <sup>1)</sup>
		79	0,3	D15C
D15C	7			60157683989
D20A	3			66260396304
D20A	7			66260392136
D20B	3			66260138338 <sup>1)</sup>
D20B	3			66260328007 <sup>2)</sup>
D20B	7			66260341987 <sup>1)</sup>

<sup>1)</sup> Available ex-stock

<sup>2)</sup> Anti-slip coating ensures that pad remains accurately positioned on the mounting without adhesive pads being used

### Parameters

(Water with 3-4% mineral oil based coolant)

Grit Size	Application	Pressure [bar]	Stock removal rate (mm <sup>3</sup> /min)	Surface roughness Ra/Rt [µm]
D15C	High Index	0,7	0,20	0,190/1,624
D20A	Normal	0,9	0,35	0,35/2,80
D20B	Normal	0,9	0,45	0,42/3,25

# Special tools

A large number of WINTER tools which are not standard tools are used of in ophthalmics. The geometry and abrasive bond and concentration are produced to suit the individual requirement of the customer. Our tools are notable for their long life, excellent grinding characteristics and good economy. Shown on this page are just a small selection of our special tools.

## Special tools for grinding mineral glass

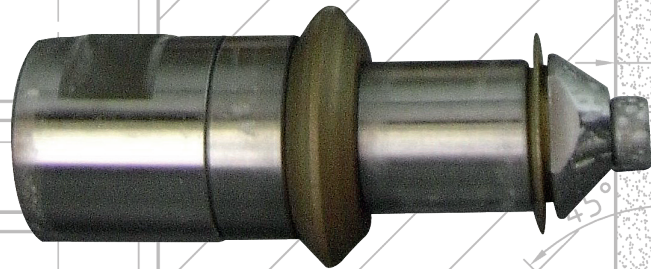
**Engraving points**  
for engraving production references or advertising messages



**Resin-bond cup wheels**  
for particularly fine finishes



**Chamfering and grooving tools**  
for counter chamfering after lens edge grinding, and slot the lenses to enable inserting a nylon thread for half rim frames.



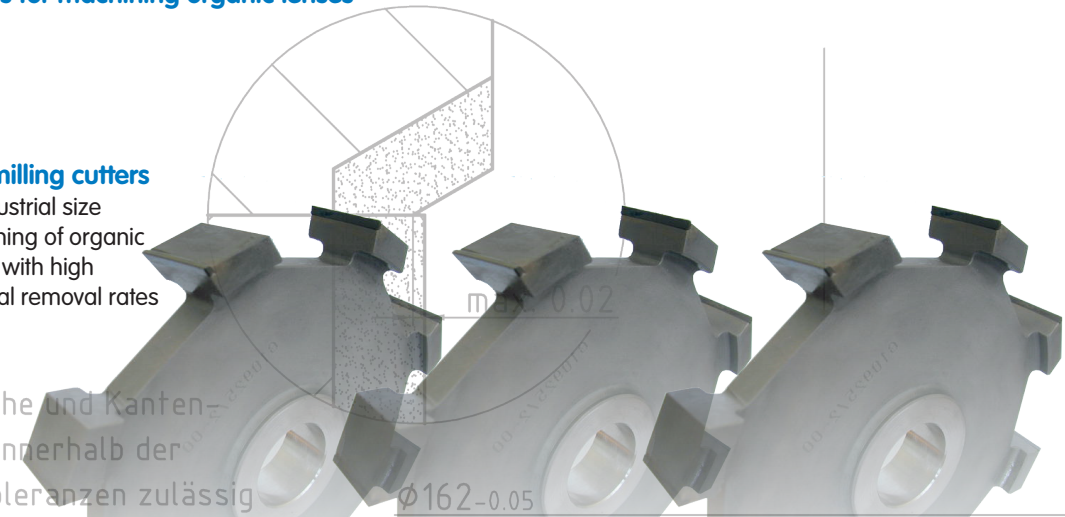
**Spherical grinding wheels**  
for grinding aspherical progressive lenses and/or free form shapes



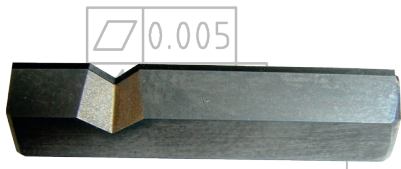
**Special tools for machining organic lenses**

**PCD milling cutters**

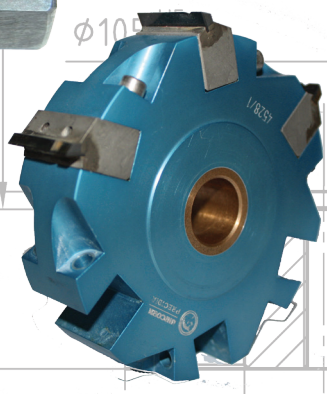
for industrial size machining of organic lenses with high material removal rates



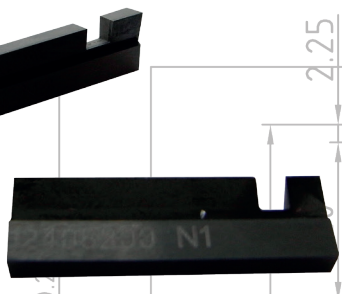
Kantenausbrüche und Kantenverrundungen innerhalb der Zylinderformtoleranzen zulässig



$\phi 160-0.1$   
 $\phi 130 \pm 0.1$  5x72°  
 $\phi 105$



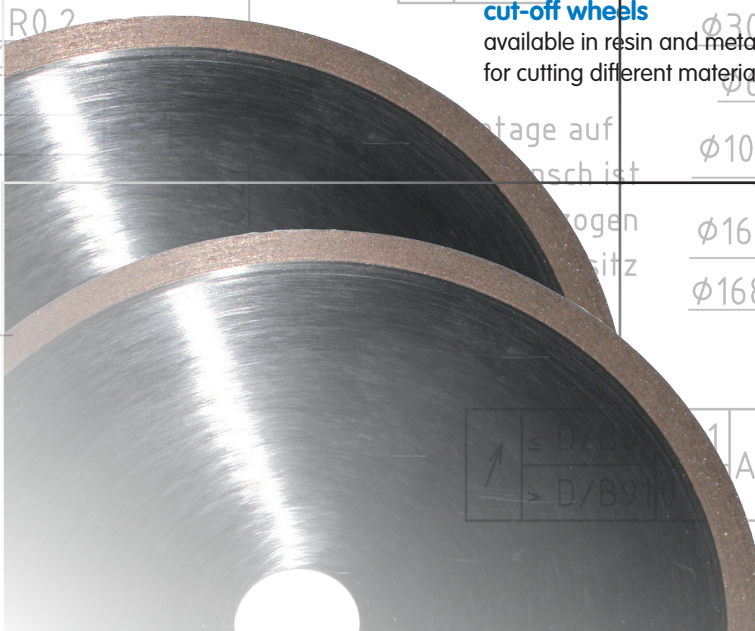
**Milling cutters for organic lens edging**



**Special tools for general purposes**

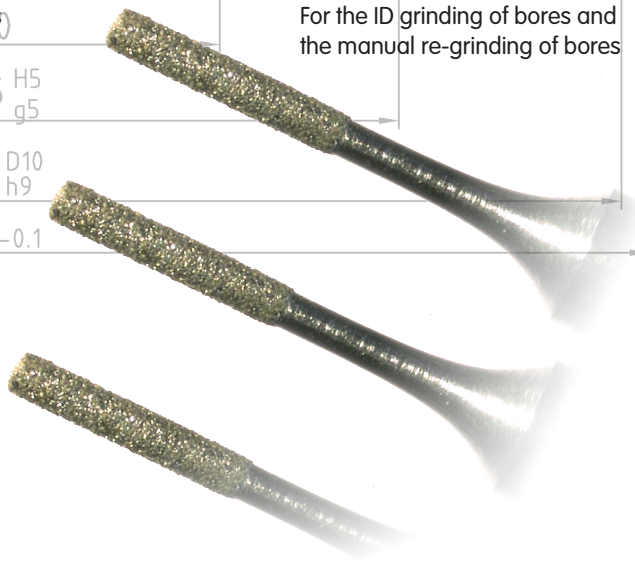
**Continuous rim cut-off wheels**

available in resin and metal bonds for cutting different materials



**Electroplated bond grinding burrs**

For the ID grinding of bores and the manual re-grinding of bores



Surface grinding of mineral glass



Precision Optics

Ophthalmics

Service Glossary Contact

# Surface machining of organic lenses

Machining concepts of organic lenses determine the various designs of the required tools. Electroplated and brazed diamond tools are increasingly complemented with tools using monocrystalline and polycrystalline diamond.

We recommend electroplated tools for coarse grinding operations on CR 39 and similar materials; braze-bonded tools on the other hand should be used for any other type of plastic lenses and specifically for grinding polycarbonate and Trivex.

You will find tools for different stock-removing techniques – turning, milling and grinding – in this section.

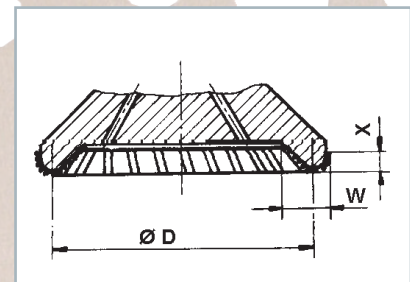


## Generating tools

Electroplated-bond diamond generating tools for coarse grinding of spherical, aspherical and toric surfaces

### Geometry

WINTER: 2F2  
 FEPA: 2F2  
 DIN: 58741



### Ordering example

Shape	Diameter D	Rim Width W	Usable abrasive depth X	Body length T-X	Machine connection A	Diamond grit size	Bond
S04B	80	14	5	75	L4	D602	Electroplated

### Ordering designation for diamond cup wheels

Shape	D	W	X	T-X	A	Grit Size	Bond
2F2	82,2	6,5	13	77	K6	D602	Electroplated
2F2	82,2	6,5	13	92	Z19	D602	Electroplated
S04B	80	14	5	75	L4	D602	Electroplated
S04B	90	14	5	75	L4	D602	Electroplated
S04B	100	14	5	75	L4	D602	Electroplated
222	66	8,5	5,5	66	26	D427	Electroplated

The above grinding wheels are also available with a braze-bond coating. Other versions available on enquiry.






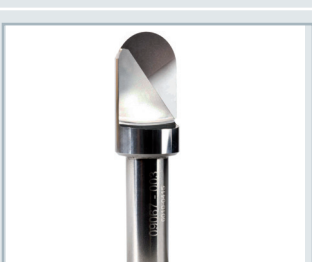
## PCD milling tools

The majority of modern-day machines can be fitted with tools employing PCD (polycrystalline diamond). In this range of high precision tools WINTER offers an extensive product portfolio. The advantage of our tools, based on our expertise and decades of experience, is their unrivalled performance, precision and economy. What gives them these qualities are the carefully selected raw materials, the close tolerances in the design of the tools and the high quality of their edges. The combination of high-tech multi-axis machining centres and high precision tools gives finishes of a quality almost as good as that of a polished workpiece. WINTER-tools machine a wide range of organic materials and are also highly suitable for the use on future organic materials.

Type	Description	Diameter	Radius	Order Number
<b>Inserts</b>				
	Machines: Gerber Coburn Replaceable round PCD insert (used as a single insert) Solid face	8 mm	4 mm	60157690999
	Machines: Gerber Coburn Replaceable round PCD insert (used as a single insert) Solid face	16 mm	8 mm	07958723323
	Machines: Satisloh Replaceable round PCD insert (used as a set of 8) Solid face	11 mm	5,5 mm	60157686330
	Machines: Satisloh Replaceable round PCD insert (used as a set of 8) With bore	11 mm	5,5 mm	69014140904

Type	Description	Diameter	Radius	Order Number
<b>Inserts</b>				
	Machines: Satisloh Replaceable round PCD insert (used as a single insert) With bore and hexagonal backplate	16 mm	8 mm	69014144052
	Machines: Schneider Replaceable round PCD insert (used as a single insert) With bore	8 mm	4 mm	07958701056
	Machines: Schneider Replaceable round PCD insert (used as a set of 9) With thread connection	12,7 mm	6,35 mm	On enquiry
	Machines: Schneider Replaceable round PCD insert (used as a single insert) With bore	16 mm	8 mm	60157686845



Type	Description	Diameter	Radius	Order Number
<b>Turning tools (PCD)</b>				
	Machines: Satisloh Replaceable PCD Insert	n.a.	16 mm	07958727938
	Machines: Satisloh Compact Replaceable PCD Insert	n.a.	2 mm	07958704735
	Machines: Satisloh Orbit Replaceable PCD Insert	n.a.	2 mm	079587273940
	Machines: Satisloh Ultra Replaceable PCD Insert	n.a.	2 mm	66260322163
	Machines: Satisloh Ultra Replaceable PCD Insert	n.a.	5 mm	60157693204
	Machines: Schneider Replaceable PCD Insert	n.a.	8 mm	07958707423

Type	Description	Diameter	Radius	Order Number
<b>Milling tools</b>				
	Machines: Optotech PCD milling cutter, 8 teeth	58 mm	6,6 mm	07958727944
	Machines: Optotech PCD milling cutter, 8 teeth	60 mm	7 mm	07958727945
	Machines: Optotech PCD milling cutter, 8 teeth	66 mm	11 mm	07958721773
	Machine: Optotech PCD milling cutter, 8 teeth	66 mm	16 mm	07958767516
	Machine: Optotech PCD milling cutter, 6 teeth	50 mm	28 mm	66260109977
	Machines: Satisloh HSK40C PCD milling cutter 8 teeth	66 mm	5,5 mm	on enquiry

WINTER  
FactsPrecision  
Optics

Ophthalmics

Service  
Glossary  
Contact

Type	Description	Diameter	Radius	Order Number
<b>Milling tools</b>				
	Machines: Satisloh ABS32L PCD Milling cutter body 8 teeth	66 mm	5,5 mm	07958748078
	Machines: Satisloh HSK 40 PCD milling cutter body, 8 teeth	66 mm	5,5 mm	69014146834
	Machines: Schneider PCD milling cutter, 8 teeth	66 mm	6 mm	69014148252
	Machines: Schneider PCD milling cutter, 12 teeth	66 mm	6 mm	07958709313
	Machines: Schneider Smart PCD milling cutter, 8 teeth	66 mm	6 mm	On enquiry
	Machines: Schneider Sprint PCD milling cutter 8 teeth	45 mm	6 mm	On enquiry

# MCD turning tools

The majority of modern-day machines can be fitted with tools employing MCD (monocrystalline diamond, either natural or synthetic). These are high-precision tools and for them WINTER offers an extensive product portfolio. The quality of these diamonds is as good as those used in jewellery manufacturing. To the naked eye, the quality of the surfaces produced is indistinguishable from that of a polished workpiece. To date, WINTER has been predominantly supplying natural diamonds however synthetic diamonds are increasingly gaining a large share of the market. This ensures excellent standards of quality is now possible on an industrial production scale. The tools listed below are therefore available in natural diamond and – on enquiry – in synthetic diamond. Worn tools can also be reworked.

## For SATISLOH VFT Ultra



Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R2 / 125° Diamond	Natural	New tool	66260322161
R2 / 125° Diamond	Synthetic	New tool	69014147049
R2 / 125° Diamond	Natural	Rework	66260324082
R5 / 60° Diamond	Natural	New tool	69014124159
R5 / 60° Diamond	Natural	Rework	66260109976

## For SATISLOH VFT Compact



Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R2 / 125° Diamond	Natural	New tool	69014133829
R2 / 125° Diamond	Natural	Rework	69014134499
R2 / 125° Diamond	Synthetic	New tool	07958708890

**For SATISLOH VFT Compact**



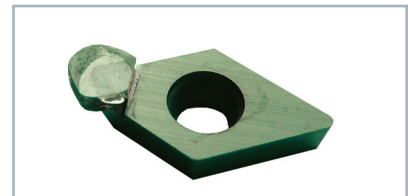
Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R5 / 125° Diamond	Natural	New tool	On enquiry
R5 / 125° Diamond	Natural	Rework	On enquiry

**For SATISLOH VFT Orbit**



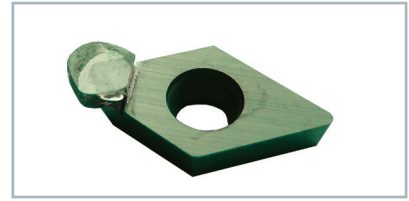
Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R2 / 125° Diamond	Natural	New tool	07958727937
R2 / 125° Diamond	Natural	Rework	07958703848
R5 / 125° Diamond	Natural	New tool	On enquiry
R5 / 125° Diamond	Natural	Rework	On enquiry

**For SCHNEIDER HSC**



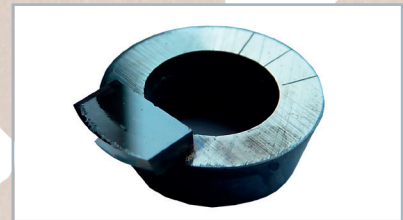
Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R2 / 60° Diamond	Natural	New tool	69014138475
R2 / 60° Diamond	Natural	Rework	69014134606
R2 / 120° Diamond	Natural	New tool	66260319707

For SCHNEIDER HSC



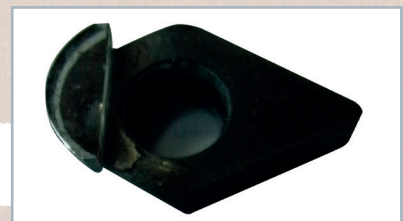
Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R2 / 120° Diamond	Synthetic	New tool	7958727149
R2 / 120° Diamond	Natural	Rework	69014140375
R5 / 60° Diamond	Natural	New tool	69014137168
R5 / 60° Diamond	Natural	Rework	On enquiry
R5 / 42° Diamond	Natural	New tool	69014137549
R5 / 42° Diamond	Natural	Rework	On enquiry

For SCHNEIDER HSC



Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R5 / 60° Diamond Ring	Natural	New tool	66260119267
R5 / 60° Diamond Ring	Natural	Rework	On enquiry

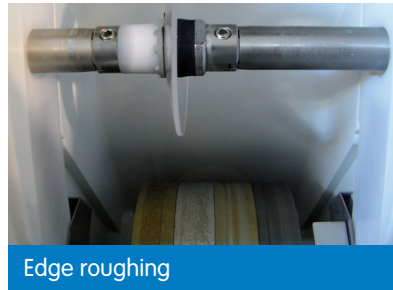
For GERBER-COBURN-DTL



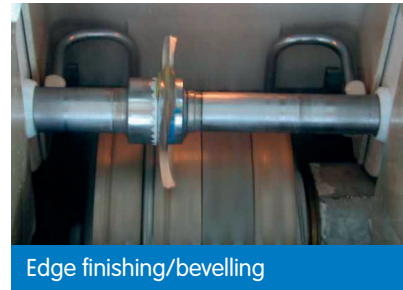
Description	Type of Diamond	Production	Order Number
<b>Replaceable Diamond insert</b>			
R3 / 120 ° Diamond	Natural	New tool	07958700976
R3 / 120 ° Diamond	Natural	Rework	69014147256

# Edge grinding

Spectacle lenses are given their final geometrical outline shape by edge finishing. This stage of the production process is often carried out by optometrists or large laboratories using edge grinding machines. Individual tools conforming to precise specifications give high rates of stock removal and edges of excellent quality.



Edge roughing



Edge finishing/bevelling

On the following pages you will find tools for the following applications

## Edge finishing/bevelling

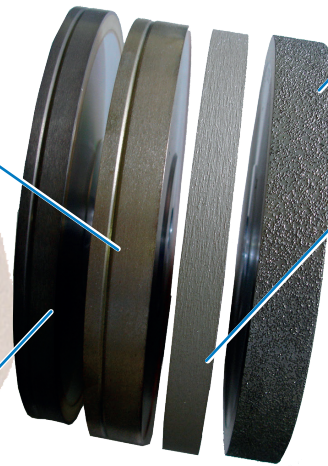
These metal bond grinding wheels generate the bevel shape and produce an excellent surface finish when used wet. All lens materials, mineral and all organic glasses, can be ground with the same tool. The wheel can be sharpened with a conventional dressing stick.

## Rough edging of organic lenses

For the coarse grinding of organic lenses, electroplated or brazed diamond grinding tools are used. Polycarbonate lenses should be ground dry, all other lens materials wet. Dressing of these wheels is not necessary; in fact, they could be damaged. Specification and geometry of a given tool depends on the machine type.

## Edge polishing

For polishing organic glasses, specially designed metal-bond grinding wheels are used. In addition to generating a brilliant surface in wet grinding, they are also capable of removing a substantial amount of material. Cleaning of these wheels can be done with a special dressing stick.

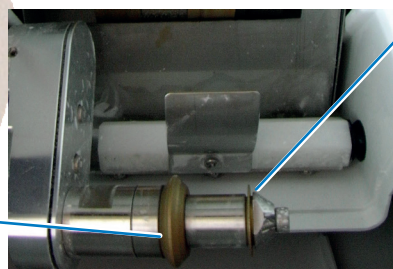


## Coarse grinding of mineral glass

Metal-bond diamond grinding wheels are used wet for this. Besides a long tool life, our wheels exhibit a reduced tendency for chipping. Sharpening can be done with conventional dressing sticks.

## Bevelling

To optimise product quality, this tool is used to remove sharp edges to reduce the risk of glass chipping.



## Grooving

In half frame spectacles the lens is held in the frame by a filament. This specially designed tool is used for grinding the groove for the filament.

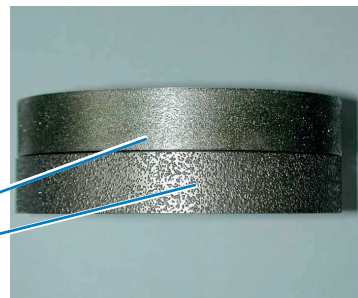
# Rough edging

## Rough edging of organic glass

Electroplated wheels consist of diamonds held by a nickel coating which is applied in an electrochemical process to the wheel core.

For a braze-bond coating the diamonds are brazed to the wheel body. The diamond chemically bonds to the braze, allowing a better grit retention and higher grit protrusion. Diamond grits can be spread randomly or set according to a pattern.

Electroplated-bond coating  
Braze-bond coating

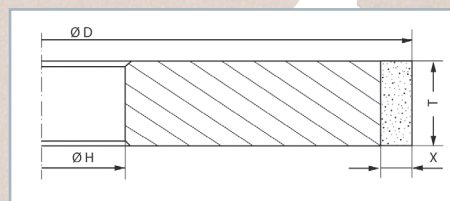


## Ordering example

Shape	D	U	X	Grit Size	Bond	Concentration
1A1	60 to 165 mm	10 to 25 mm	< 1 mm	D181 to D427	Electroplated or Brazed	20-70

## Rough edging of mineral glass

For lenses of mineral glass, WINTER supplies metal-bond grinding wheels of large grit sizes, mainly D151. In spite of their high stock-removal rate, they do not produce large swarf particles. They also provide a reliable grinding force and long life.



## 1A1 Grinding wheels for rough edging of mineral glass

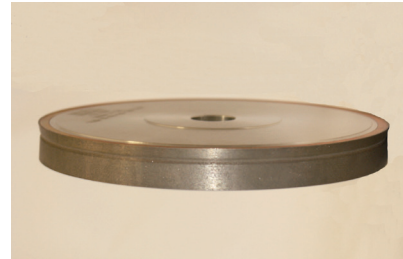
Shape	D	U	X	Grit Size	Bond	Concentration
1A1	60 to 165 mm	10 to 25 mm	1 - 3 mm	D126 to D151	Metal bond	C35-C50
1V1	60 to 150 mm	10 to 25 mm	1 - 3 mm	D91 to D151	Metal bond	C35-C50

These rough edging tools can also be supplied with smaller grit sizes for fine grinding.

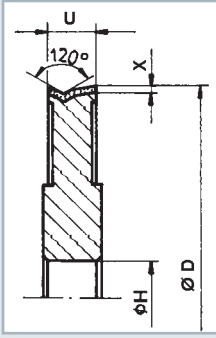
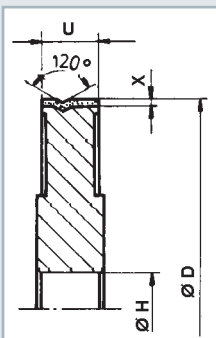
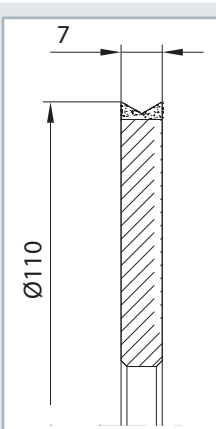


# Fine bevelling

Fine bevelling is carried out with metal-bond tools with and without a bevel profile; the grinding is mainly done wet on mineral and organic glasses. The tools are sharpened with conventional dressing sticks or dressing wheels when required. The geometry and dimensions of the grinding wheel are determined by the type of machine on which it is used. These WINTER tools are produced under clean room conditions to exclude coarse grit contamination and to ensure reliable grinding results. They are also available for all existing machine models used in grinding ophthalmic glasses.



## Edging wheels for fine bevelling

Shape	D	T	X	Grit Size	Bond	Concentration
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D20A to D54	Metal bond	C30-C50
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D20A to D54	Metal bond	C30-C50
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D20A to D54	Metal bond	C30-C50

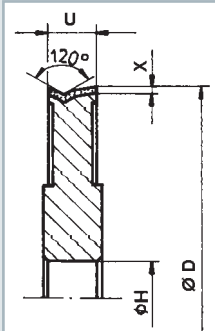
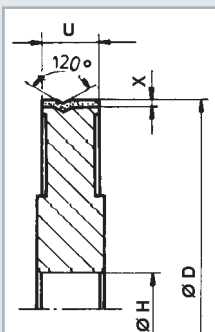
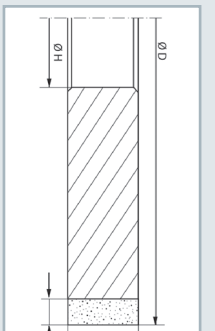
Exact shape and dimensions depend on machine manufacturer, machine model and wheel reference. Please state when ordering.

# Flat or bevel polishing

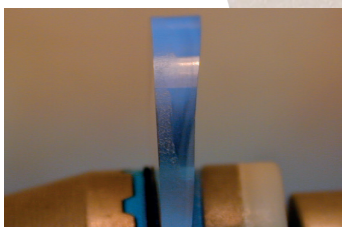
Edge polishing of organic glasses (CR39, polycarbonate, high index materials and Trivex) is done with metal bonded diamond wheels. Their extraordinary high quality is based on two features: on one side the carefully selected fine grit diamonds which are processed under clean room conditions, on the other side their exceptional profile accuracy made with the most up-to date technology, which matches perfectly the profile of the fine and facet grinding tools. Thus the surfaces are given exactly the polish and gloss required by the market.



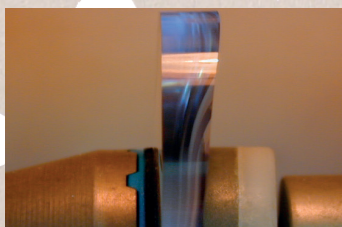
## Edging wheels for polishing

Shape	D	T	X	Grit Size	Bond	Concentration
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D3 to D7	Metal bond	C70 - C115
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D3 to D7	Metal bond	C70 - C115
	20 to 165 mm	7 to 25 mm	1 - 3 mm	D3 to D7	Metal bond	C70 - C115

Exact shape and dimensions depend on machine manufacturer, machine model and wheel reference. Please state when ordering

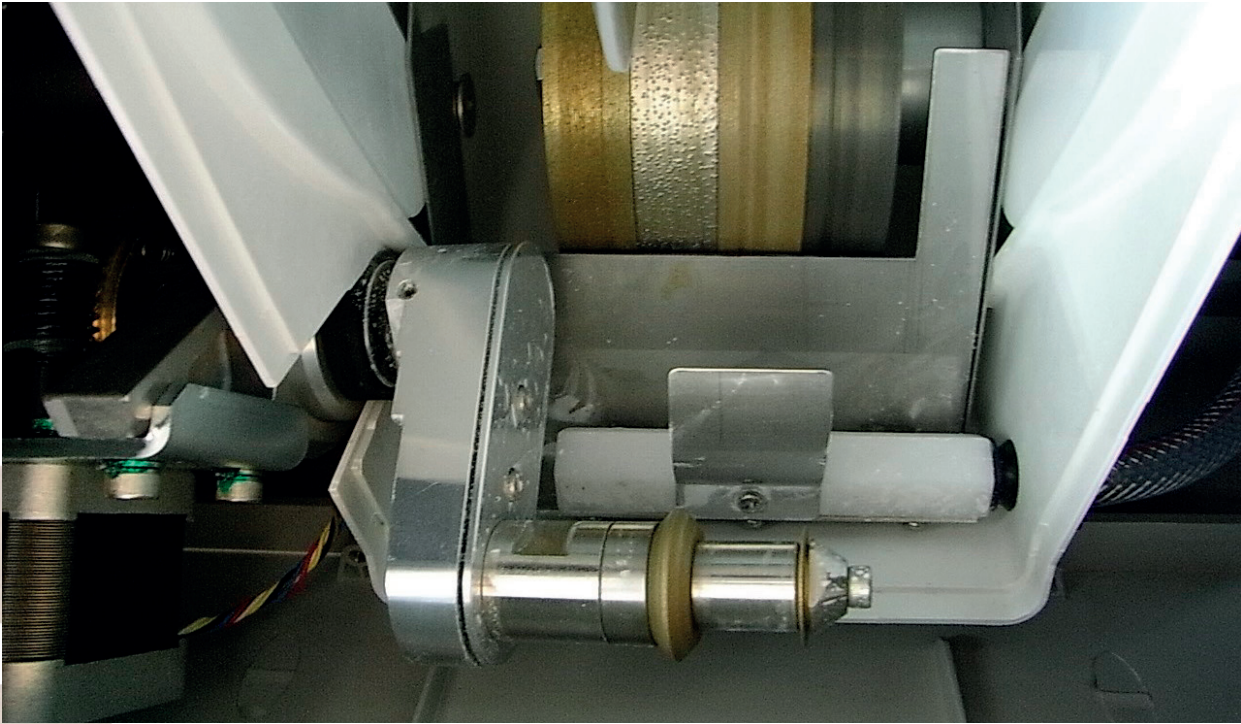


Surface after fine edging



Surface after polishing

# Counterchamfering & Grooving



Counterchamfering						
Shape	Diameter D	Layer width U	Usable layer depth X	Grit Size	Bond	Concentration
1V1 (or 2 x 1V1)	15 - 40	3,5 - 10	1,5 - 3	D1 - D36	Metal	20 - 70

Grooving						
Shape	Diameter D	Layer width U	Usable layer depth X	Grit Size	Bond	Concentration
1A1	15 - 40	0,5 - 1,2	1,5 - 5	D36 - D54	Metal	20 - 70
1Y1	15 - 25	0,5 - 1,2	1,5 - 3	D36 - D54	Metal	20 - 70

# Edging with PCD tools

For organic glass edging, a number of machines are available in the market having been designed exclusively for PCD (polycrystalline diamond) tools. PCD tools offer a long tool life and a high material removal rate, generating a very good surface finish without causing thermal damage. Shaping and smoothing can be achieved in a combined operation with a single WINTER PCD-tool. However, the tools can be easily damaged, therefore they must be handled with great care. Other than grinding wheels, a defective PCD tool will damage the organic lenses while machining. Worn PCD tools need to be reground and resharpened by skilled experts. WINTER offers a repair service for PCD tools, ensuring their quality and efficiency.

## Individual Profile Tools



Shape	Length	Height
Profile analog 1A1	2 ... 10 mm	10 ... 25 mm
Profile analog 1MM1	2 ... 10 mm	10 ... 25 mm

Further versions on enquiry

## Milling Tools



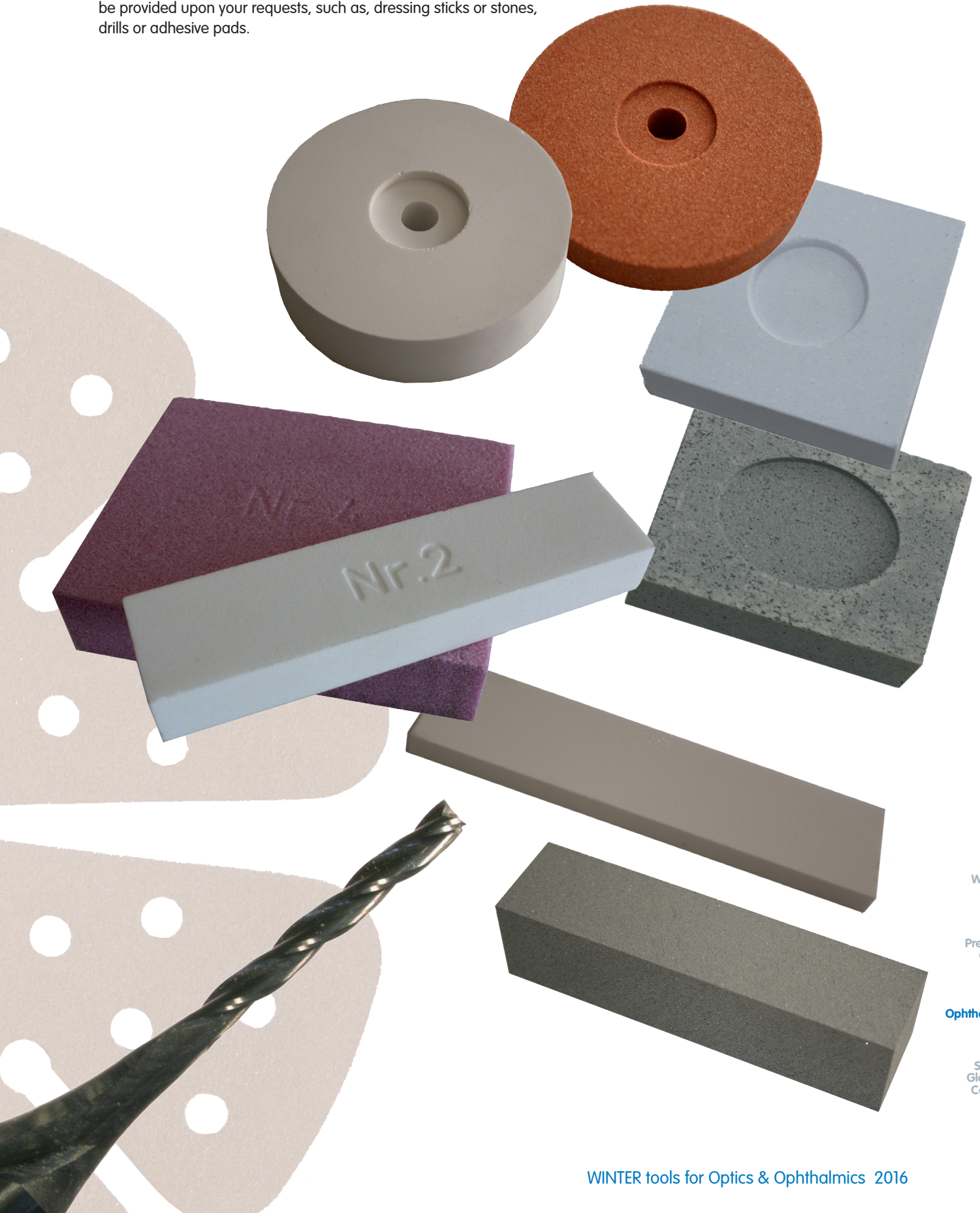
Shape	Diameter	Width	Number of Teeth
SATISLOH 1A1	60 mm	20 mm	6
	70 mm	31 mm	6
	155 mm	25 mm	8
SCHNEIDER	50 mm	38 mm	4
			5
			7

Further versions on enquiry



# Accessories

Additional articles used while edging or for tool preparation can be provided upon your requests, such as, dressing sticks or stones, drills or adhesive pads.



# Cleaning and sharpening stones

## Stock programme of cleaning and sharpening stones

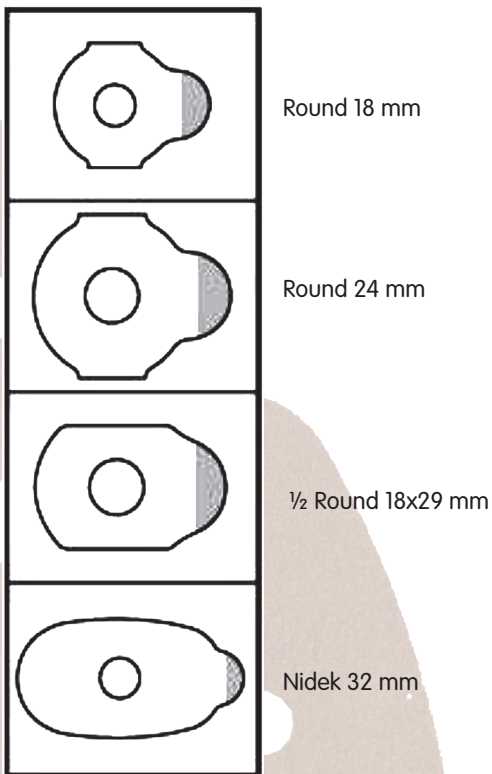
Description	Application	Order number
WINTER stone No. 2 (100×24×13)	White aluminium oxide, ceramic bond, 180 mesh, for sharpening resin and metal bonded grinding wheels and cut-off wheels with grit size $\geq$ D46	66260195816
WINTER stone No. 4 (90×70×20)	Pink aluminium oxide, ceramic bond, 60 mesh, for sharpening metal bonded grinding wheels with grit size $\geq$ D251	60157642665
WINTER stone No. 5 (100×50×25)	See WINTER stone No. 2	66260389054
Stone WA150GV (25×25×150)	Cleaning and sharpening resin and metal bonded grinding wheels with grit size $\geq$ D107	69936621643
Stone WA220GV (25×25×150)	Cleaning and sharpening resin and metal bonded grinding wheels with grit size between D46 and D107	69014165446
Stone WA320GV (25×25×150)	Cleaning and sharpening resin and metal bonded grinding wheels with grit size $\leq$ D46	69936651380
Stone for core drill 8A100-G8 (8×50×200)	Cleaning and sharpening all types of core drills	60157651338
Slab for core drill 8A120-I8 (10×155×285)	Cleaning and sharpening all types of core drills	66253270933

# Adhesive Edging Pads

A complete range of products for optical shop or labs



## 4 Shapes available



## 4 material types available

- P12 : standard type
- P14 : very adhesive
- P10 : strong resistance to torsion
- P46 : special for super-hydrophobics

## Packing

For shops : roll of 1000 pads in double layer / box



For labs : roll of 1500 – 3000 pads on 1 layer



# Checklist - Ophthalmics

Company/contact \_\_\_\_\_

Telephone no./e-mail address for any queries \_\_\_\_\_

Technical advice for improving results

Quotation

Order

## 1. Application:

Surface Grinding

Edge Grinding

Other

Description: \_\_\_\_\_

2. Workpiece material \_\_\_\_\_

## 3. Machine (this must be stated for surface grinding and edge grinding)

3.1 Manufacturer \_\_\_\_\_

3.2 Machine type \_\_\_\_\_

3.3 Coolant \_\_\_\_\_

4. Tool shape/type \_\_\_\_\_

5. Tool diameter in mm (middle diameter in the case of 2F2 tools) \_\_\_\_\_

6. Grinding wheel width in mm (for edge grinding) \_\_\_\_\_

7. Total stock removal in grinding (mm/Ø) \_\_\_\_\_

## 8. Specification, if known:

8.1 Bond \_\_\_\_\_

8.2 Grit Size \_\_\_\_\_

8.3 Concentration \_\_\_\_\_

Please fill in the above list and send it, with a drawing if possible, to your expert adviser or direct to our Product Management Department at [metal@saint-gobain.com](mailto:metal@saint-gobain.com).

SAINT-GOBAIN Diamantwerkzeuge GmbH  
Schützenwall 13-17, D-22844 Norderstedt, Tel.: +49 (0)40 5258-0, Fax +49 (0)40 5258-215  
[www.winter-superabrasives.com](http://www.winter-superabrasives.com)

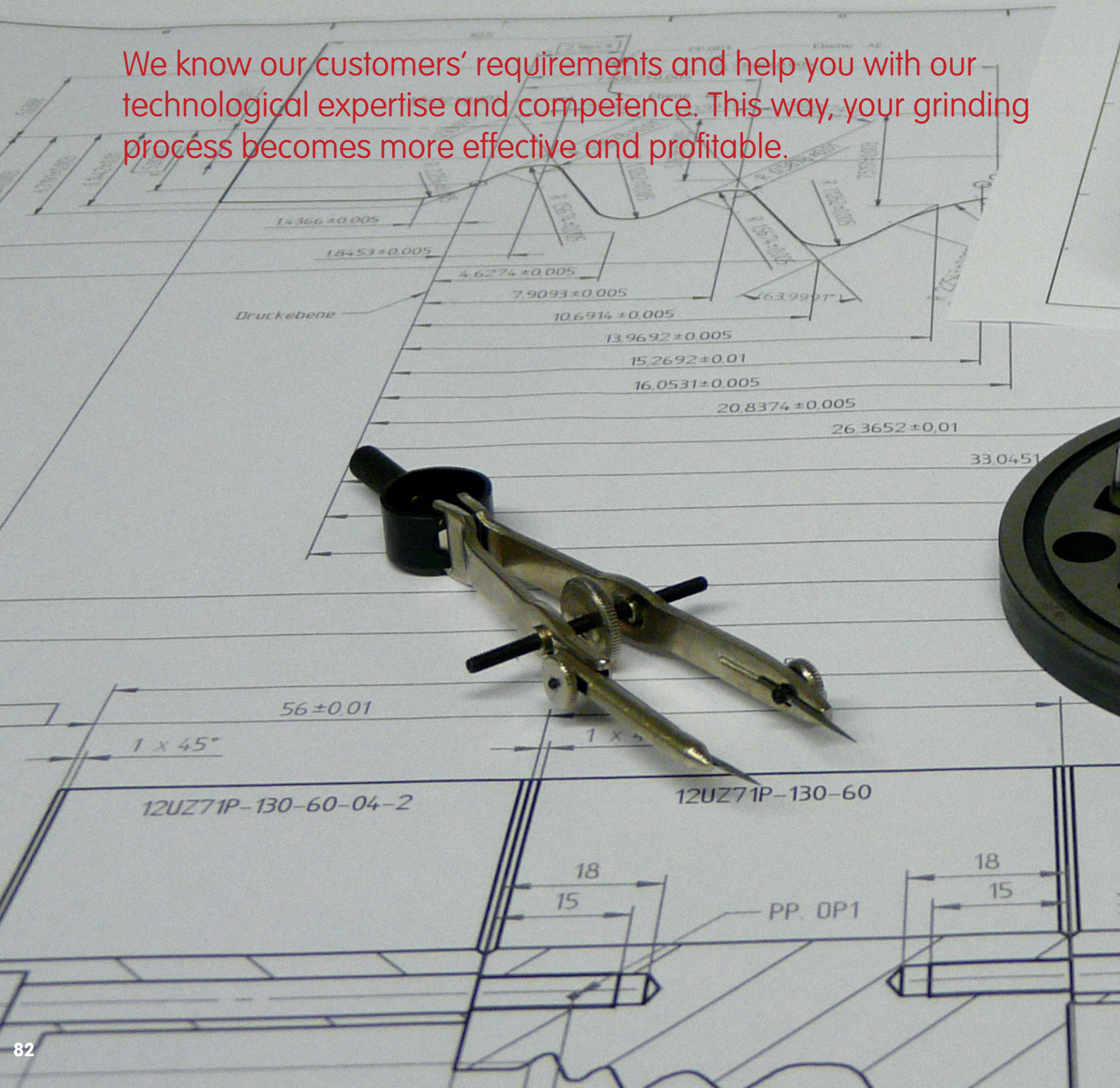




# Compendium

The 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.





#### 84 Service

In addition to design and production of grinding tools, WINTER offers you a multitude of services.

#### 86 Glossary

Compiled for you: this little reference guide explains terms around grinding: bonds, roughness, material removal rates, etc.

#### 97 Contact

Whom to ask first?

Who is my nearest contact person?

Where can I get quick and easy help?

# Service

Competition is keen, and cost pressures are acute. To improve productivity and technical capability, you need a supplier who co-operates efficiently. 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 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

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.

## 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.

### 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)



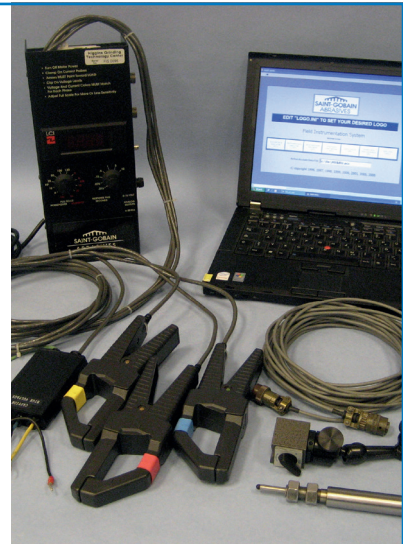
## Field Instrumentation System (FIS)

### 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

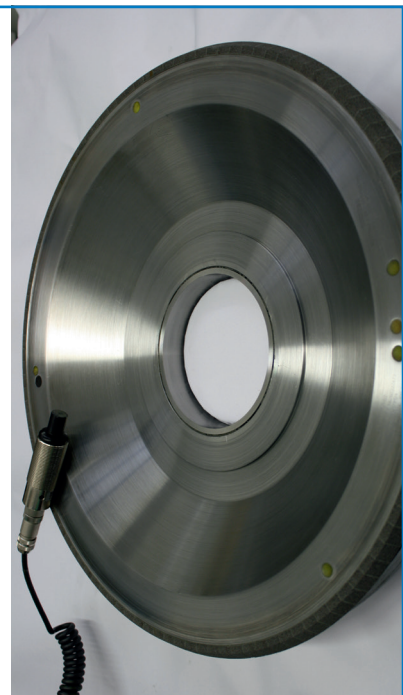
- Integrated tool-life monitoring
- Automated scanning and storage of tool use

### 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 wheel



# 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 anchored 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 WINTER system, the concentration value defines the volume fraction of diamond or cBN in the abrasive layer as follows:

Diamond			cBN		
Concentration	Carat / cm <sup>3</sup>	Volume %	Concentration	Carat / cm <sup>3</sup>	Volume %
C50	2.2	12.5	V120	2.09	12
C75	3.3	18.75	V180	3.13	18
<b>C100</b>	<b>4.4</b>	<b>25</b>	<b>V240</b>	<b>4.18</b>	<b>24</b>
C125	5.5	31.25	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, quartz, 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 choose to change the direction of rotation.

## Dressing = Truing + Sharpening

It is necessary to distinguish 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 sharpening stones, SiC grinding wheels, the 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.**

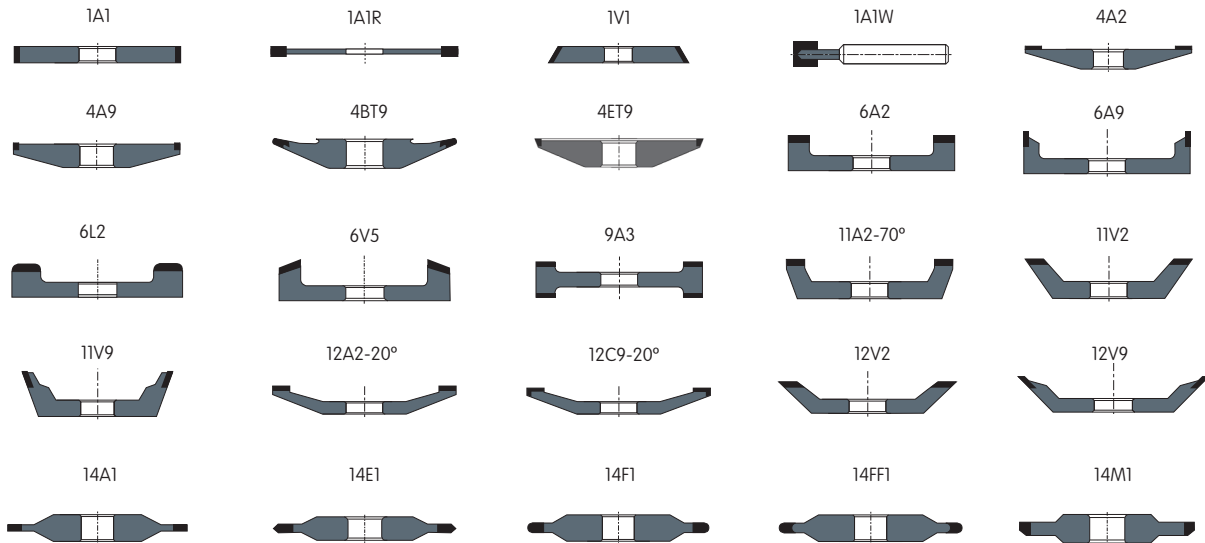
## FEPA

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 to 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 Absorption	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 thin-walled 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 sieve-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 [ $\mu\text{m}$ ]	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

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

WINTER diamond classification	Grit size [ $\mu\text{m}$ ]
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

WINTER diamond classification	Grit size [µm]
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  $\text{mm}^3/\text{s}$  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  $[\text{mm}^3/(\text{s} \cdot \text{mm})]$ .

## Parameters influencing Grinding Results

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

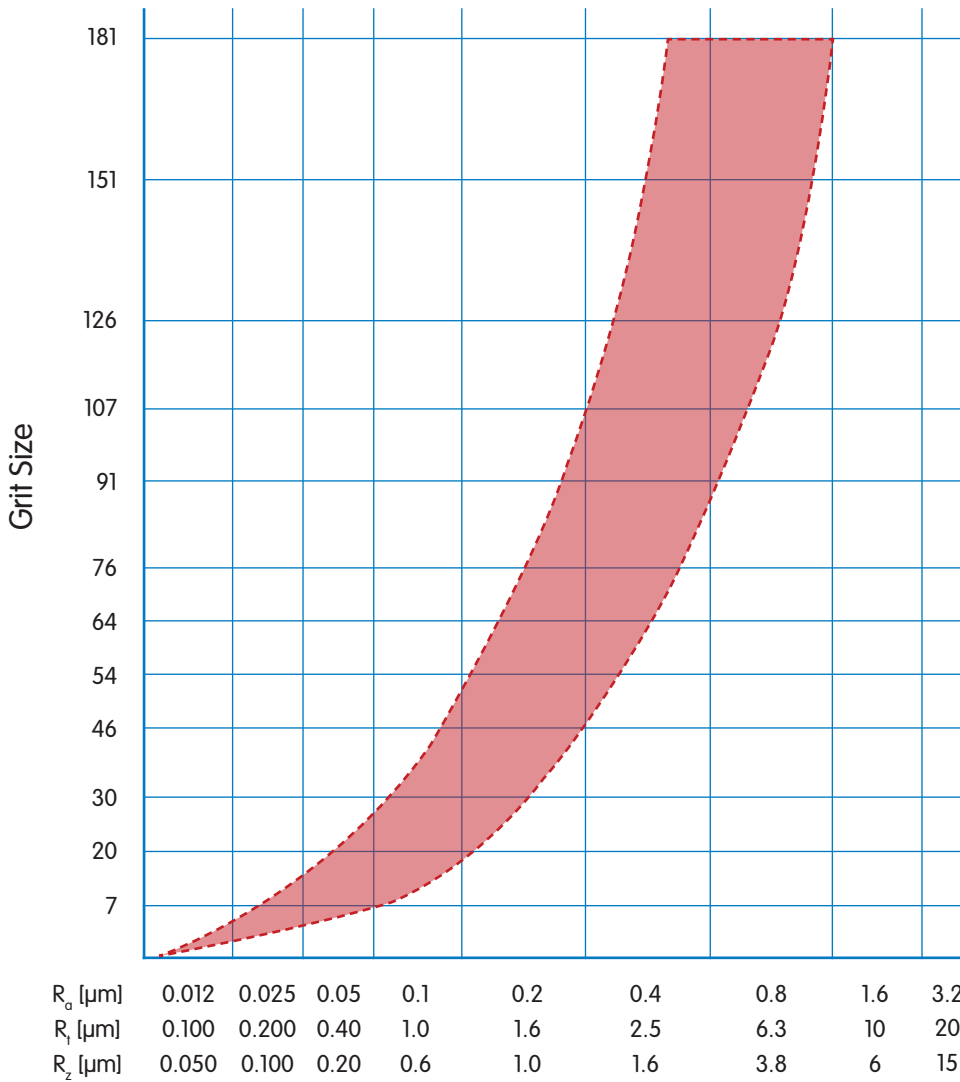
Influencing Parameters		Appraisal criterion				
		Cutting Force F $F = f(\dots)$	Grinding Ratio G $G = f(\dots)$	Roughness $R_a$ $R_a = f(\dots)$	Temperature $\vartheta$ $\vartheta = f(\dots)$	
Machine- and Operation Parameters	Cutting Speed $v_c$ (m/s)					
	Material Removal Rate $Q_w$ ( $\text{mm}^3/\text{s}$ )					
	Coolant (Oil Content)					
Grinding Wheel	Grit Size ( $\mu\text{m}$ )					
	Concentration ( $\text{Carat}/\text{cm}^3$ )					

# 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:



# 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 occurrence 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 contact your sales engineer:

Saint-Gobain Diamantwerkzeuge GmbH  
Schützenwall 13-17  
DE-22844 Norderstedt

Telefon: +49 - (0)40 - 52 58 0  
Fax: +49 - (0)40 - 52 58 215  
E-Mail: [info.winter@saint-gobain.com](mailto:info.winter@saint-gobain.com)

[www.winter-superabrasives.com](http://www.winter-superabrasives.com)





SAINT-GOBAIN ABRASIVES N.V.  
BOULEVARD INDUSTRIEL, 129  
1070 ANDERLECHT / BRUSSEL  
BELGIUM  
TEL: +32 2 267 21 00  
FAX: +32 2 267 84 24

SAINT-GOBAIN ABRASIVES, S.R.O.  
POCERNIKÁ 272/96, MALEŠICE  
108 00 PRAHA 10  
CZECH REPUBLIC  
TEL: +420 255 719 326  
FAX: +420 267 719 321

SAINT-GOBAIN ABRASIVES A/S  
ROBERT JACOBSENS VEJ 62 A  
2300 KØBENHAVN S  
DENMARK  
TEL: +45 467 552 44  
FAX: +45 467 550 60

SAINT-GOBAIN ABRASIFS  
OFFICE NO. 2106 FORTUNE TOWER  
CLUSTER C, JUMEIRA LAKE TOWERS  
P.O. BOX 643706  
DUBAI, U.A.E  
UNITED ARAB EMIRATES  
TEL: +971 4 43 15 154  
FAX: +971 4 43 15 434

SAINT-GOBAIN ABRASIVES  
RUE DE L'AMBASSADEUR BP 8  
78702 CONFLANS CEDEX  
FRANCE  
TEL: +33 (0)1 34 90 40 00  
FAX: +33 (0)1 39 19 89 56

SAINT-GOBAIN  
DIAMANTWERKZEUGE GMBH  
SCHÜTZENWALL 13-17  
22844 NORDERSTEDT  
GERMANY  
TEL: +49 40 5258-0  
FAX: +49 40 5258-215

SAINT-GOBAIN CONSTRUCTION  
PRODUCT HUNGARY KFT  
1225 BUDAPEST, BÁNYALÉG U. 60/B  
HUNGARY  
TEL: +36 1 371 22 50  
FAX: +36 1 371 22 55

SAINT-GOBAIN ABRASIVI S.P.A.  
VIA PER CESANO BOSCONI 4  
20094 CORSICO MILANO  
ITALY  
TEL: +39 024 48 51  
FAX: +39 024 47 82 66

SAINT-GOBAIN ABRASIVES S.A.  
190 RUE J.F. KENNEDY  
4930 BASCHARAGE  
GRAND DUCHE DE LUXEMBOURG  
TEL: +352 50 40 11  
FAX: +352 50 16 33  
NO. VERT (FRANCE) 0800 906 903

SAINT-GOBAIN ABRASIFS, S.A.  
2 ALLÉE DES FIGUIERS  
AÏN SEBAA - CASABLANCA  
MOROCCO  
TEL: +212 22 66 57 31  
FAX: +212 22 35 09 65

SAINT-GOBAIN ABRASIVES BV  
GROENLOSEWEG 28  
7151 HW EIBERGEN  
THE NETHERLANDS  
TEL: +31 545 466 466  
FAX: +31 545 474 605

SAINT-GOBAIN ABRASIVES AS  
BROBEKKVEIEN 84  
0582 OSLO  
NORWAY  
TEL: +47 63 87 06 00  
FAX: +47 63 87 06 01

SAINT-GOBAIN HPM POLSKA SP. Z O.O  
UL. NORTON 1  
62-600 KOLO  
POLAND  
TEL: +48 63 26 17 100  
FAX: +48 63 27 20 401

SAINT-GOBAIN ABRASIVOS, L. DA  
ZONA INDUSTRIAL DA MAIA I  
SECTOR VIII , NO. 122  
APARTADO 6050  
4476 - 908 MAIA  
PORTUGAL  
TEL: +351 229 437 940  
FAX: +351 229 437 949

SAINT-GOBAIN GLAS  
BUSINESS UNIT ABRASIVI  
PUNCT DE LUCRU: LOC.VETIS, JUD.  
SATU-MARE 447355  
STR. CAREIULUI 11  
PARC INDUSTRIAL RENOVATIO  
ROMANIA  
TEL: +40 261 839 709  
FAX: +40 261 839 710

SG HPM RUS  
58, F. ENGELS STR.,  
STROENIE 2 2  
105082 MOSCOW  
RUSSIA  
TEL: +74 955 408 355  
FAX: +74 959 373 224

SAINT-GOBAIN ABRASIVOS, S.A.  
CTRA. DE GUIPÚZCOA, KM. 7,5  
31195 BERRIOPLANO (NAVARRA)  
SPAIN  
TEL: +34 948 306 000  
FAX: +34 948 306 042

SAINT-GOBAIN ABRASIVES AB  
NORRA MALMVÄGEN 76  
19162 SOLLENTUNA  
SWEDEN  
TEL: +46 8 580 881 00  
FAX: +46 8 580 881 01

SAINT GOBAIN INOVATIF  
MALZEMELER VE ASINDIRICI  
SAN. TIC. A.S.  
GOLD PLAZA, ALTAY CESME  
MAHALLESİ, ÖZ SOKAK, NO:19/16  
34843 MALTEPE-ISTANBUL  
TURKEY  
TEL: +90 216 217 12 50  
FAX: +90 216 442 40 74

SAINT-GOBAIN ABRASIVES LTD.  
DOXEY ROAD  
STAFFORD  
ST16 1EA  
UNITED KINGDOM  
TEL: +44 1785 222 000  
FAX: +44 1785 213 487



Saint-Gobain Diamantwerkzeuge Gmbh  
Schützenwall 13-17  
D-22844 Norderstedt  
Germany

Tel: +49 40 5258-0  
Fax: +49 40 5258-215

[www.winter-superabrasives.com](http://www.winter-superabrasives.com)

WINTER is a registered trademark of SAINT-GOBAIN  
Form #3120

