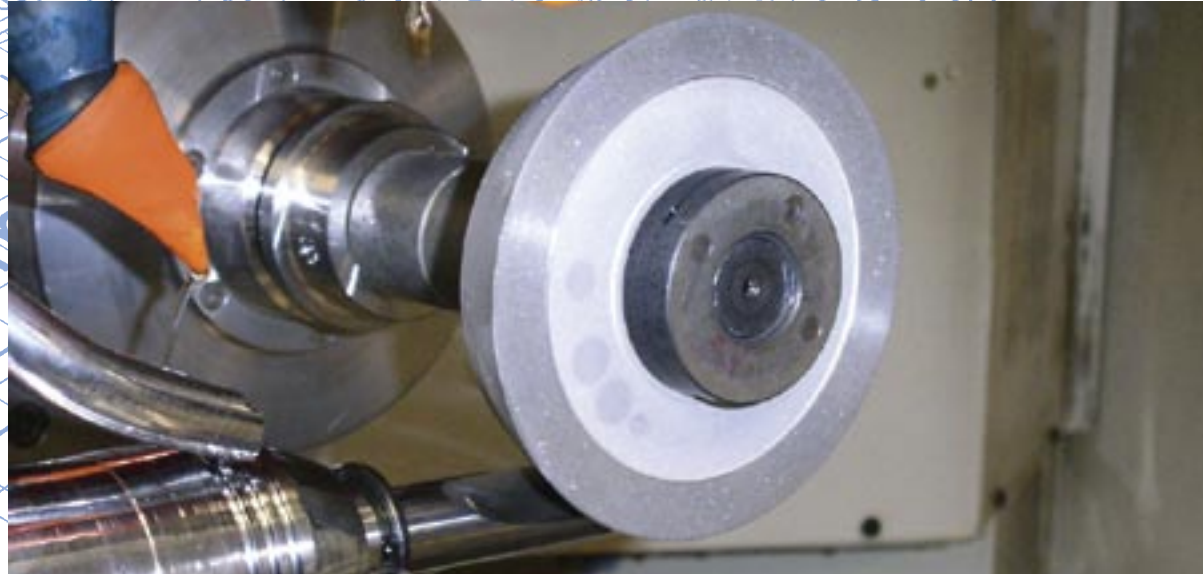
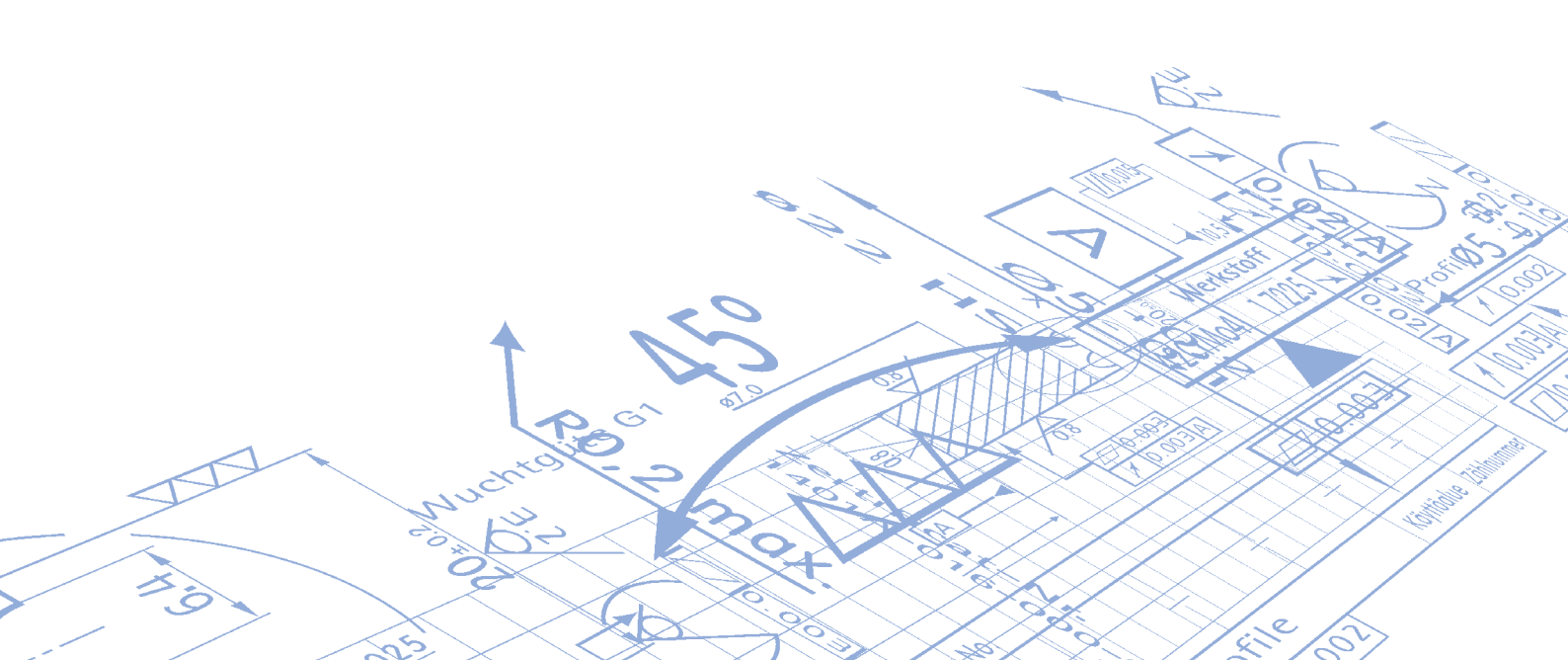


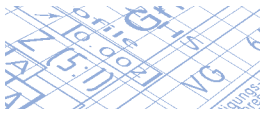
# WINTER

Precision Grinding Solutions



Flute grinding perfection  
- Solutions for each geometry

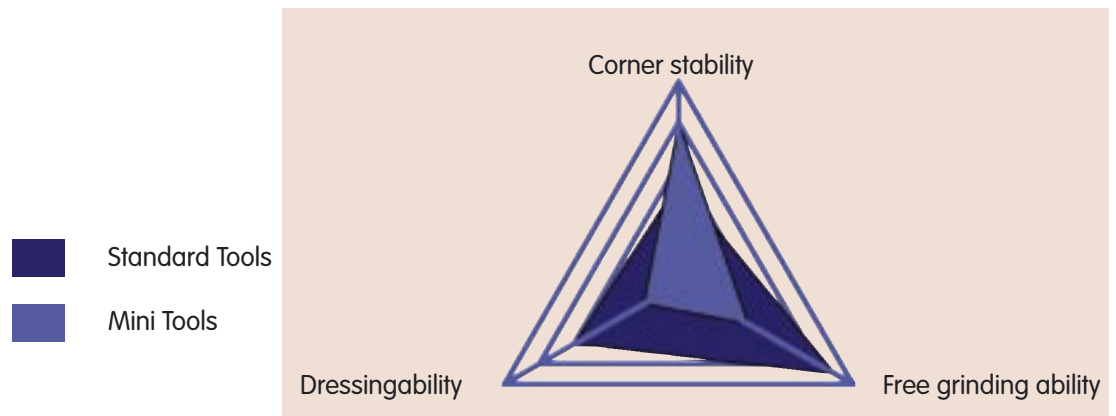




# Flute grinding perfection - Solutions for each geometry

## Overview

Shank tools are available in a very wide range of materials and dimensions, which place competing demands on the grinding wheels used for their production. Shorter grinding times, more automated processes and longer dressing intervals are also desirable. The specific characteristics of grinding wheels such as edge stability and free grinding behaviour must therefore be balanced carefully for the different grinding conditions.



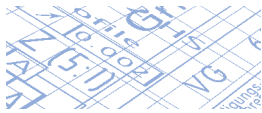
With our large flute grinding program WINTER offers solutions for all flute grinding operations.

### Properties:

	MRR	Corner stability	Dress ability	Page
<b>Q-Flute<sup>2</sup></b>	++	+	++	<b>4</b>
<b>Q-Flute<sup>+</sup> Dress</b>	+	o	++	<b>6</b>
<b>µicro<sup>+</sup></b>	+	++	-	<b>8</b>
<b>K-plus 1421R</b>	o	-	-	<b>10</b>
<b>KSS 12N</b>	o	-	-	<b>10</b>

### Application guide:

	Standard Tools	Mini Tools	Re-sharpening	Page
<b>Q-Flute<sup>2</sup></b>	++	-	-	<b>4</b>
<b>Q-Flute<sup>+</sup> Dress</b>	+	+	-	<b>6</b>
<b>µicro<sup>+</sup></b>	-	++	-	<b>8</b>
<b>K-plus 1421R</b>	-	-	++	<b>10</b>
<b>KSS 12N</b>	-	-	++	<b>10</b>



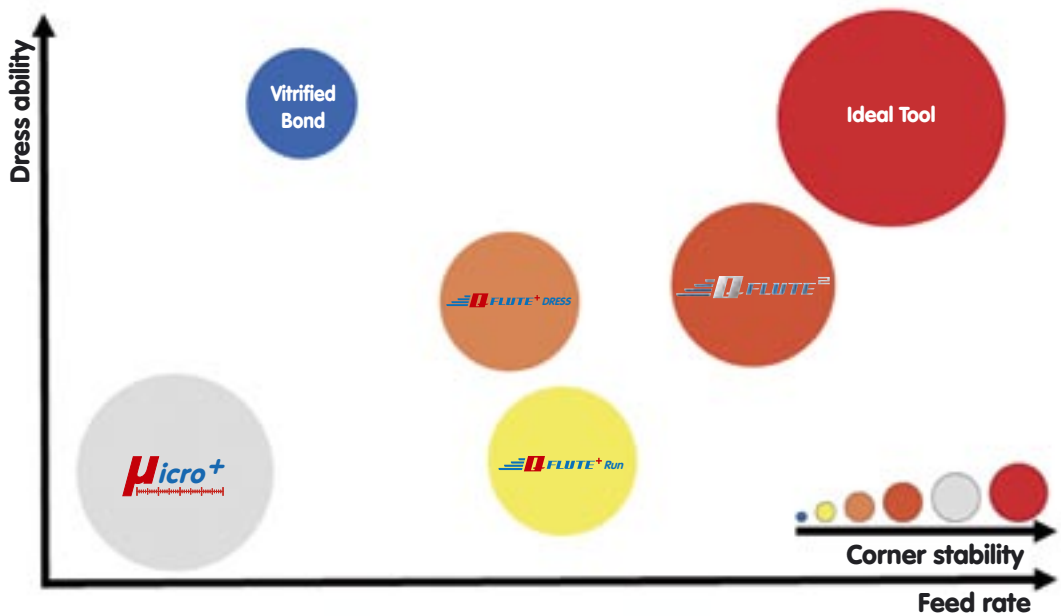
# Flute grinding perfection - Solutions for each geometry

## Flute grinding in the tool industry

Flute grinding is the most time consuming and thus most cost intensive manufacturing step during drill and end mill production. Therefore it is necessary to optimise the machine- and cooling lubricant systems as well as the abrasives.

In recent years, grinding machines have become more compact, axis path lengths have reduced, and machine controls have become more efficient.

Simultaneously WINTER has developed flute grinding wheels which meet these increasing requirements, and which now enable the improved machine capacities to deliver a higher and more economic output.

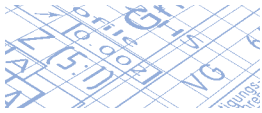


Matched to the application and the machine periphery WINTER flute grinding wheels are always the best solution.

Convince yourself of our high performance flute grinding solutions!

### Content:

Q-Flute <sup>2</sup> .....	4
Q-Flute <sup>+</sup> Dress .....	6
Diamond Dressing System (DDS) .....	7
µmicro <sup>+</sup> .....	8
K-plus 1421R .....	10
KSS 12N.....	10



# Flute grinding perfection - Solutions for each geometry

## Q-Flute<sup>2</sup>



This specification is the newest flute grinding development from Winter. With Q-Flute<sup>2</sup>, clearly increased Material Removal Rates (MRR) are possible whilst at the same time maintaining edge stability. Therefore Q-Flute<sup>2</sup> delivers the optimum combination of lifetime and free grinding behaviour.

In many cases dramatically increased feed rates with simultaneously longer dressing intervals have been achieved. The wheel wear per part is reduced accordingly.

### Fields of application:

The new Q-Flute<sup>2</sup> is the solution for all flute grinding applications in the diameter range  $\varnothing \geq 3$  mm. This bond system is applicable not only under oil but also under water and emulsion. It provides outstanding results for tungsten carbide tools as well as for HSS tools.

#### Specification

- D54 Q-Flute<sup>2</sup>
- B64 Q-Flute<sup>2</sup>
- D54 Q-Flute<sup>2</sup> W

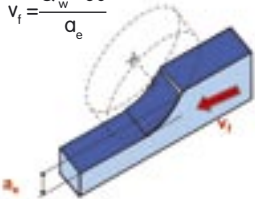
#### Application

- Tungsten carbide, oil
- High speed steel, oil
- Tungsten carbide, water based coolant

## Application guide

#### High Performance Grinding Wheels for Flute-Grinding.

$$v_f = \frac{Q'_w \cdot 60}{a_e}$$



Example: Q-Flute<sup>2</sup>  
( $Q'_w = 6 \text{ mm}^3 / \text{mm} \cdot \text{s}$ ,  $a_e = 4 \text{ mm}$ )  
 $v_f = \frac{6 \cdot 60}{4} = 90 \text{ mm/min}$

Test **start** with following parameter:

Q-Flute<sup>2</sup> Dress < D46  $Q'_w = 4 \text{ mm}^3 / \text{mm} \cdot \text{s}$

Q-Flute<sup>2</sup> Dress  $\geq$  D46  $Q'_w = 5 \text{ mm}^3 / \text{mm} \cdot \text{s}$

Q-Flute<sup>2</sup>  $Q'_w = 6 \text{ mm}^3 / \text{mm} \cdot \text{s}$

(If Infeed  $< a_e = 3 \text{ mm}$ ,  
Start with approx.  
 $v_f = 80 \text{ mm/min}$ )  
 $v_c 15...18 \text{ m/s}$

Important:  
Condition before first grinding.

		Feed rate $v_f$ [mm/min]																	
		30	40	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300
Infeed $a_e$ [mm]	3	1,5	2	2,5	3	3,5	4	4,5	5	6	7	8	9	10	11	12	13	14	15
	3,2	1,6	2,1	2,7	3,2	3,7	4,3	4,8	5,3	6,4	7,5	8,5	9,6	11	12	13	14	15	16
	3,4	1,7	2,3	2,8	3,4	4	4,5	5,1	5,7	6,8	7,9	9,1	10	11	12	14	15	16	17
	3,6	1,8	2,4	3	3,6	4,2	4,8	5,4	6	7,2	8,4	9,6	11	12	13	14	16	17	18
	3,8	1,9	2,5	3,2	3,8	4,4	5,1	5,7	6,3	7,6	8,9	10	11	13	14	15	16	18	19
	4	2	2,7	3,3	4	4,7	5,3	6	6,7	8	9,3	11	12	13	15	16	17	19	20
	4,2	2,1	2,8	3,5	4,2	4,9	5,6	6,3	7	8,4	9,8	11	13	14	15	17	18	20	21
	4,4	2,2	2,9	3,7	4,4	5,1	5,9	6,6	7,3	8,8	10	12	13	15	16	18	19	21	22
	4,6	2,3	3,1	3,8	4,6	5,4	6,1	6,9	7,7	9,2	11	12	14	15	17	18	20	21	23
	4,8	2,4	3,2	4	4,8	5,6	6,4	7,2	8	9,6	11	13	14	16	18	19	21	22	24
	5	2,5	3,3	4,2	5	5,8	6,7	7,5	8,3	10	12	13	15	17	18	20	22	23	25
	5,2	2,6	3,5	4,3	5,2	6,1	6,9	7,8	8,7	10	12	14	16	17	19	21	23	24	26
	5,4	2,7	3,6	4,5	5,4	6,3	7,2	8,1	9	11	13	14	16	18	20	22	23	25	27
	5,6	2,8	3,7	4,7	5,6	6,5	7,5	8,4	9,3	11	13	15	17	19	21	22	24	26	28
	5,8	2,9	3,9	4,8	5,8	6,8	7,7	8,7	9,7	12	14	15	17	19	21	23	25	27	29
	6	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30

Increase potential →

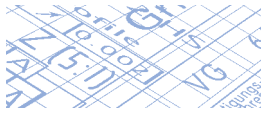
For  $a_e < 3 \text{ mm}$ : Start with ca.  $v_f = 80 \text{ mm/min}$

Starting parameters for Q-Flute<sup>2</sup> DRESS  $\geq$  D46

Starting parameters for Q-Flute<sup>2</sup> DRESS < D46

Starting parameters for Q-Flute<sup>2</sup>





# Flute grinding perfection - Solutions for each geometry

## Q-Flute<sup>2</sup> Case studies and stock programme

### Case study 1:

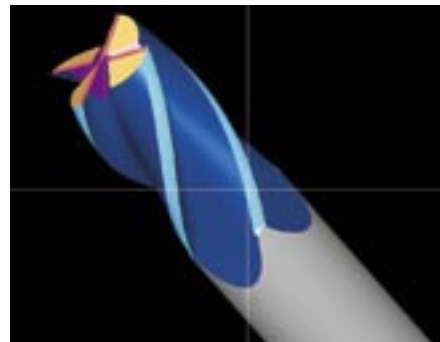


**Grinding wheel:** B64 Q-Flute<sup>2</sup>  
**Machine:** ITM, Coolant: Oil  
**Work piece:** HSS counter bore drill, Ø15 mm

**Operating parameters**  
 Feed rate:  $v_f = 150 \text{ mm/min}$   
 Depth of cut:  $a_e = 5 \text{ mm}$   
 Cutting speed:  $v_c = 35 \text{ m/s}$   
 MRR:  $Q_w^t = 12,5 \text{ mm}^3 / \text{mm} \cdot \text{s}$

**Benefit**  
 20% less grinding time  
 3 to 4 times longer dressing interval  
 Clearly less wear

### Case study 2:



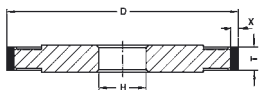
**Grinding wheel:** D54 Q-Flute<sup>2</sup>  
**Machine:** ANCA, Coolant: Oil  
**Work piece:** Tungsten carbide end mill, Ø12,5 mm

**Operating parameters**  
 Feed rate:  $v_f = 250 \text{ mm/min}$   
 Depth of cut:  $a_e = 4 \text{ mm}$   
 Cutting speed:  $v_c = 18 \text{ m/s}$   
 MRR:  $Q_w^t = 16 \text{ mm}^3 / \text{mm} \cdot \text{s}$

**Benefit**  
 25% higher feed rate  
 Dramatic grinding time savings  
 Significant cost reductions

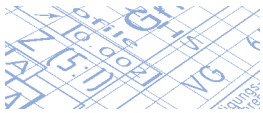
### Stock programme:

Grinding wheel shape according to FEPA 1A1



Shape	D	T	X	H	Grit size	Bond	Concentration	Order No.	Remarks
SP 1A1	100	8	10	20	D54	Q-Flute <sup>2</sup>	-	60157687140	
SP 1A1	100	10	10	20	D54	Q-Flute <sup>2</sup>	-	60157680365	
SP 1A1	100	12	10	20	D54	Q-Flute <sup>2</sup>	-	60157697235	
SP 1A1	100	15	10	20	D54	Q-Flute <sup>2</sup>	-	60157680730	
SP 1A1	125	8	10	20	D54	Q-Flute <sup>2</sup>	-	66260113945	
SP 1A1	125	10	10	20	D54	Q-Flute <sup>2</sup>	-	60157688224	
SP 1A1	125	12	10	20	D54	Q-Flute <sup>2</sup>	-	60157687848	
SP 1A1	125	15	10	20	D54	Q-Flute <sup>2</sup>	-	66260117916	





# Flute grinding perfection - Solutions for each geometry

## Q-Flute+ Dress



**Innovative flute grinding with precise CNC- dressing on the grinding machine**

Each tool change on the grinding machine causes a degree of unbalance and run-out, because the new grinding wheel surface is never exactly concentric to the wheel spindle axis.

In order to meet the highest level of round tool accuracy, WINTER has developed Q-Flute+ Dress. Innovative flute grinding is combined with precise CNC Touch-Dressing, to meet today's demands.

This novel technology enables very high quality main and minor tool edge generation without adversely affecting grinding performance. By regularly regenerating the wheel topography, closer part tolerances and fully automatic "lights-out" shift operations are possible.

### Fields of application:

Besides outstanding dressability, Q-Flute+ Dress shows an excellent grinding behaviour, especially within the fine grit range.

Therefore Q-Flute+ Dress is widely applicable.

#### Specification

D25...D107 Q-Flute+ Dress

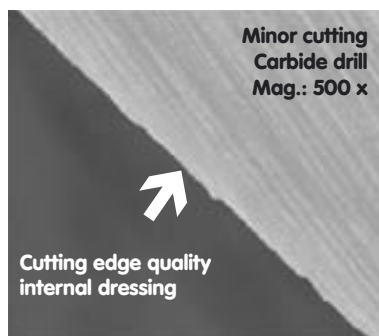
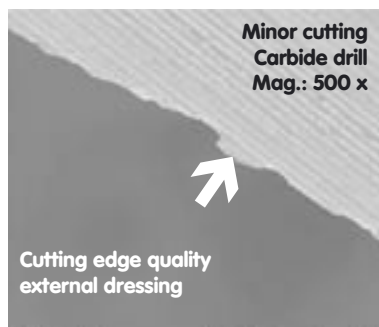
B35...B126 Q-Flute+ Dress

#### Application

Tungsten carbide, mostly oil

High speed steel, mostly oil

### Case study:



#### Grinding wheel:

#### Dressing tool:

#### Machine:

#### Work piece:

#### Operating parameters

Feed rate:

Depth of cut:

Cutting speed:

MRR:

D64 Q-Flute+ Dress

WINTER DDS form roller

Walter Helitronic, Coolant: Oil

Tungsten carbide end mill;  
Ø16 mm

$v_f = 150 \text{ mm/min}$

$a_e = 3,2 \text{ mm}$

$v_c = 18 \text{ m/s}$

$Q'_w = 8 \text{ mm}^3 / \text{mm s}$

#### Dressing parameters:

RPM grinding wheel:

RPM roller dresser:

Speed ratio:

Overlap ratio:

Dressing infeed:

$n_s = 2750 \text{ min}^{-1}$ ,

$n_r = 2005 \text{ min}^{-1}$

$q_d = 0,7$

$U_d = 3$

$a_{ed} = 3 \mu\text{m}$

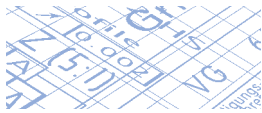
#### Benefit

Perfect edge qualities

Accurate profile stability

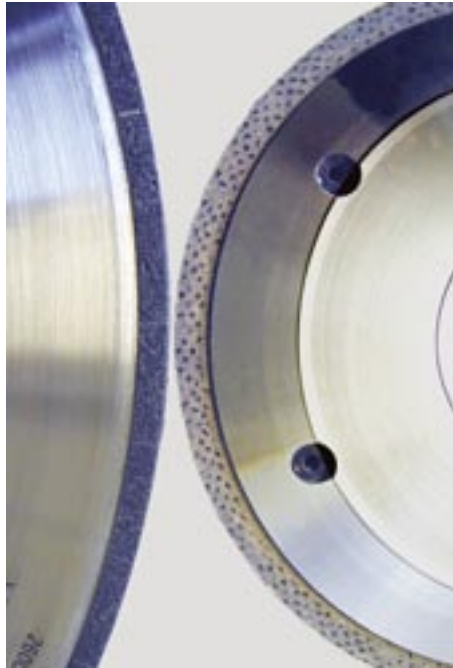
Close tolerance fields





# Flute grinding perfection - Solutions for each geometry

## WINTER Diamond Dressing System (DDS)



The Diamond Dressing system (DDS) allows diamond grinding wheels to be dressed under CNC control on production grinders.

Despite the extreme hardness of diamond in both the grinding wheel and dressing disc, the dressing parameters and results are similar to those found when dressing softer abrasive materials such as Al<sub>2</sub>O<sub>3</sub>, SiC, SG, TG and CBN.

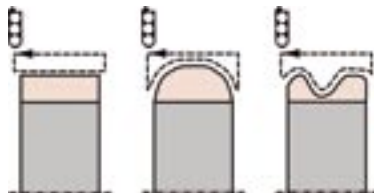
The working results can also be influenced by contact ratio and speed ratio as usual.

Recommended dressing parameters for



Speed ratio	$q_d = 0,6...0,9$
Overlap ratio	$U_d = 2...6$
Dressing infeed	$a_{ed} = 1...10 \mu\text{m}$

### Profile examples:



CNC- controlled Dressing on the production machine

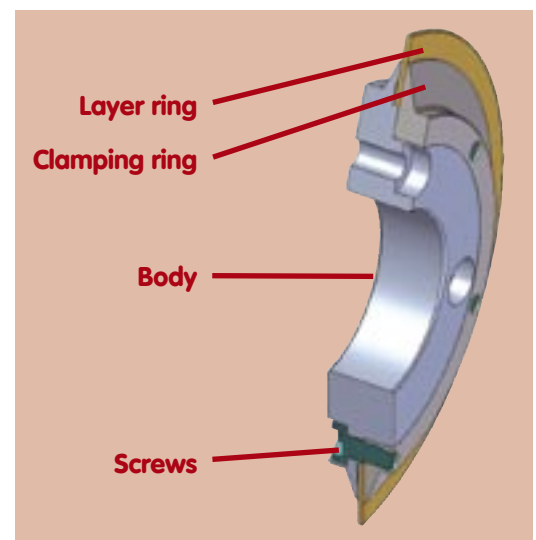
- Precise profile accuracy
- Easy to automate
- Dressing at production speeds

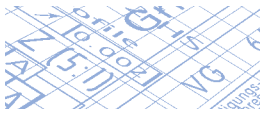
### Properties:

The DDS profile roller consists of a single set layer of sintered diamond which is clamped in a two-piece steel holder. This ensures a constant layer width with a consistently high active diamond component throughout its entire service life.

The design permits the highest possible degree of flexibility when dressing different profiles in a single working cycle.

The only requirement is a grinding machine with CNC dressing spindle and an Acoustic Emission contact sensor. With this new dressing system a broad range of different profiles can be created in a single working step.





# Flute grinding perfection - Solutions for each geometry

## micro+



As well as innovation in new materials and tool designs, the recent trend to miniturisation has become more important.

From Mini- and micro- down to nano-tools, nowadays tools with diameters under 0.1mm are becoming commonplace. The production of these tools demands special grinding wheels with very small and sturdy edge radii.

The tools of the WINTER micro+ series are specifically developed for these requirements characterised by their edge stability.

### Fields of application

---

Classic areas of application for WINTER micro+ products are mini and micro drills and end mills for electronics and medical technology. In addition, WINTER micro+ grinding wheels can be used for more traditional processes e.g. the production of burrs.

Specification		Application
D15A...D15C	micro+ 2013 C150	0,05 mm – 0,75 mm
D20A...D25	micro+ 2012 C150	0,75 mm – 2 mm
D46...D64	micro+ 2062 C135	Rotary tools up to ½ "

### Dressing recommendations:

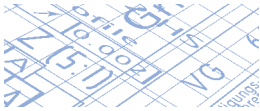
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Beside the right grinding wheels for flute grinding SAINT-GOBAIN also offers the compatible dressing wheels.

Specification	Field of application
NORTON 39C400 FB5	D7...D15C micro+
NORTON 39C320 HB5	D20A...D25 micro+
NORTON 39C240 HB5	D25...D54 micro+ / Q-Flute+ Dress
NORTON 39C180 HB5	D54...D91 Q-Flute+ Dress / Q-Flute <sup>2</sup>

Contact address for NORTON- Abrasives, Wesseling, see backside.





# Flute grinding perfection - Solutions for each geometry

## WINTER micro+ case studies

### Case study 1:



**Grinding wheel:** D54 micro+ 2062 C135 A  
**Machine:** Kirner K360, Coolant: Oil  
**Work piece:** Tungsten carbide burr; Ø 1/2"

#### Operating parameters

Right-hand fluting:

Feed rate:  $v_f = 270 \text{ mm/min}$   
 Depth of cut:  $a_e = \text{ca. } 0,7 \text{ mm}$   
 Cutting speed:  $v_c = 28 \text{ m/s}$   
 MRR:  $Q_w' = 3,15 \text{ mm}^3 / \text{mm} \cdot \text{s}$

Left-hand fluting:

Feed rate:  $v_f = 1080 \text{ mm/min}$   
 Depth of cut:  $v_c = 28 \text{ m/s}$

#### Benefit

Up to 50% increased feed rate  
 Impressive capacity progression  
 Enormous cost reductions

### Case study 2:



**Grinding wheel:** D25 micro+ 2012 C150 A  
**Machine:** Rollomatic 620XS, Coolant: Oil  
**Work piece::** Tungsten carbide ball nose end mill; Ø 2 mm

#### Operating parameters

Feed rate:  $v_f = 25 \text{ mm/min}$   
 Depth of cut:  $a_e = 0,5 \text{ mm}$   
 Cutting speed:  $v_c = 28 \text{ m/s}$

#### Benefit

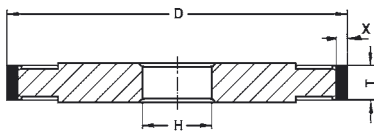
Perfect edge qualities  
 Accurate profile stability  
 Longer dressing intervals



# Flute grinding perfection - Solutions for each geometry

## 1A1 Stock programme for re-sharpening

Grinding wheel shape according to FEPA **1A1**



### WINTER

#### For carbide tools

Shape	- D - T - X - H	Grit size	Bond	Concentration	ORDER NO.	Remarks
K 1A1	- 75 - 10 - 5 - 20	D64	K-plus 1421 R	C100H	66260339426	
K 1A1	- 100 - 10 - 5 - 20	D64	K-plus 1421 R	C100H	66260339422	
K 1A1	- 100 - 10 - 5 - 20	D91	K-plus 1421 J	C75A	66260356902	
K 1A1	- 100 - 12 - 5 - 20	D64	K-plus 1421 R	C100H	66260347629	
K 1A1	- 100 - 15 - 5 - 20	D64	K-plus 1421 R	C100H	66260339419	
K 1A1	- 100 - 15 - 5 - 20	D91	K-plus 1421 J	C75A	66260355621	
K 1A1	- 125 - 5 - 10 - 20	D64	K-plus 1421 R	C100A	66260350079	
K 1A1	- 125 - 10 - 10 - 20	D64	K-plus 1421 R	C100A	66260341750	
K 1A1	- 125 - 12 - 10 - 20	D64	K-plus 1421 R	C100A	66260352659	
K 1A1	- 125 - 16 - 10 - 20	D64	K-plus 1421 J	C100A	66260351497	
K 1A1	- 150 - 12 - 10 - 20	D64	K-plus 1421 R	C100A	66260352657	

Application depending on software of machine manufacturer:  
For flute grinding, periphery grinding, relief grinding, radius sharpening.

#### For HSS tools

Shape	- D - T - X - H	Grit size	Bond	Concentration	ORDER NO.	Remarks
K 1A1	- 75 - 10 - 5 - 20	B107	KSS 12 N	V240H	66260352656	)
K 1A1	- 100 - 10 - 5 - 20	B107	KSS 12 N	V240H	66260352654	
K 1A1	- 100 - 15 - 5 - 20	B107	KSS 12 N	V240H	66260347909	
K 1A1	- 125 - 10 - 5 - 20	B107	KSS 12 N	V240A	66260352653	
K 1A1	- 150 - 12 - 5 - 20	B107	KSS 12 N	V240A	66260352652	

Application depending on software of machine manufacturer:  
For flute grinding, periphery grinding, relief grinding, radius sharpening.

) Delivery within four weeks.

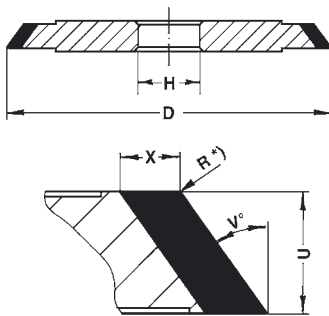




# Flute grinding perfection - Solutions for each geometry

## TV1 / 14V1 Stock programme for re-sharpening

Grinding wheel shape according to FEPA **TV1 / 14V1**



\*) Radius only at extra labeled explanations. See remarks.

### WINTER

#### For carbide tools

Shape	D	U	X	V°	H	Grit size	Bond	Concentration	ORDER NO.	Remarks
1K TV1	75	10	5	10	20	D64	K-plus1421 R	C100H	66260339433	
1K TV1	100	10	5	10	20	D64	K-plus1421 R	C100H	66260339432	
1K TV1	100	15	5	10	20	D64	K-plus1421 R	C100H	66260339431	)
K TV1	100	15	5	20	20	D64	K-plus1421 R	C100H	66260347907	
K TV1	100	15	5	30	20	D64	K-plus1421 R	C100H	66260342813	
K TV1	100	15	5	45	20	D64	K-plus1421 R	C100H	66260352665	
1K 14V1	125	4	6	45	20	D64	K-plus921	C100A	66260352637	
1K TV1	125	6	5	20	20	D64	K-plus1421 R	C100A	66260117593	Hertel SE-Drill R = 0,2
1K TV1	125	10	5	10	20	D64	K-plus1421 R	C100A	66260352633	
3K TV1	125	10	5	20	20	D64	K-plus1421 R	C100A	66260346267	Hertel SE-Drill R = 0,5
1K TV1	125	10	5	30	20	D64	K-plus1421 R	C100A	66260115545	
1K TV1	125	10	5	45	20	D64	K-plus1421 R	C100A	66260352664	
1K TV1	125	15	5	10	20	D64	K-plus1421 R	C100A	66260352641	
1K TV1	125	15	5	20	20	D64	K-plus1421 R	C100A	66260345983	Hertel SE-Drill R = 0,9
K TV1	125	15	5	30	20	D64	K-plus1421 R	C100A	66260352640	)
K TV1	125	15	5	45	20	D64	K-plus1421 R	C100A	66260352639	
1K 14V1	150	4	5	45	20	D91	K-plus921	C100A	66260131709	)
K TV1	150	12	5	15	20	D64	K-plus1421 R	C100A	66260119886	)

Application depending on software of machine manufacturer: For flute grinding, end and end relief thinning, drill sharpening (in some cases Hertel SE drill).

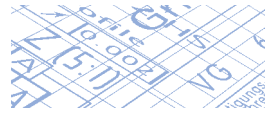
) Delivery within four weeks.

#### For HSS tools

Shape	D	U	X	V°	H	Grit size	Bond	Concentration	ORDER NO.	Remarks
1K TV1	75	10	5	10	20	B107	KSS 12 N	V240H	66260119689	
1K TV1	100	10	5	10	20	B107	KSS 12 N	V240H	66260127891	)
1K TV1	100	15	5	10	20	B107	KSS 12 N	V240H	66260116353	
K TV1	100	15	5	20	20	B107	KSS 12 N	V240H	66260115554	
K TV1	100	15	5	30	20	B107	KSS 12 N	V240H	66260115756	
K TV1	100	15	5	45	20	B107	KSS 12 N	V240H	66260352663	
1K TV1	125	12	5	10	20	B107	KSS 12 N	V240A	66260119462	
1K TV1	125	12	5	45	20	B107	KSS 12 N	V240A	66260352661	
1K 14V1	150	4	5	45	20	B107	KSS 12 N	V240A	66260131441	)
K TV1	150	12	5	15	20	B107	KSS 12 N	V240A	66260127964	)

Application depending on software of machine manufacturer: For flute grinding, end and end relief thinning, drill sharpening.

) Delivery within four weeks.



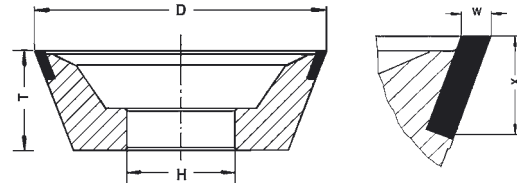
# Flute grinding perfection - Solutions for each geometry

## Excerpt from our CNC grinding wheel programme

Saint-Gobain has also been active in the development of new wheel specifications for other grinding processes in shank tool production. Higher and more consistent wheel wear resistance has been achieved to enable automatic production on modern CNC machines.

An example is the particularly edge-stable WINTER 11V9 grinding wheel specification, W+3060, for highest efficiency tool manufacturing.

Grinding wheel  
shape according  
to FEPA **11V9**



## WINTER

### For carbide tools

Shape	D	W	X	H	Grit size	Bond	Concentration	ORDER NO.	Remarks
2 SP 11V9	75	2	10	20	D46	W-plus 3060	C125H	66260118286	T = 30
2 SP 11V9	100	2	10	20	D46	W-plus 3060	C125H	66260346785	T = 35

Application depending on software of machine manufacturer:  
For flute grinding, periphery grinding, relief grinding, radius sharpening.

Our complete CNC program is described in the catalogue "Diamond and CBN grinding wheels and conventional grinding wheels specially for application on CNC tool grinding machines".

On request we will gladly send you the catalogue.

For your enquiries please contact:

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