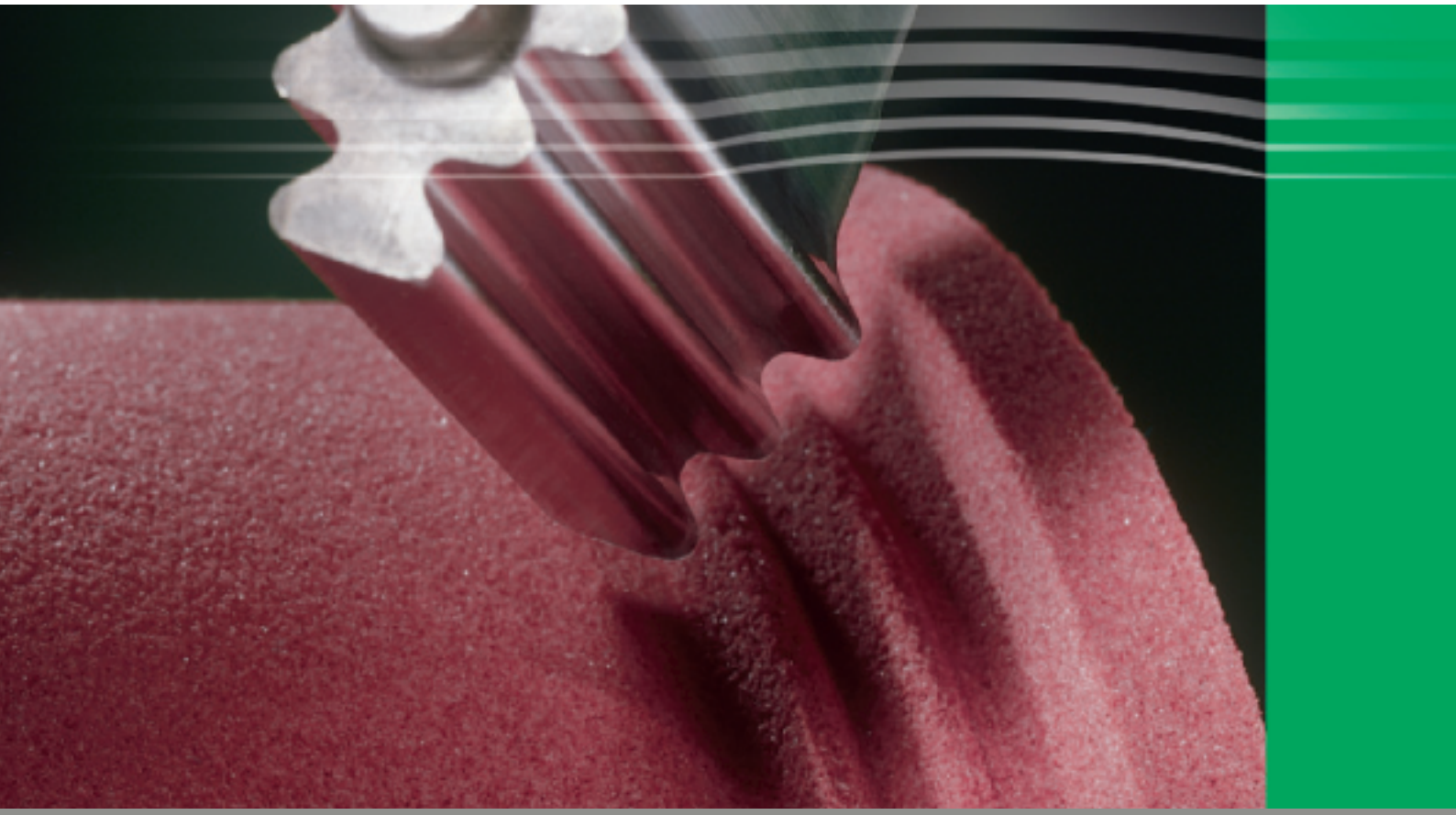
WINTERTHUR
TECHNOLOGY GROUP

PRECISION GRINDING WHEELS
2011 CATALOGUE



ENGLISH

WENDT | SlipNaxos | RAPPOLD | WINTERTHUR

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A SHORT OUTLINE

The Winterthur Technology Group (WTG), at the time of writing, is still listed on the Swiss stock exchange, consists of four traditional manufacturers of abrasive tools. In April 2011 the WTG was acquired by 3M.

WTG is one of the three largest manufacturers of bonded abrasives in Europe with a total of 15 factories, some of which are located outside of Europe: such as in the USA and in China, for example.

All of the four members of the Group look back on many years of experience and know-how. These are, Winterthur Schleiftechnik, Wendt GmbH, SlipNaxos and Rappold. Together, to offer the comprehensive portfolio of grinding tools and diamond dressing rolls in the market place, allowing customers to source all their grinding needs from one source. The full range of products is supported by an extensive service package which encompasses customer training courses, process analysis, grinding software and tool management, to name just a few.

Winterthur Schleiftechnik AG, Switzerland

Formed in 1906, Winterthur has a long tradition in making vitrified precision grinding wheels. Given its close proximity to many of the world's best grinding machines, Winterthur enjoy a close cooperation with machine tool OEMs, and hence, maintains its cutting edge technology along with any new developments in the field of grinding engineering.

WENDT GmbH, Meerbusch, Germany

WENDT is leading manufacturer of superabrasives tools (CBN and Diamond) and also of CNC tool grinding machines for grinding hard materials such as PCD, ceramics, glass and tungsten carbide. Making tools and machine tools embodies the core philosophy of "system approach"

Rappold, Villach, Austria

Rappold was formed in 1876 as has specialized itself in making large diameter cut-off wheels for the steel industry. Furthermore, today it hosts the Group's largest manufacturing unit for vitrified precision grinding wheels.

SlipNaxos, Västervik, Sweden

SlipNaxos was formed in 1920 and has specialized in making hot-pressed grinding wheels for the steel industry for the grinding of slabs and billets. Furthermore, the product range consists of roll grinding and centerless grinding wheels for the steel industry and large diameter precision grinding wheels for cam and crankshaft grinding.

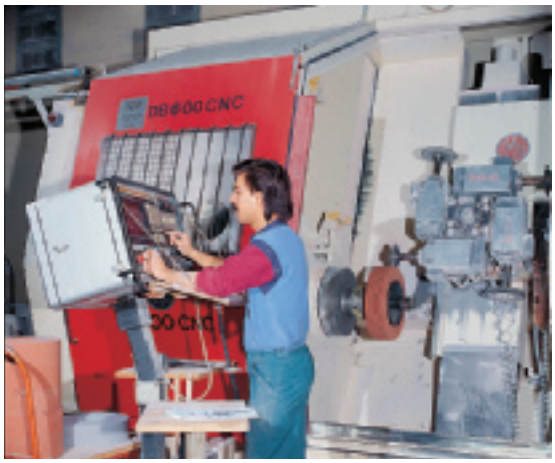
Winterthur, August 2011

QUALITY FIRST

To manufacture grinding wheels to our high standard we use only the finest raw materials, which are always subjected to rigorous quality controls. To satisfy today's and tomorrow's customer needs, we continually invest in modern machinery and equipment to keep the plant in line with the latest manufacturing technology.

NC-controlled presses ensure the exact duplication of the homogenous wheel structure.

Electronically controlled periodic kiln firing curves guarantee consistent quality.



CNC-controlled machine tools are used for precise profiling and machining.

Winterthur grinding wheels are checked for imbalance in a single operation on a computer controlled machine.

INTERNET STOCK LIST

Rappold-Winterthur have a stock policy which ensures a high degree of grinding wheel availability. Wheels can be altered to the required dimensions in a short period. Wheel blanks can be given face profiles, recesses, larger bores, smaller diameters and reduced thickness. (See illustration on the right).

The stock list is available in printed form or can be consulted directly on our homepage or downloaded from it.

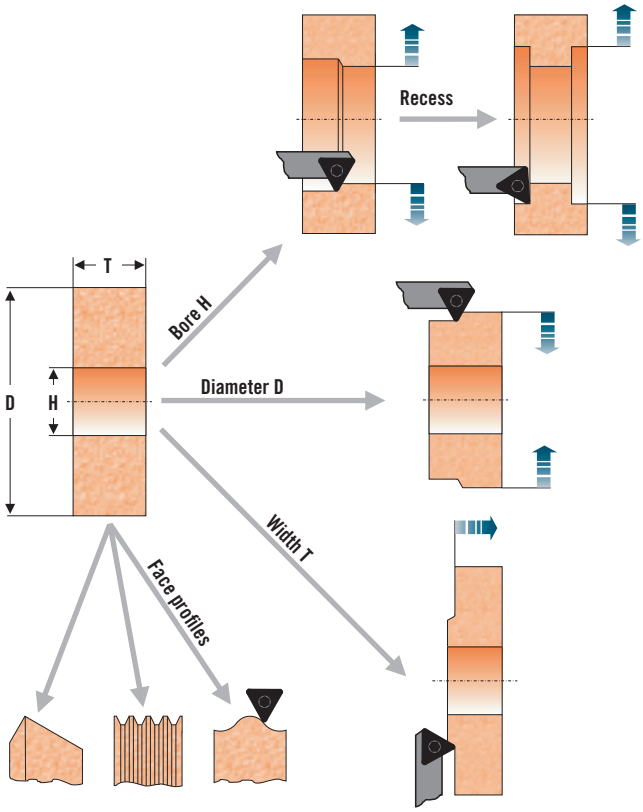
WINTERTHUR HOMEPAGE

Our homepage is a practical, customer oriented tool. It offers direct access to the following information:

- Up-to-date stocklist
- Adresses of all sister companies and agencies
- Product catalogues
- Trade show participation
- Links to grinding machine tool manufacturers
- Quality and environmental policies
- News on products and services

www.winterthurtechnology.com

ALTERATION OF STOCK WHEELS



OPTIMIMAZATION OF GRINDING PROCESS PARAMETERS

The development of grinding wheels ran parallel to the advances in grinding machine tool technology. Today, we have sophisticated tools and machines at our disposal. To combine these elements and to optimize the grinding process, however, was left in the main to the user in the factory or workshop. There are more factors than just the machine tool and the grinding wheel which influence the grinding process. In fact, the German Society of Engineers (VDI) distinguishes between over 100 factors. The illustration below of a chain of factors just shows the main influences.

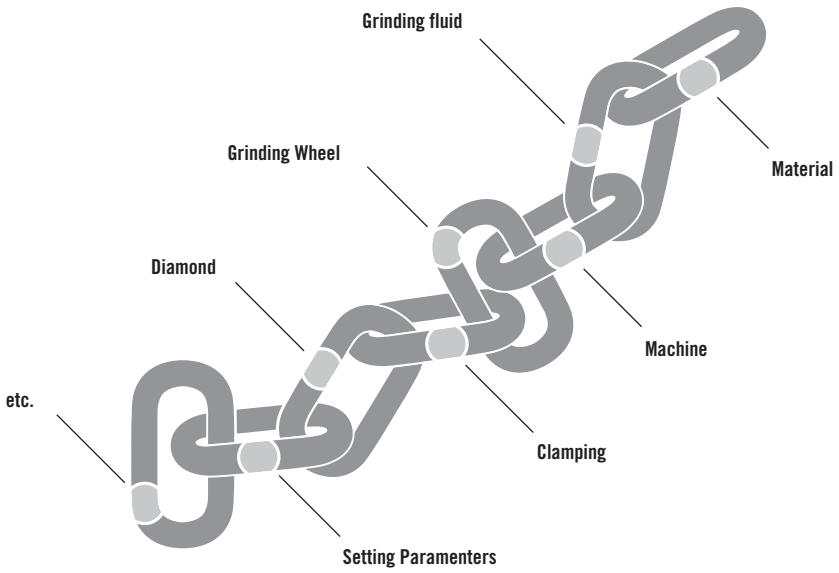
To optimize a grinding process, the factors such as machine tool, workpiece requirements, grinding wheel, grinding fluid and diamond dressing tools have to be balanced within the total system. Manual process optimization can be time-consuming and therefore costly. Supported by the OPTIMA software, Winterthur engineers can offer specific solutions as part of our customer service.

OPTIMA SOFTWARE

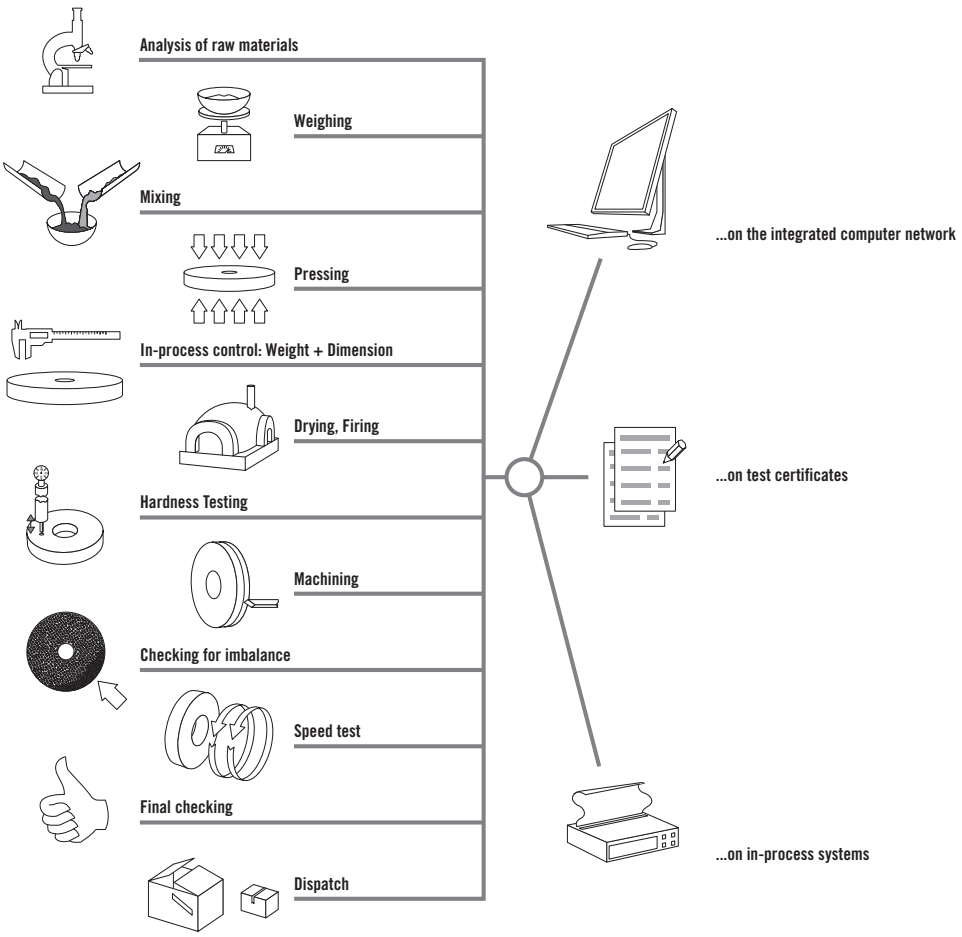
The computer based support can provide customers with process parameters for the following:

- Cylindrical grinding (OD & ID)
- Creep-feed grinding
- Gear grinding (Reishauer. Liebherr, Höfler, Niles, etc.)
- Centerless grinding
- Diamond dressing with fixed and rotary dressers
- Grinding fluid flow rates, nozzle design and tank capacity requirements

For more information, please contact your Winterthur grinding engineer or representative.



WINTERTHUR QUALITY ASSURANCE ISO 9001



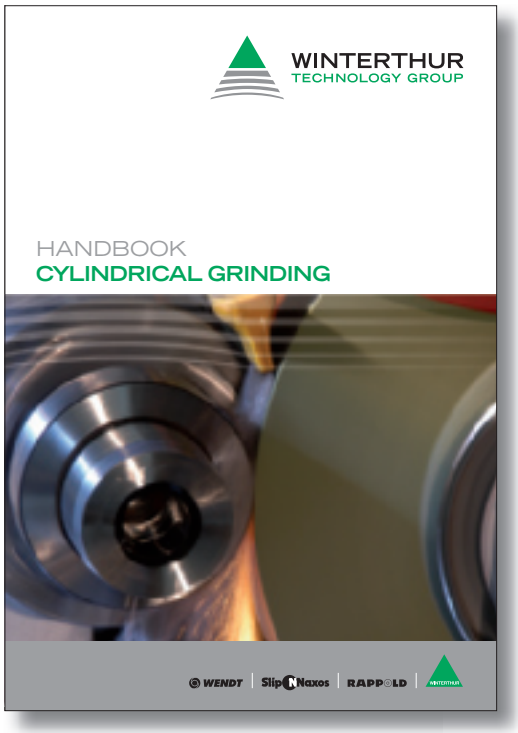
WINTERTHUR'S ENVIRONMENTAL POLICY ISO 14001

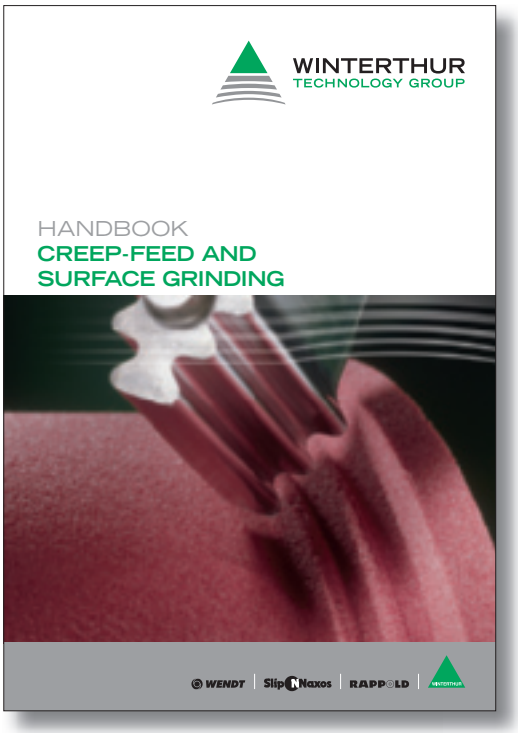
ISO 9001
ISO 14001

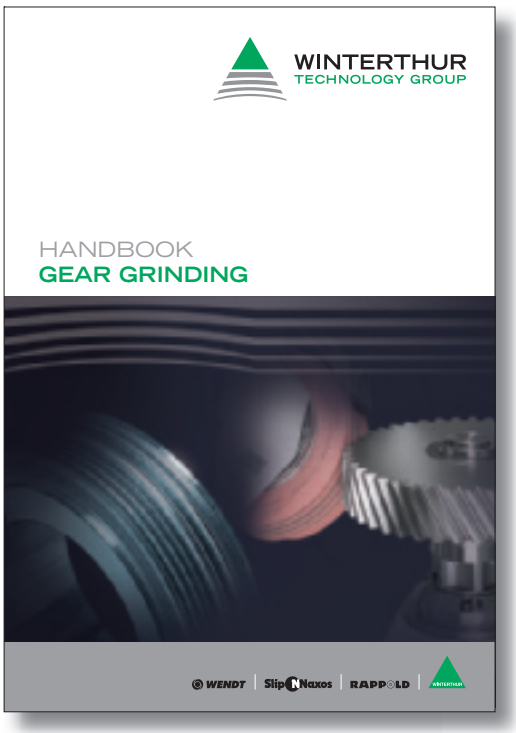
Our resposibility towards Nature an our Customers:

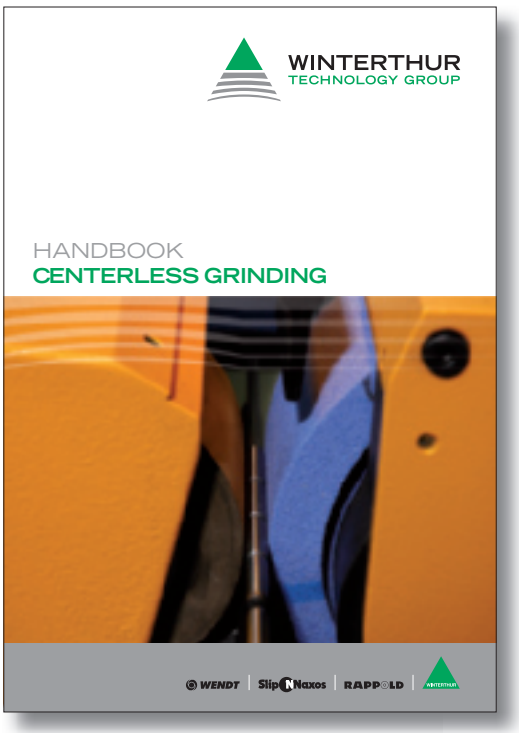
- non-toxic raw materials and production processes
- non-toxic disposable final products
- low energy consupmtion
- recycling of materials and energy at plant

AVAILABLE CATALOGUES









INDUCED POROSITY WHEELS

Winterthur Schleiftechnik has been one of the pioneers of induced porosity (open structure) wheels and, today, remains second to none in this field. Why use induced porosity wheels in the first place? Ask most grinding engineers and they will give you two reasons:

- Open structure wheels provide chip clearance for high material removal.
- Open structure wheels transport more coolant into the arc of cut while decreasing friction.

These are good and valid reasons. Most importantly, however, open structure wheels optimise the self-sharpening process.

If self-sharpening does not take place, heat damage to the workpiece will follow. In creep-feed grinding we have a very large area of contact A_k. If a standard structure were used the grinding pressure would be distributed over too many abrasive grits in the given contact area A_k, and the pressure on the individual grit would be insufficent to make it fracture and thus self-sharpening could not take place.

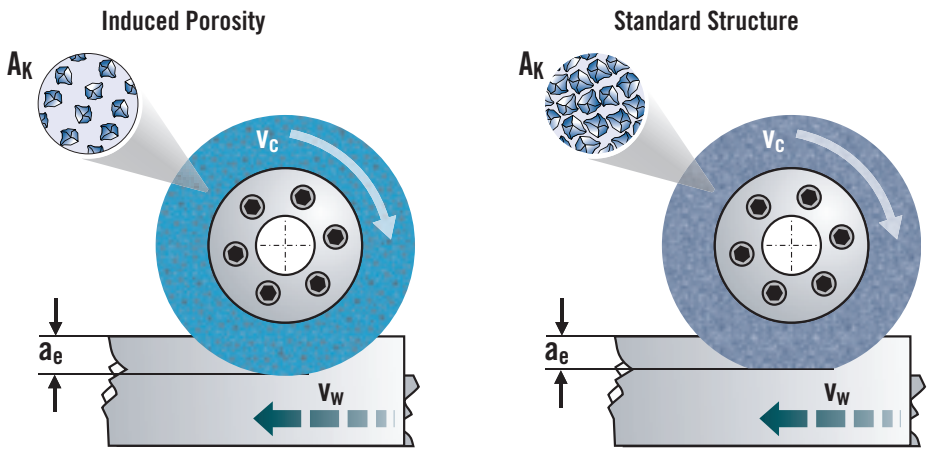
The wheel illustrated below on the left features induced porosity to spread out the abrasive grits over the contact area, thus improving self-sharpening. Winterthur uses naphthalene as its pore inducing agent which has the following advantages:

- does not leave any chemical traces in a finished grinding wheel.
- does not expand while being removed (no stresses are introduced into wheel).
- mixes well with abrasive grit (low imbalance in finished product).
- makes for interlinked porosity for superior grinding fluid delivery (cool cutting).

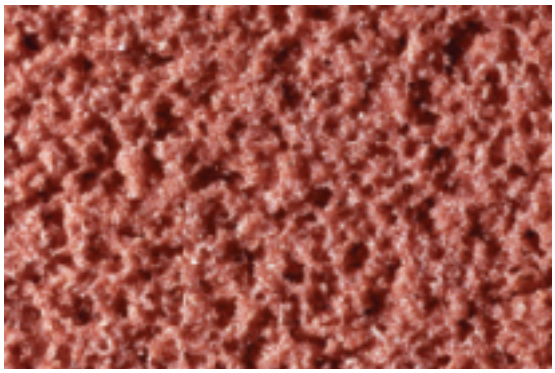
The following page shows some good examples of highly homogenous, induced porosity open structure wheels.

In every Grinding Process, the Abrasive must Fracture to Remain Sharp and Cool Cutting.

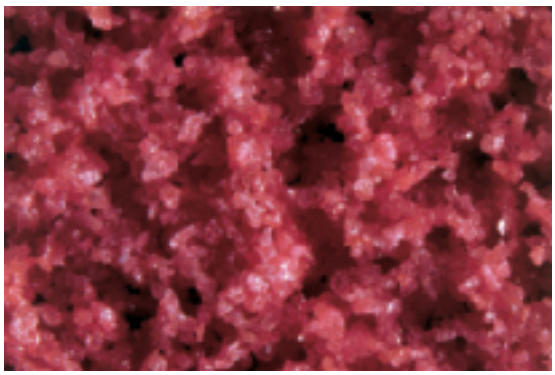
Contact Area (A_k): Creep-feed vs. Reciprocating



INDUCED POROSITY OR OPEN STRUCTURE WHEELS



53A120 L15VPMF
medium-fine induced porosity for cylindrical grinding



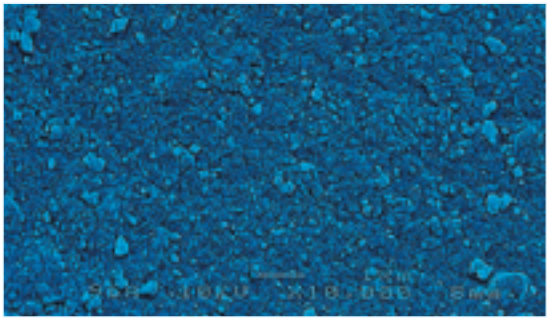
57A46 H18VPHHGG
very high induced porosity with large pores for very high material removal rates; mostly used for aerospace turbine blade components.

93A AND 93S MICRO-CRYSTALLINE

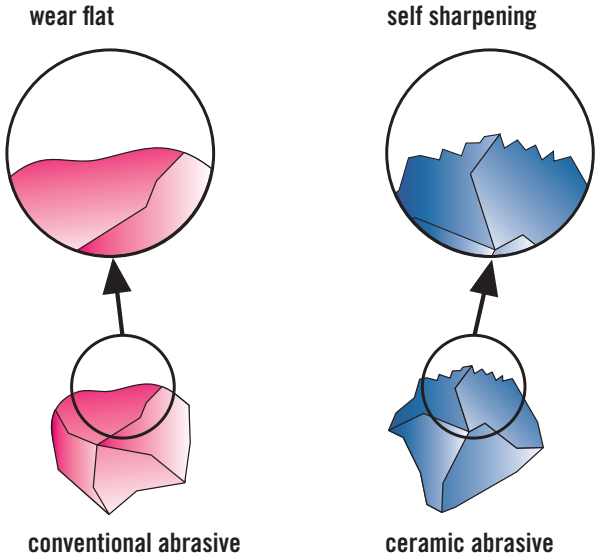
The remarkable increase in performance across the whole spectrum of grinding, compared to using conventional white or pink aluminium oxide wheels, is largely due to the unique micro-structure of the 93A and 93S grains.

The sub-micron particles making up individual 93A and 93S grains are a result of a special sintering process. Grinding pressure induces micro-fracturing within the grain matrix and continually creates and exposes sharp cutting edges, avoiding the development of wear flats as observed with conventional aluminium oxide.

To fully exploit the inherent potential of the micro-fracturing and the self-sharpening properties, a specifically matched bond system had to be developed.

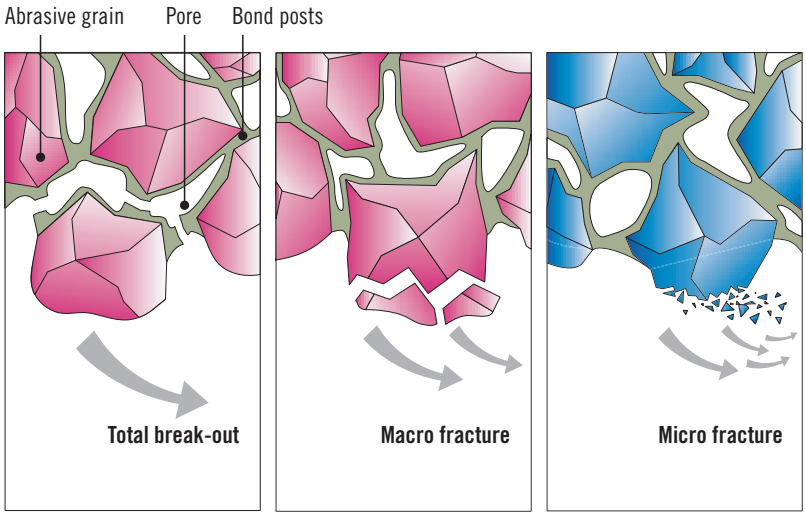


Electron microscpoe enlargement: 10,000 x



PERFORMANCE PROPERTIES

- High metal removal rates translate into shorter cycle times
- Longer wheel life results in fewer wheel changes
- Constant cutting performance at low grinding forces
- Consistent quality due to excellent form holding
- Cool cutting due to constant self-sharpening action
- Less frequent dressing cycles



Benefits:

Consistent overall quality, shorter cycle times and lower grinding costs per part.

NANOWIN™ GRINDING WHEELS 93N

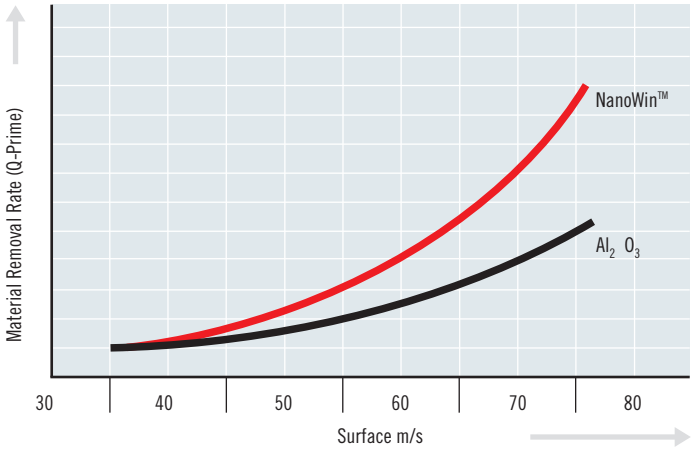
NanoWin™ grinding wheels have the surface of the grain-bond-system modified with self-organising nano-surface structures which prevent cold welding of chips and also any loading with other debris. As a consequence, the grinding wheel remains free-cutting, requires less machine spindle power and achieves constant surface finishes without causing any thermal damage to the workpiece.

Advantages at a single glance:

- Burn-free grinding
- High metal removal rates
- Constant surface finishes
- Smaller mechanical deformation of workpieces
- Easily controllable process conditions
- Cost savings

Cost-effective Grinding with NanoWin™

In comparison to standard aluminium oxide wheel, (Al_2O_3), NanoWin™ grinding wheels lead to higher material removal rates (Q-primes or Q_w') at lower risk of burning and at lower reject rates. Conclusion: the grinding process becomes more economical at higher quality levels. The higher material removal rates come particularly into their own the higher the surface speed can be applied.



WINTERTHUR QUALITIES

Index	Description
A	Regular aluminium oxide
3A	Semi-pure aluminium oxide
5A	Blend of semi-pure and white aluminium oxide
25A	Blend of special monocrystalline and white aluminium oxide
28A	Blend of special monocrystalline and white aluminium oxide
29A	Special monocrystalline aluminium oxide
31A	Blend of regular, semi-pure and white aluminium oxide
33A	Blend of semi-pure and ruby aluminium oxide
35A	Blend of semi-pure and white aluminium oxide
42A	White aluminium oxide with white bond
49A	White aluminium oxide with light blue bond
53A	White aluminium oxide with brown bond
54A	White aluminium oxide with green bond
55N	Special abrasive (NanoWin)
57A	Pink aluminium oxide
64A	Blend of monocrystalline and pink aluminium oxide
68A	Ruby aluminium oxide
77A	Special aluminium oxide
79A	Ceramic aluminium oxide (30%) blended with ruby and monocrystalline aluminium oxide
81A	Ceramic aluminium oxide (10%)
85A	Ceramic aluminium oxide (20%)
93A	Ceramic aluminium oxide (30%)
93N	Special abrasive (NanoWin)
93S	Ceramic aluminium oxide (30%)
32B	CBN
11C	Silicon carbide (green)
1D	Diamond (vitrified bond)

KEY TO WINTERTHUR'S WHEEL SPECIFICATIONS

Abrasive Index/ Type	Grit Size	Wheel Grade	Wheel structure
Vitrified bonds	very coarse	extremely soft	natural porosity
C	12	C	1
11C	14	D	2
27A	coarse	very soft	3
28A	16	E	4
29A	24	F	5
31A	36	soft	6
42A	medium	G	7
49A	46	H	8
53A	54	J	9
57A	60	medium hard	10 (puddled wheel)
61A	70	K	porous structures
62A	80	L	11
63A	fine	M	12
64A	90	hard	13
65A	100	N	14
67A	120	O	15
69A	150	P	16
77A	180	Q	17
92A	220	very hard	18
93A	very fine	R	19
resin bond	240	S	20
C	280	T	
11C	320		
A	400		
31A	500		
42A	600		
AC	800		
ZA			
resin bond/ reinforced			
C			
A			

Special Symbols	Bond Type
P = porous structure	V = vitrified bond
L = low porosity	BW = resin bold
M = medium porosity	BFW = resin bold /reinforced
H = high porosity	
HH = very high porosity	
G = large pores	
GG = very large pores	
F = fine pores	
FF = very fine pores	
SR = special formula	

Example: 64A60H15VP

- vitrified bond 64A
- medium grain size of 60
- soft wheel grade H
- wheel structure 15
- vitrified bond type
- induced porosity

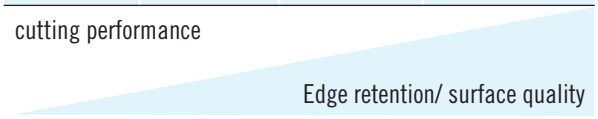
GRAIN SIZES

The assignment of numbers to specific grain size distributions has been determined on the basis of an internationally applicable standard. Extremely fine grains (micro-grains: approx. grain > 240) are obtained by sedimentation. Finer grains are less brittle and harder to break out of a bond. For this reason, a wheel with fine grains appears harder than a wheel within the identical range of wheel hardness but with coarse grains.

The surface roughness generated during the grinding action is less dependent on the abrasive grain size selected than on the actual dressing and grinding process. Coarse grinding wheels are more efficient, but produce a rougher surface. Grinding profiles or small radii considerably influence the selection of grain size. The manner in which the wheel is mounted and trued must be taken into consideration

Grain nos.	Dimension (mm)	Dimension (mm)	Hardness grade
	from	to	
8	2.83	2.00	very coarse
10	2.38	1.68	
12	2.00	1.41	
14	1.68	1.19	
16	1.41	1.00	coarse
20	1.19	0.84	
24	0.84	0.60	
30	0.71	0.50	
36	0.60	0.42	
46	0.42	0.30	medium
54	0.35	0.25	
60	0.30	0.21	
70	0.25	0.18	
80	0.21	0.15	
90	0.18	0.13	fine
100	0.15	0.11	
120	0.13	0.09	
150	0.11	0.06	
180	0.09	0.05	
220	0.075	0.045	
240	0.047	0.043	very fine
280	0.038	0.035	
320	0.031	0.028	
400	0.018	0.016	
500	0.014	0.012	
600	0.010	0.008	
800	0.008	0.006	
1000	0.005	0.004	
1200	0.004	0.003	

Cutting performance		Edge retention/ Surface quality	
coarse	medium	fine	very fine
20-36	46-80	90-220	240-600



Hardness

The term „hardness of grinding wheels“ does not refer to the abrasive grain, but designates the resistance of the bond to grains being removed during the grinding process. In other words, grain particles break out of a soft wheel more readily than out of a hard wheel. The letters A to Z characterise the degree of hardness, with A referring to the softest and Z to the hardest grade.

Lettre symbols	Hardness grade
A / B / C / D /	extremely soft
E / F	very soft
G / H	soft
J / K / L	medium
M / N / O / P	hard
Q / R / S / T	very hard
U / V / W / X / Y / Z	extremely hard

Within each grade of wheel hardness (for example hardness F), a grinding wheel with fine grains and fine pores acts „harder“ during the grinding process than one with large grains and large pores.

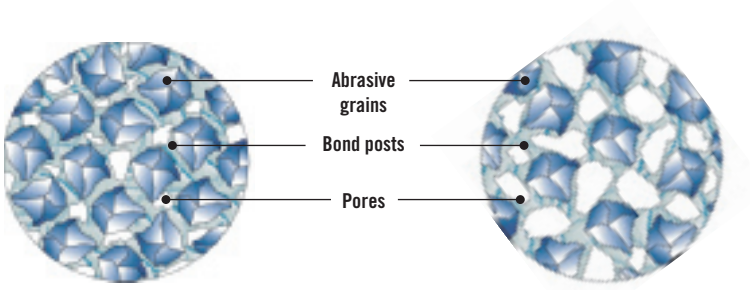
STRUCTURE

The total volume of the grinding wheel is made up of the abrasive grain, the bonding material and the pore volume. The pore volume characterises the structure and is of paramount importance for the grinding process. The pores form chip chambers and assist cooling during grinding. Every grinding wheel has a natural porosity. Here at Winterthur this is expressed in structure numbers ranging from 1 - 9. These are considered standard structures. The higher the structure number, the more porous the grinding wheel.
The natural porosity of a grinding wheel can be increased artificially by the addition of a special pore generating agent, which produces additional pore space. This additional porosity is expressed in structure numbers 11 - 19, which are known as porous or open structures. Grinding wheels with structure numbers 10 (standard structure) and 20 (porous structure) are manufactured by a special puddling process.

Natural porosity	Artificially increased porosity
Standard Structure	**Porous structure**
1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20

The higher the number, the more open the structure

Closed structure **Open structure**



Bonding

Abrasive grains are held together by the bond. The type of bonding material and its percentage of the total volume of the grinding wheel determine the strength, hardness and cutting performance of the wheel. Winterthur manufactures vitrified and resin bonded grinding wheels.

Resin Bond (Symbol B)

The resinoid bond is made from phenolic resins and various fillers which help to determine the characteristics of the bond. Resinoid bonded grinding wheels are cured at a temperature of approx. 180°C. They are less sensitive to sudden temperature changes, shocks or blows than vitrified bonded wheels. Chemical damage and lengthy storage should be avoided.

Vitrified Bond (Symbol V)

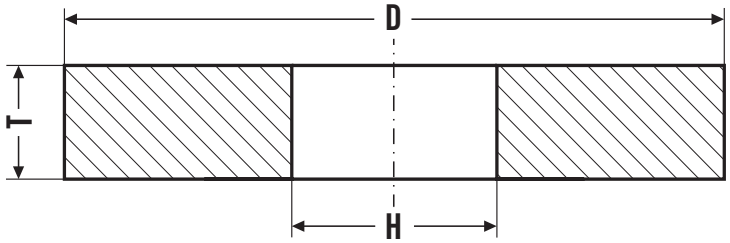
The vitrified bond consists of clay, kaolin, feldspar and glass-like frits or recrystallised glasses. Vitrified bonded grinding wheels are fired at approx. 800°C to 1350°C. They are not sensitive to chemical effects and can be stored indefinitely. However, sudden changes in temperature, shocks or blows should be avoided.

Resinoid Bond reinforced (Symbol BF)

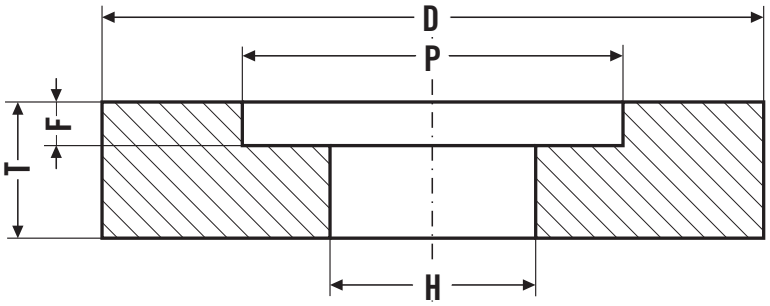
Resinoid, fibre-reinforced snagging and cutting wheels are provided with glass fibre mesh. These wheels are extra strong.

STANDARD WHEEL SHAPES 1, 5, 7,
Wheel Face Profiles

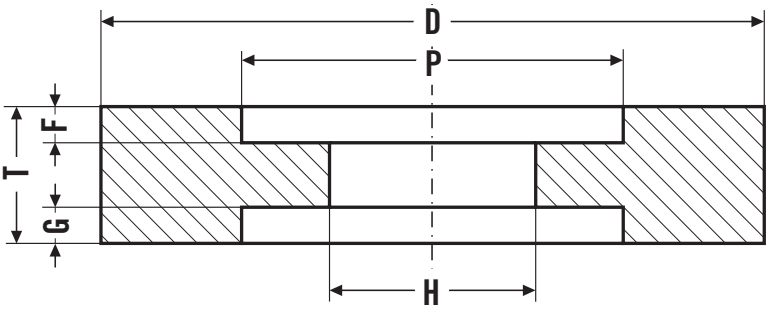
Type 1
D x T x H



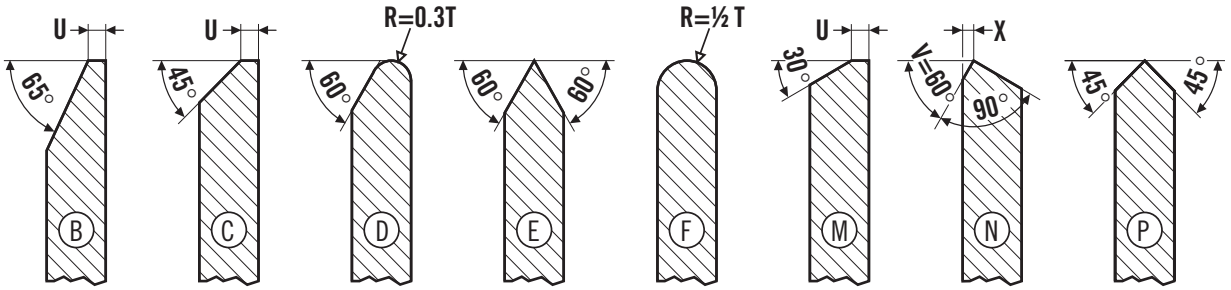
Type 5
D x T x H
1 - P x F



Type 7
D x T x H
2 - P x F/G



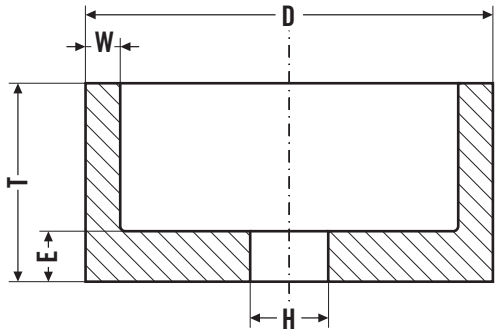
WHEEL FACES FOR TYPES 1, 5 AND 7



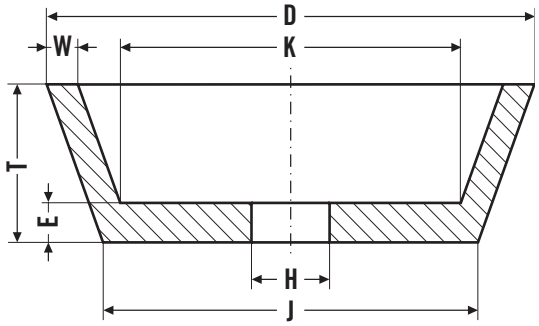
U = 3.2 mm unless otherwise ordered.

STANDARD WHEEL SHAPES 6, 11, 12, 3, 4, 2

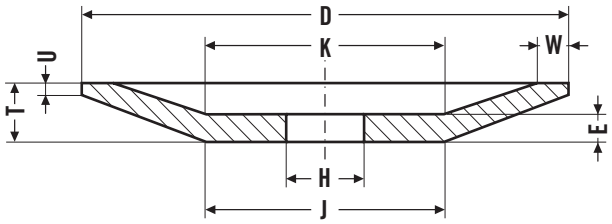
Type 6
D x T x H
W E



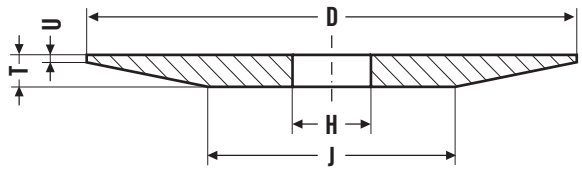
Type 11
D x T x H
W E J K



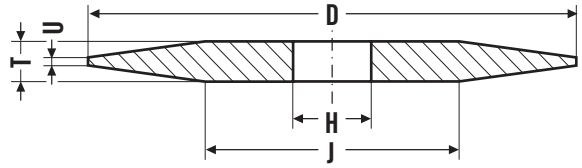
Type 12
D x T x H
W U E J K



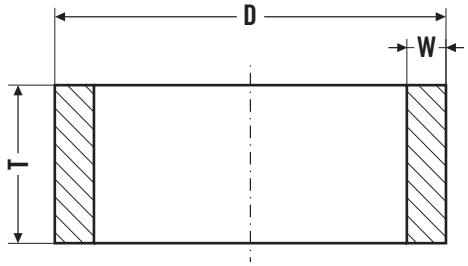
Type 3
D x T x H
U J



Type 4
D x T x H
U J

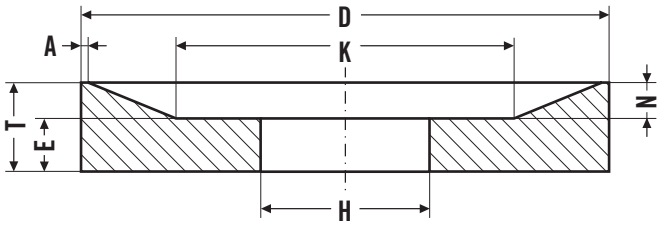


Type 2
D x T
W

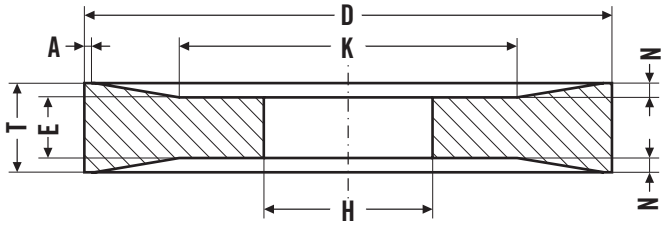


STANDARD WHEEL SHAPES 20 TO 26

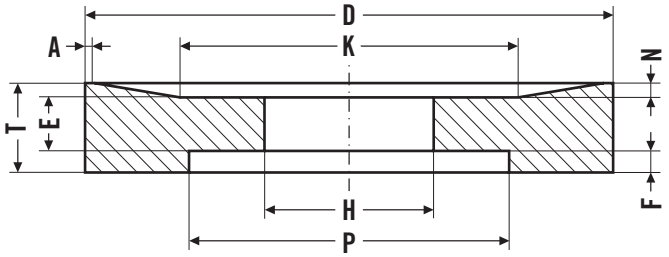
Type 20
D x T x H
K N A



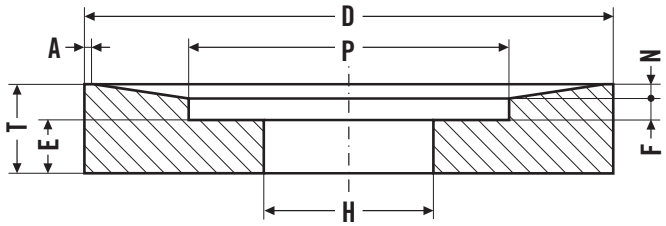
Type 21
D x T x H
K N A



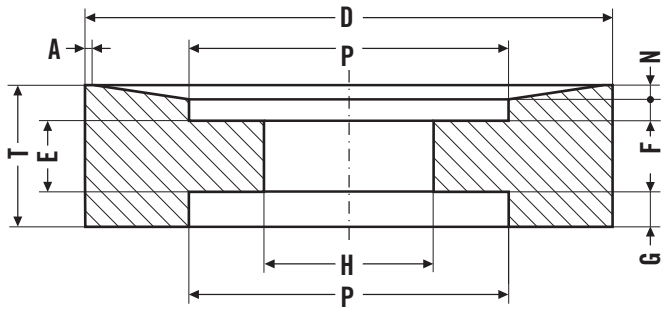
Type 22
D x T x H
1 - P x F
K N A



Type 23
D x T x H
1 - P x F
N A

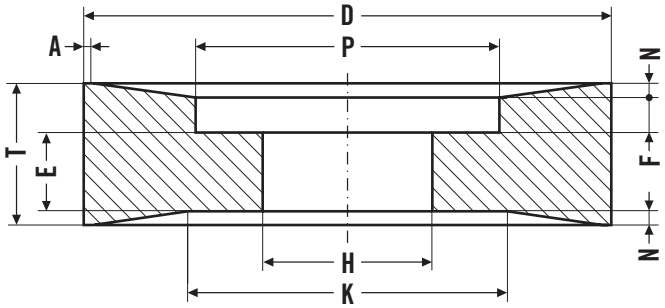


Type 24
D x T x H
2 - P x F/G
N A



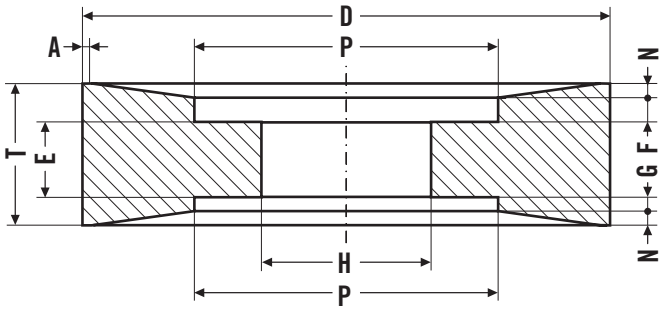
A = 2 mm standard width

Type 25
D x T x H
1 - P x F
K N A



Type 26
D x T x H
2 - P x F/G
N A

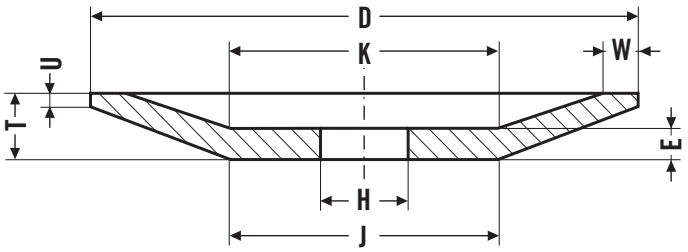
A = 2 mm standard width



STANDARD GRINDING WHEELS FOR SPECIAL APPLICATIONS

Gear grinding (Maag gear grinders)

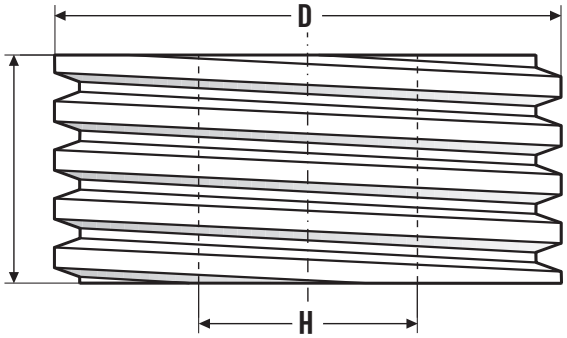
Type 12sp
D x T x H
W U E J K



Gear grinding (continuous generating process)

Type 1
(without profile)

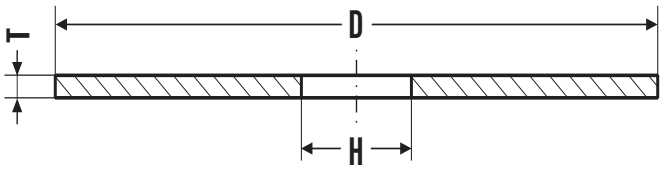
Type 1sp
D x T x H
(preprofiled)
Mod., PA, number of starts



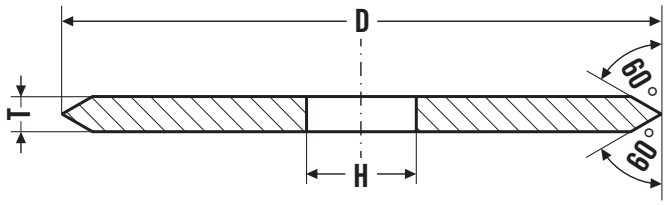
Specify module (DP), pressure angle (PA) and number of starts

Thread grinding (Reishauer and other machines)

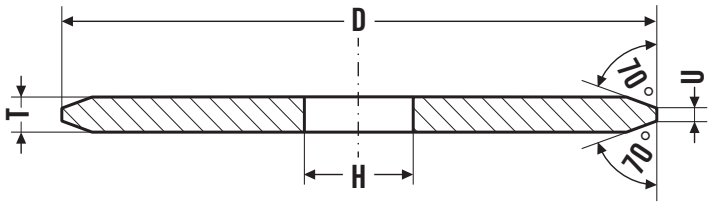
Type 1
D x T x H
(single rib wheel)



Type 1E
D x T x H
(single rib wheel 60° angle)

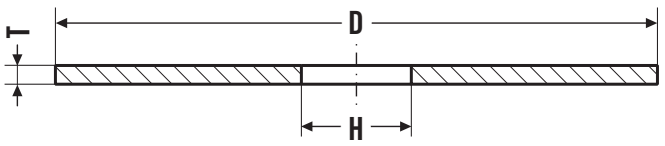


Type ESP
D x T x H
U
(single rib wheel 70° angle)

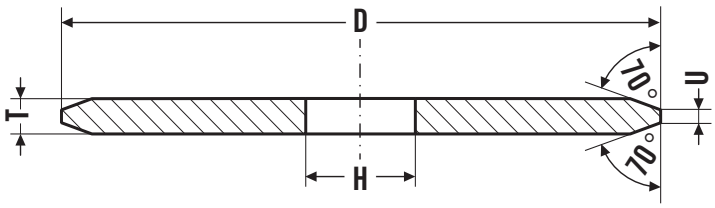


Profile grinding (Studer PSM and other machines)

Type 1E
D x T x H
(single rib wheel 60° angle)

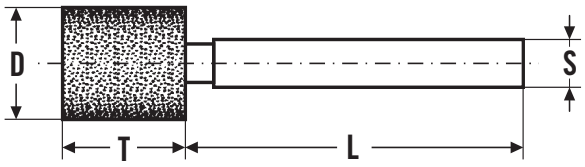


Type 39E
D x T x H
V° J U
(single rib wheel 60° angle)

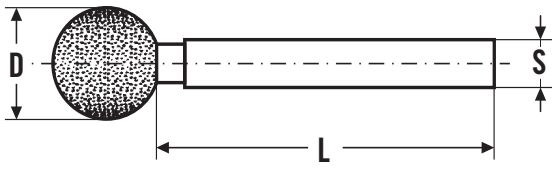


Mounted Wheels

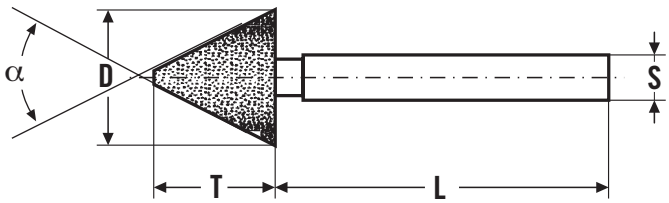
Type 52/ZY
D x T x S
L



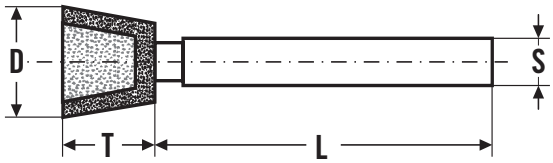
Type 52/KU
D x S
L



Type 52/KE
D x T x S
L

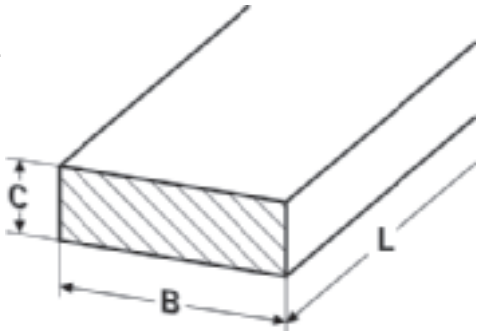


Type 52/TO
D x T x S
L

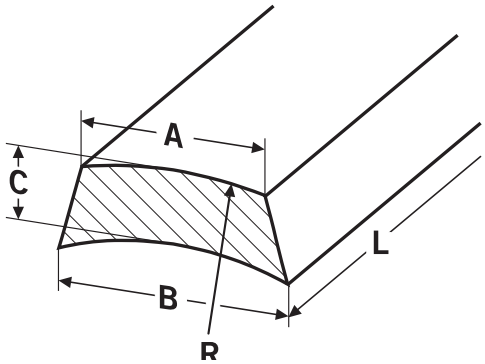


SEGMENTS

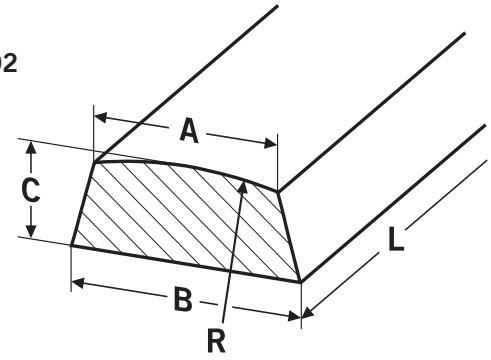
Type 3101
B x C x L



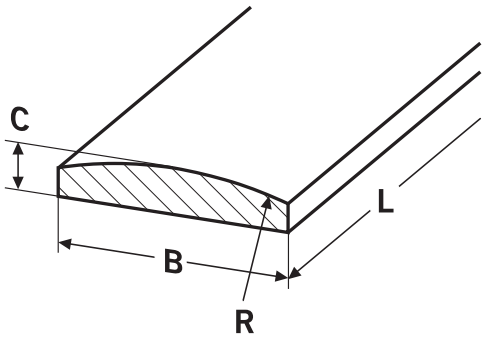
Type 3105
B/A x C x L
R



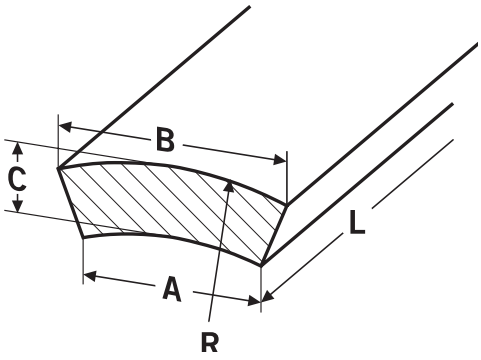
Type 3102
B x C x L
R



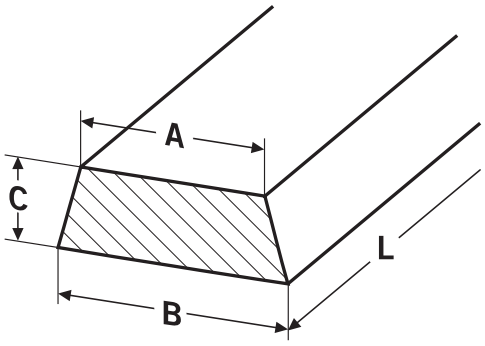
Type 3108
B x C x L
R



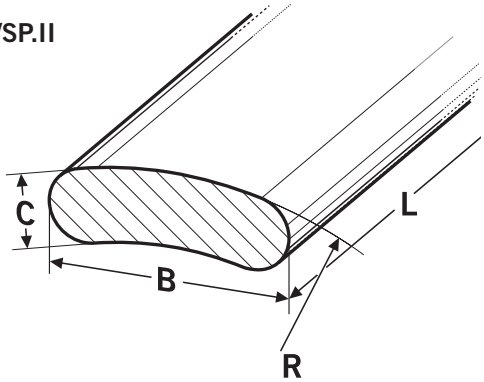
Type 3104
B/A x C x L
R



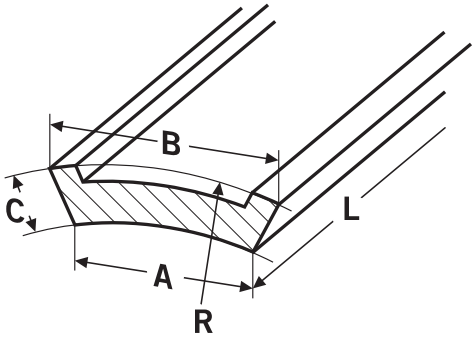
Type 3109
B/A x C x L



Type 3104/SP.II
B x C x L
R



Type SP.I
B/A x C x L
R



INTERNATIONAL STANDARD DIMENSIONS

D Diameter (mm)	T Thickness (mm)	H Hole (mm) [1]
3	0.5	1.6
10	0.8	2.5
13	1	4
16	1.25	6
20	1.6	9.53 [3]
25	2	10
32	2.5	13
40	3.2	16
50	4	20
63	6	22.23 [3]
80	8	25
100	10	32
115	13	40
125	16	50.8
150	20	76.2
180 [2]	25	127
200	32	203.2
225	40	304.8
230 [2]	50	
250	63	
300	80	
350	100	
400	125	
450	160	
500	200	
600	250	
750	315	
800	400	
900	500	
1000		
1060		

[1] **Bore tolerances:**

H7 CBN & diamond wheels and for special applications
H12 Bore diameters up to 50.8 mm
H11 Bore diameters up to 76.2 mm
H13 Rough grinding wheels

[2] For fibre reinforced cutting-off and roughing wheels used on portables grinders.

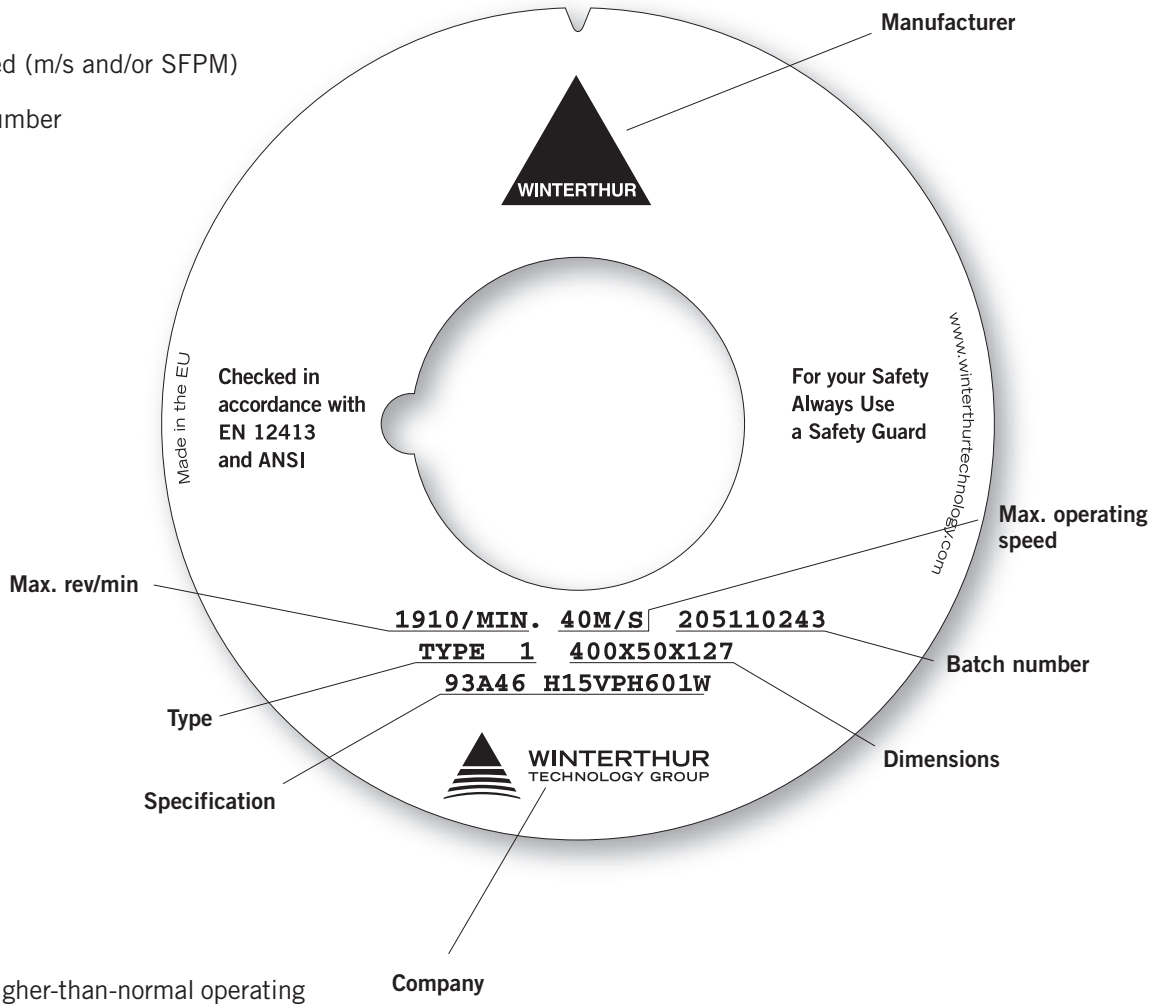
[3] **As listed under point 2:**

but also for wheel types 6 and 11 used on portable grinders.

MARKING OF WINTERTHUR GRINDING WHEELS

In accordance with ANSI, ISO, FEPA and other regulations, Winterthur wheels are marked with the following information:

- Manufacturer; trade mark
- max. rev/min
- max. operating speed (m/s and/or SFPM)
- batch and article number
- type
- dimensions
- specification



Grinding wheels for higher-than-normal operating speeds, which are marked in accordance with FEPA regulations, must be colour coded with a diagonal stripe as follows:

Colour Code	
blue	9,830 SFPM (50 m/s)
yellow	12,400 SFPM (63 m/s)
red	15,750 SFPM (80 m/s)
green	19,680 SFPM (100 m/s)
yellow/blue	24,600 SFPM (125 m/s)

GRINDING WHEEL SAFETY INFORMATION

Many countries have specific regulations which list codes of practice governing the use of abrasive wheels. It is of paramount importance that users are aware of the relevant regulations and conform to their requirements.

For general information, the European Association of Abrasive Wheel Manufacturers (FEPA) has issued the European Safety Code for the safe use of grinding wheels and bonded abrasive products.

This code contains the safety rules which are common tho all FEPA member countries. Safety recommendations particular to each country are not included in the FEPA Safety Code. Winterthur strongly advises users to refer to and comply with their country‘s codes:

United Kingdom

«Safety in the Use of Abrasive Wheels», published by the H&SE and obtainable from HMSO as HS(G)17.

Abrasive Wheel Regulations 1970, HMSO publicatin. The European Safety Code FEPA GB-12-87 for the USE, Care and Protection of Abrasive Wheels.

Europe in general

FEPA Safety Code, obtainable from:
FEPA
20 Avenue Reille,
75014 Paris, France
Phone: +33 (0)1 45 81 25 90
Fax: +33 (0)1 45 81 62 94

United States of America

American National Standards Institute (ANSI), Inc., N.Y., «Safety requirements for the use, care and protection of abrasive wheels», Standard B7.1, 1988.

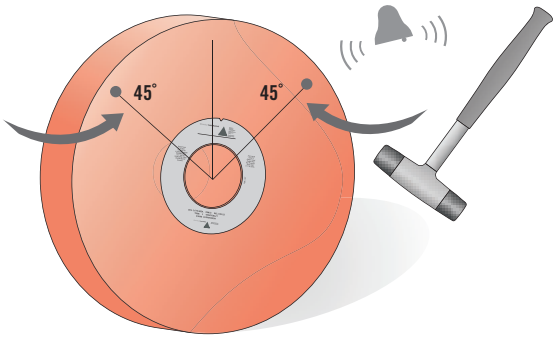
Also consult the Occuptional Health and Safety Act of 1970 (OSHA), which has made it mandatory for industrial users of grinding wheels, and their employees, to observe the safety rules as laid down by law.

The following pages are a summary, by no means complete, of the most common general safety rules

INITIAL OPERATION OF A GRINDING WHEEL

The Ring Test

The ring test should be carried out immediately before mounting a new or used grinding wheel. The wheel should be lightly tapped to the right and to the left of the vertical centreline with a non-metallic hammer. Light wheels should be held on the finger or on a mandrel, heavier wheels tilted on their edge on the floor. The wheel must be dry for the ring test. A crack-free wheel will emit a clear ringing sound; a damaged wheel will sound dull. Resin bonded wheels do not emit the same clear metallic ring as vitrified wheels.



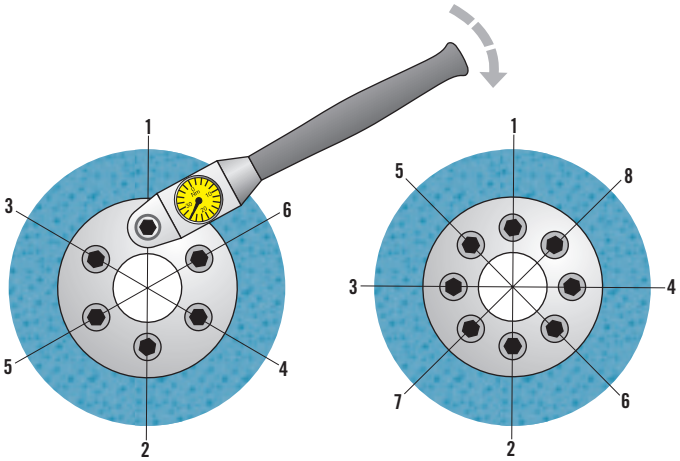
Mounting of Grinding Wheels

The condition and the design of flanges have considerable effects on the final grinding results. Flanges must be free of damage as this may lead to imbalanced wheels. Damage to flanges may also exert uneven pressure on the grinding wheels and considerably reduce their resistance to breakage. When selecting grinding machine flanges, please refer to the relevant national recommendations (ANSI B7.1-1988; Section 5, FLANGES; or ISO/DP 666 or DIN 6375).

Blotters (paper or plastic) must always be used between each flange and the abrasive wheel surface to ensure uniform flange pressure. Blotters must cover the entire flange contact area.

Attention: Torque wrenches should be used to tighten screws on multiple screw flanges. As per ANSI B7.1-1988, Chapter 6.10.2, applied torque should not exceed 20 foot pound (27 Newton metres) unless greater torque is recommended by the wheel manufacturer. In the case of wheel width < 0.75 in. (< 20 mm) and wheels with induced porosity, lower torque may be necessary.

If unsure, please consult a Winterthur engineer.



Flange screws must be tightened in a criss-cross sequence similar to the illustration:

Order of Tightening	
1/2/3/4/5/6	1/2/3/4/5/6/7/8

THE «DOS» AND «DON'TS» OF GRINDING WHEEL USAGE

Always:
Read the safety rules pertaining to your country. Consult Winterthur's main catalogue's safety section.
Inspect products for defects when receiving and, again, prior to mounting.
Store grinding wheels in suitable rooms fitted with appropriate racks.
Ensure that permissible RPM and/or surface speed in m/s or sfpm correspond to grinding wheel and machine intended for use.
Use paper or plastic blotters between wheel and steel flange.
Use torque wrench when tightening flange nuts.
Inspect all guards and other safety f eatures for proper functioning.
Wear safety glasses.
Start machine, step out of the way, and run machine at idle speed for 1 minute prior to cutting metal.
Operate machine according to machine and wheel instructions

Never:
NEVER, ever run a grinding wheel at higher surface speed (m/s or sfpm) than marked on the wheel.
NEVER mount a vitrified grinding wheel without prior ring test. If dull sounds occurs, do not use the wheel.
DO NOT force a grinding wheel onto a flange, shaft or arbour..
DO NOT operate a grinding machine with safety devices removed.
DO NOT use a grinding wheel without wearing safety glasses.
DO NOT side-grind with a wheel not intended for this purpose.

If in doubt, ask your Grinding Wheel supplier!

BALANCING

Any imbalance of revolving parts will influence the grinding surface quality as well as the life expectancy of the grinding wheel and the machine tool. Only a well balanced wheel will achieve optimum surface quality. As a rule, it is sufficient to statically balance a wheel which is already mounted on its flanges.

To statically balance a wheel, it must be mounted on a precision ground arbor and placed on a balancing device. After a certain degree of wear or the changing of flanges, the wheel must be rebalanced.

All wheels leaving the Winterthur plant have undergone stringent tests for imbalance. Wheels which do not meet Winterthur's tolerances, which are even stricter than the ISO or DIN standards, are withdrawn. With flange mounting, new imbalances may be introduced. These can be offset by adjusting the balancing segments on the flanges.

Balancing may take place continuously on the machine itself if it is equipped with an automatic balancing unit. However, today's requirements for high precision and quality often demand dynamic balancing, particularly at high speeds. This is also necessary for wheels with a width of more than 1/6th of their diameter, given, of course, that the flanges conform to the relevant recommendations.

In accordance with safety regulations and recommendations (DIN, ISO, FEPA, ANSI) each grinding wheel should be **running at its full operating speed before grinding.** During this initial potentially hazardous time, all necessary care should be taken. Operating speeds of grinding wheels must not exceed the manufacturer's recommendations.

WHO IS RESPONSIBLE FOR WHAT?

Grinding Wheel Manufacturer

The wheel manufacturer must make certain that the wheels are of adequate strength and have been tested at the relevant overspeed in accordance with the applicable "test factor of safety". The factor of safety depends, amongst other things, on the type of grinding operation and the machine tool design.

The wheel manufacturer's responsibilities include:

- periodic bursting tests at manufacturer's factory
- marking all wheels with max. operating speeds
- identifying those wheels which may run at special speeds
- ensuring adequate packing for shipping.

Manufacturer's responsibilities do not extend to damages incurred during shipping or inadequate storage at the user's plant.

Machine Builder

Grinding and cutting-off machines must be equipped with safety guards conforming to the relevant national regulations. Safety guards must be capable of catching broken wheel fragments effectively.

Work-rests and safety guards must be adjustable to allow for wheel wear.

Machines on which the rotational speed is adjustable must be fitted with a fail-safe locking system to prevent the wheel from exceeding the maximum permissible speed.

Wheel flange design must conform to national regulations.

User

The user's responsibilities include:

- wearing safety glasses
- adequate storage
- visual inspection and ring test prior to mounting the grinding wheel
- correct mounting of the grinding wheel
- checking wheels for imbalance; balancing wheels if necessary
- checking maximum permissible operating speeds-
- adjusting work-rests and safety guards
- running a newly-mounted wheel at the max. operating speed for at least one minute prior to grinding
- avoiding chipping the grinding wheel for any reason

MAXIMUM PERIPHERAL SPEEDS

Standard or Normal Operating Speeds

The maximum operating speed for each wheel must be established by the wheel manufacturer.

General international guidelines	
Vitrified bonded wheels	up to 6,890 SFPM (35 m/s)
Resinoid bonded wheels	up to 8,860 SFPM (45 m/s)
Cutting-off wheels on fixed machines	up to 15,750 SFPM (80 m/s)

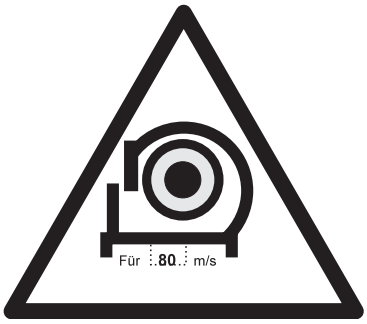
WHAT IS A TOTALLY ENCLOSED WORKING AREA?

Grinding wheels requiring official approval may be subject to a particular "restriction of use". The grinding wheel manufacturer is obliged to mark this restriction either on the wheel itself, its blotters or on accompanying tabs or stickers. For example, the following restriction of use frequently leads to queries:

VE 4: permissible only in conjunction with a totally enclosed working area

For precision grinding operations carried out at speeds in excess of 63 m/s (12,400 SFPM) the wheel must be totally enclosed by the machine's guards. When operating in a totally enclosed working area, the workpiece can be fed in mechanically with complete safety. Moreover, in case of wheel breakage, the wheel fragments are completely held back by the guards.

If a grinding wheel is marked with this restriction of use it may only be used on fixed machines which have been fitted with the necessary approved safety guards as "a totally enclosed working area". Such maschines carry the following symbol which states the max. permissible operating speed.

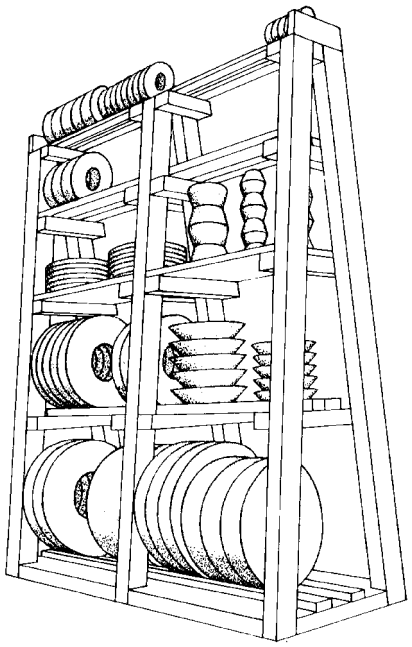


STORAGE OF GRINDING WHEELS

Grinding wheels require careful handling and special storage (see illustration). Prior to storage every shipment must be visually inspected and ring tested for damage. In case of doubt – do not use any questionable wheel!

Grinding wheels are to be placed on racks or in bins in such a way as to ensure that they are protected from damage and may be removed without disturbing adjacent wheels. The storage area must be dry and free from frost and large variations in temperature. Condensation on the wheels must be avoided. Excessive vibration from machinery and other sources must also be avoided.

Vitrified bonded grinding wheels can be stored indefinitely. Resin bonded grinding wheels may begin to break down after two to three years and should not be stored for a longer period than this.



BASIC GUIDELINES

To achieve a superior surface finish and high metal removal rates, it is of utmost importance to work with SMALL amounts of infeed a_d (0.002 mm to 0.003 mm; 0.00008" to 0,0012")

In order to increase the wheel's surface roughness, increase the crossfeed velocity v_d rather than increasing the depth of dressing infeed a_d.

Higher crossfeed velocity = higher wheel surface roughness and vice versa.

Notes

- Always apply grinding fluid when dressing. Diamonds are very heat sensitive!
- Never traverse grinding wheel without further incrementing the dressing depth.

Terminology

a_d = Depth of infeed of dressing tool (mm or inch)
b_d = Effective width dressing tool (mm or inch)
n_s = Grinding wheel RPM
s_d = Crossfeed rate of diamond dressing tool per grinding wheel revolution (mm/rev. or inch/rev.)
U_d = Overlap ratio (No.)
V_d = Crossfeed velocity of dressing tool (mm/min or inch/min)

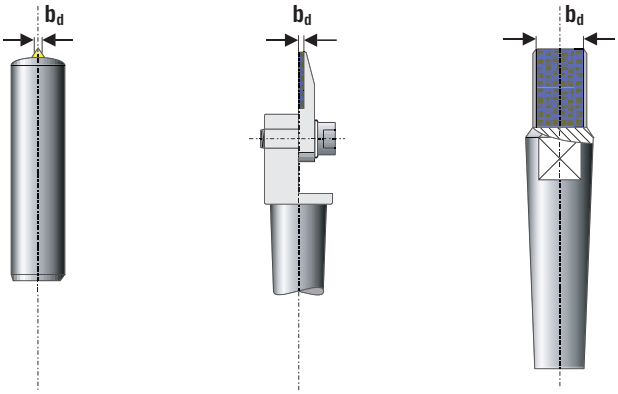
DRESSING WITH FIXED DRESSING TOOLS

Effective width b_d

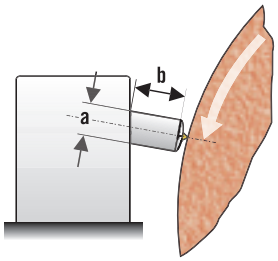
This dressing parameter designates the effective cutting width b_d of a diamond tool at a certain depth of infeed a_d. For the dressing tools as shown the effective width b_d is a approximately as follows:

Single-point diamond	Blade tool	Multipoint diamond *
0.5 to 1.0 mm	0.7 to 0.9 mm	1.5 to 12 mm
0.020" to 0.040"	0.027" to 0.035"	0.60" to 0.500"

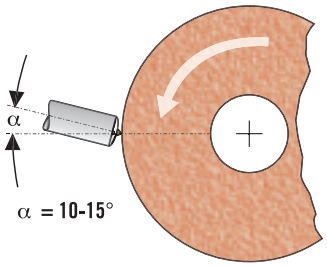
* in the case of multipoint diamond tools with a measured b_d > than 3 mm (>1/8") take only 35% of measured b_d as the total width of all protruding diamond points is roughly a third of the actual measured width of the tool.



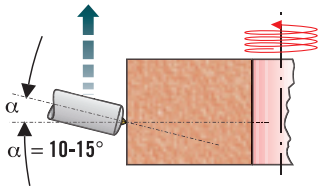
DRESSING WITH SINGLE POINT DIAMONDS



Clamping length as short as possible
Length b = max. of 2 x a



Use drag angle of 10 to 15°
To avoid dulling of diamond, turn shaft by 90° from time to time



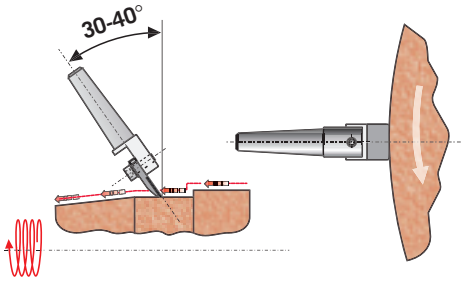
Set diamond at drag angle up to 15° relative to cross axis

DRESSING WITH DIAMOND BLADE TOOLS

Guidelines:

Wheel surface speed:
- dress at full working surface speed

Always use blade tool in such as fashion that the diamond-free section on the back of the blade touches the grinding wheel first. This will ensure a free-cutting dressing operation.



Apply ample amount of grinding fluid while dressing as diamonds are very heat sensitive. Ensure uninterrupted flow.

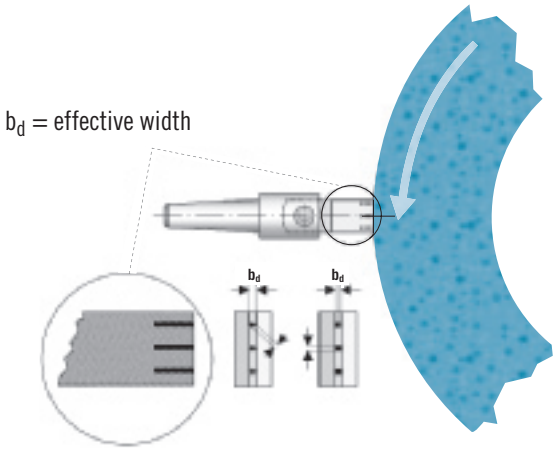
In order to increase the wheel's surface roughness, increase the crossfeed velocity v_d rather than increasing the depth of dressing infeed a_d.

Depth of cut a_d = 0.005 to 0.02 mm (0.0002 to 0.0008 inch)

Guidelines for dressing crossfeed velocity v_d:
n_s = grinding wheeel RPM

$$V_d = \frac{n_s \times 0.9}{4} \text{ [mm/min]}$$

DRESSING WITH MCD DRESSING BLADES (CERAMIC ABRASIVES AND VITRIFIED CBN)



Guidelines for dressing cross-feed velocity v_d:

$$v_d = \frac{n_s \times \text{cross-section } b_d}{4\ (u_d)}$$

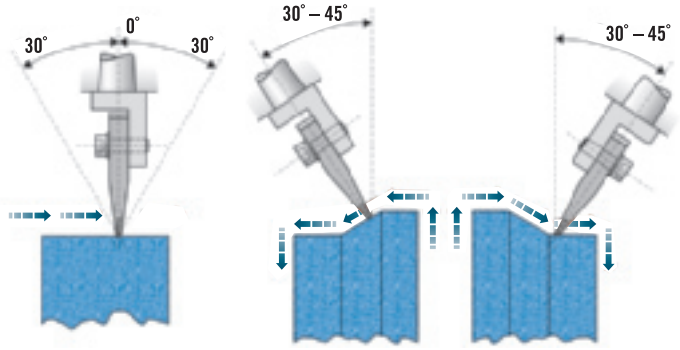
b_d = effective width of dressing tool in mm or inches
n_s = grinding wheel RPM
u_d = overlap ratio

Depth of cut a_d for:
- vit CBN = 0.002 to 0.01 mm (0.0001“ to 0.0005“)
- ceramic abrasives = 0.005 to 0.02 mm (0.0002“ to 0.0008“)

Determining MCD Cross-section and No. of MCD Inserts:

Cross-section	For abrasive grit size
MCD 0.6 x 0.6mm (0.024¨)	120 and finer
MCD 0.8 x 0.8mm (0.031¨)	80 and coarser

No. of MCD inserts	Wheel diameter
up to 100mm (4¨)	2 MCDs
up to 500mm (20¨)	3 MCDs
up to 750mm (30¨)	4 MCDs



Straight dressing

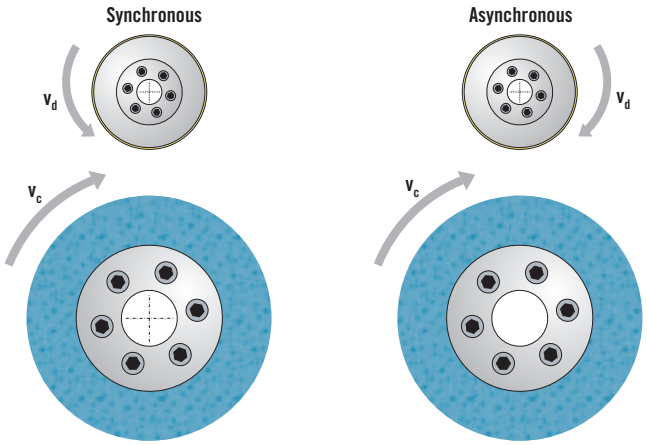
Profile dressing from right to left

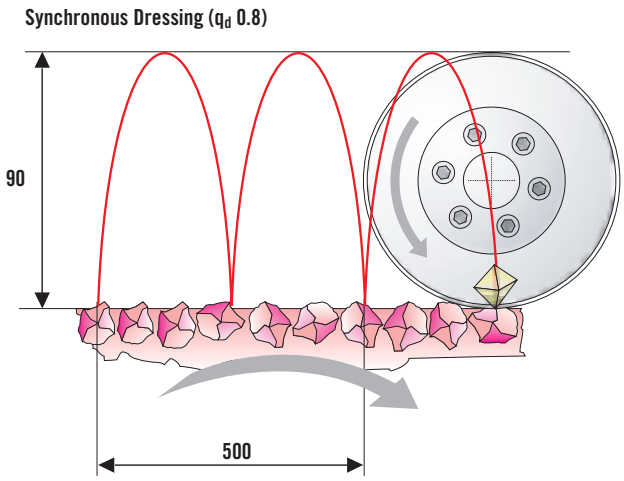
Profile dressing from left to right

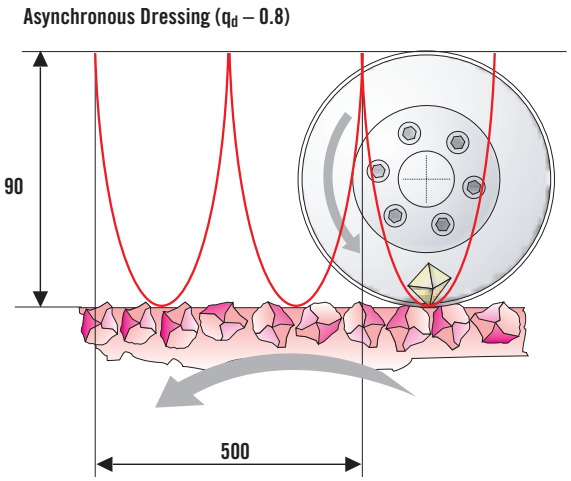
DIFFERENCE BETWEEN SYNCHRONOUS AND ASYNCHRONOUS DRESSING

The diagrams on the following pages explain the difference between synchronous and asynchronous dressing. If we imagine a single diamond on a dressing roll of ∅ 90 mm and a speed ratio q_d of 0.8 (ratio of surface speeds of grinding wheel and dressing roll), this single diamond will describe the paths shown on the following page.

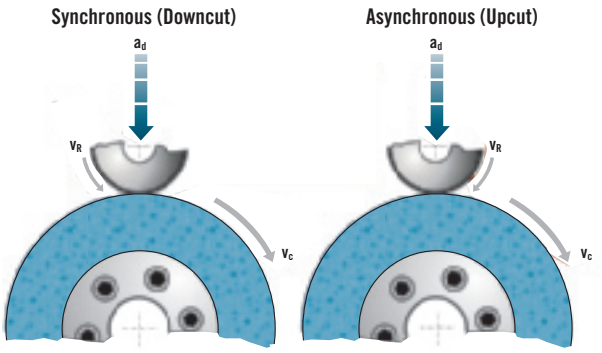
In synchronous mode, the diamond's angle of penetration into the grinding wheel is much steeper, therefore resulting in a much more aggressive wheel than in asynchronous mode. As a general guideline it is recommended to always dress in synchronous mode to obtain as aggressive a wheel as possible. Only use the asynchronous mode if the surface requirements cannot be met with synchronous dressing.





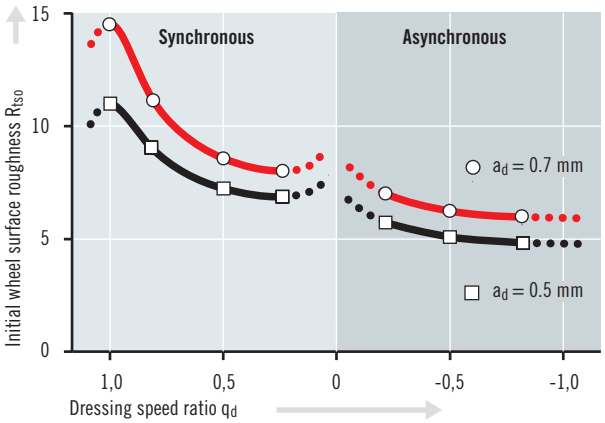


DRESSING WITH ROTARY DIAMOND DRESSING TOOLS



$$q_d = \frac{v_R}{v_c}$$

Influence of Speed Ratio and of Dressing Infeed on Surface Roughness (acc. to E. Saljé):



q_d = Speed ratio between diamond tool and grinding wheel
a_d = Infeed of diamond roll
v_R = Surface speed of diamond roll
v_c = Surface speed of grinding wheel

Grinding wheel: WA 60 KV
Dressing tool: diamond roll (D700/7.5)
Wheel surface speed during dressing: 30 m/s (5900sfpm)

This illustration shows that the wheel's surface roughness and the resulting surface finish can be substantially influenced across a wide range.

The most important setting parameter:
q_d = dressing speed ratio
a_d = dressing roll infeed per revolution

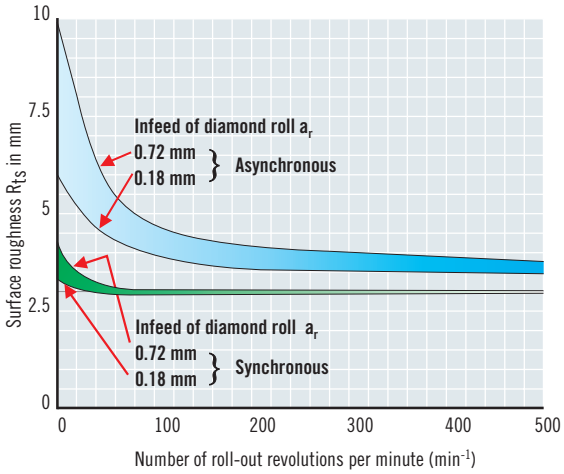
The highest grinding wheel surface roughness could be achieved at a dressing speed ratio of $q_d = 1$ as this ratio corresponds to a crush dressing process.

A ratio of $q_d = 1$ cannot be recommended as the dressing roll wear would be excessive. If a high surface roughness (aggressive grinding wheel) is desired, use the synchronous (downcut) dressing mode at a ratio of 0.8.

For lower wheel surface roughness, and therefore a finer surface finish on the workpiece, use the asynchronous (upcut) dressing mode; q_d between –0.5 and –0.8.

NUMBER OF ROLL-OUT REVOLUTIONS

The following diagram shows the influence of the number of dressing revolutions on the grinding wheel's surface roughness. For practical purposes, this means that after 80 dwell or roll-out revolutions in asynchronous mode, or 160 dwell revolutions in synchronous mode, the minimal surface roughness of the grinding wheel has been achieved. Any additional dwell revolutions will have little influence on the dressing result, i.e. the surface roughness of the grinding wheel. After the full amount of dressing depth has been dressed off, it is of paramount importance that the machine retracts the dressing roll immediately (max. 10 revolutions) as excessive dwell will blunt the grinding wheel. Even grinding wheels that have been dressed in synchronous mode with a speed ratio q_d of 0.8 will be blunted by excessive dwell. Machines with high stiffness will dress an accurate profile with just a few dwell or roll-out revolutions.



Grinding wheel :
WA 60 L7V
Surface speed v_c:
29 m/s
Dressing roll:
D711, 7.5 ct/cm3

(Dissertation
1968
Rainer Schmitt)

Form Dressing Rolls

Form dressing rolls with a single ring on the periphery of lapped diamonds or PDC diamonds offer a high degree of flexibility in comparison to profile diamond rolls with a fixed profile. Using the machine's "Z" and "Y" axes, the grinding wheel can be profiled with a large degree of freedom.

The dressing parameters can be influenced to achieve the desired wheel surface roughness:

	Sense of rotation	Speed ratio q_s	Overlap ratio u_d
Standard grinding	synchronous	0.8	5
Finish grinding	asynchronous	-0.6 to -0.7	6 - 8
Rough grinding			3 - 5

To calculate the dressing cross-feed rate v_d, use the following formula:

$$b_d = 2 \times \sqrt{r^2 - (r - a_d)^2} \qquad V_d = \frac{n_s \times b_d}{u_d}$$

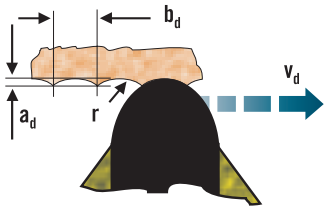
b_d = effective width of dressing tool (mm or inches)

n_s = grinding wheel RPM (min-1)

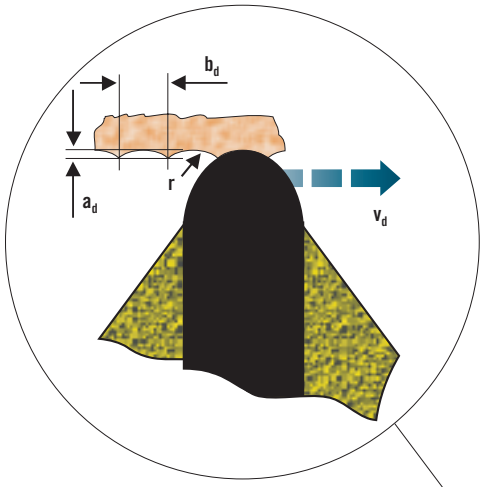
r = radius of form dressing roll

u_d = overlap ratio (--)

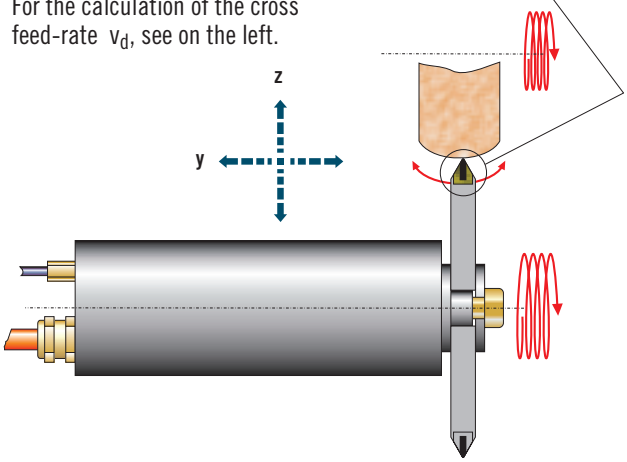
v_d = cross-feed rate (mm/min or inch/min)



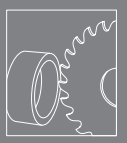
PCD Form Dressing Roll

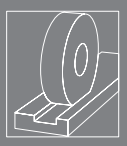


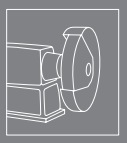
Note:
For the calculation of the cross feed-rate v_d, see on the left.

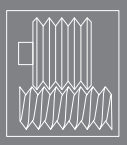


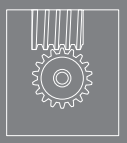
RECOMMENDED SPECIFICATIONS

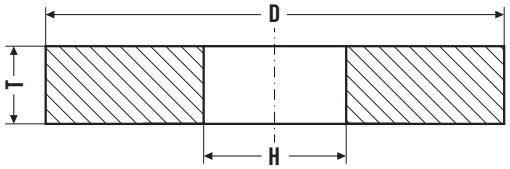






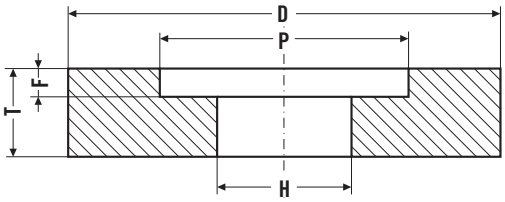






Straight Grinding Wheels
Type 1 D x T x H

Wheel Dimensions (Type 1)		
D	**T**	**H**
250	13, 16, 20, 25	50.8, 76.2
300	13, 16, 20, 25, 32, 40, 50	76.2, 127
350	16, 20, 25, 32, 40, 50	76.2, 127
400	20, 25, 32, 40, 50, 63, 80	127, 203.2
450	25, 40, 63, 100, 125, 160	127, 203.2
500	25 32, 40, 50, 63, 80, 100	203.2 203.2, 304.8
600	32, 40, 50, 63, 80, 100	203.2, 304.8
750	30 - 125	304.8
800	31 - 125	304.8
900	32 - 125	304.8
1060	32 - 160	304.8
Type 1 Ordering data	500 x 32 x 203.2 54A80 H15VPMF904W 50 m/s	

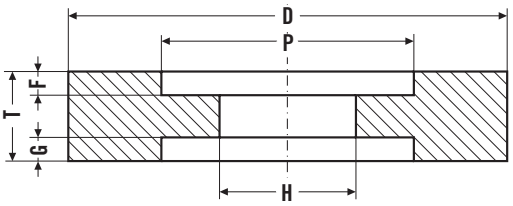


Straight Grinding Wheels recessed on one side
Type 5 D x T x H / 1- P x F

Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F**
300	40, 50	127	190	F = max. T/2
350	40, 50	127	215	
400	40, 50, 63, 80, 100	127	215	
450	40, 50, 63, 80, 100	127 203.2	215 290	
500	40, 50, 63, 80, 100	203.2 304.8	290 390	
600	63, 80, 100 63, 80, 100, 125	203.2 304.8	290 390	
750	63, 80, 100, 125	304.8	410	
900	63, 80, 100, 125	304.8	410	
Type 5 Ordering data	500 x 63 x 203.2 57A80 J7V300W 50 m/s 1 - 290 x 20			

Straight Grinding Wheels recessed on both sides
Type 7 D x T x H / 2 - P x F/G

Wheel Dimensions (Type 7)				
D	**T**	**H**	**P**	**F G**
300	40, 50	127	190	F + G = max. T/2
350	40, 50	127	215	
400	40, 50, 63, 80, 100	127	215	
450	40, 50, 63, 80, 100	127 203.2	215 290	
500	40, 50, 63, 80, 100	203.2 304.8	290 390	
600	50, 63, 80, 100 50, 63, 80, 100, 125	203.2 304.8	290 390	
750	80, 100, 125, 160	304.8	410	
900	80, 100, 125, 160	304.8	410	
Type 7 Ordering data	500 x 80 x 203.2 54A80 H15VPMF904W 50 m/s 2 - 290 x 10/15			



Roughing with Straight Grinding Wheels Types 1, 5, 7

Universal Application:

Material	Conventional abrasives
In general:	
Unhardened steel	57A80 J7V300W 57A60 K5V900W
Hardened steel	54A60 J7V904W 54A60 H8V904W

Specific Application:

Material	Application	Conventional abrasives	Ceramic abrasives, vitriefied CBN
Soft steel	machining or constructional steel	57A80 J7V300W 54A60 J7V904W	
Hardened steel, low-alloy up to 62 HRc	case hardened, quenched and tempered steel	54A80 H8V904W	
	flame and induction hardened steel	54A80 H8V904W	93N80 H8V902W
Hardened steel, high-alloy above 62 HRc, for example HSS, tool steel etc.		11C80 J15VPLF	93A80 H8V901W 32B126 P5CV600C100
Stainless steel, acid and heat resistant steel	unhardened	11C80 J15VPLF	
	hardened, high-alloy	54A60 J7V904W 54A60 H8V904W 11C80 F13VPMF	32B126 P5CV600C100
Hardchrome plated steel	solid pieces		93N80 H15VPMF302W 93A54/60 H16VP-MFSR601W
	thin-walled pieces	54A60 H15VPMF904W	
Nitriding steel	untreated	54A60 H8V904W	93N60 H8V902W
Cast iron and cast steel	gray cast iron	11C60 H6V	93A60 H8V601W
	cast steel	54A60 J7V904W	93A60 H8V601W
	annealed cast iron, nodular cast iron	64A60 J7V300W	93A60 H8V601W
Tungsten carbide and ceramics		11C80 F13VPMF	1D126 P5CV734C100
Non-ferrous metals aluminium, copper, bronze, etc.		11C46 H15VP	
Plastics		11C46 H15VP	
Rubber		57A60 H18VPHHGG900W (only for 30 m/s)	

Finishing and High Precision Grinding
(Types 1, 5, 7, 1A1)

Universal Application:

Finishing	≤ ∅ 500 mm	> ∅ 500 mm	High Precision Grinding
in general:			
Unhardened / hardened steel	93A80 H8V601W	93A60 H8V601W	
Unhardened steel	54A120 H15VPMF904W	54A80 H15VPMF904W	
Hardened steel	54A120 H15VPMF904W	54A80 H15VPMF904W	54A180 H15VPMF904W

Specific Application:

Finishing	Application	≤ ∅ 500 mm	> ∅ 500 mm	High Precision Grinding
Unhardened steel	machining of constructional steel	93N80 H8V902W	54A80 H15VPMF904W	64A180 J6V300W
Hardened steel low-alloy up to 62 HRc	case hardened, quenched and tempered steel	57A80 J7V300W 93A80 H8V601W 32B91 P5V600C100	93A80 H8V901W	11C320 G12VPS81 42A240 K4V300W
	flame hardened and induction hardened steel	57A80 H8V300W 93A80 H8V601W	54A80 H8V904W 93A80 H8V901W	
Hardened steel	high-alloy 62 – 64 HRc	93N120 H15VPMF902W 93A80 H8V601W	93N80 H15VPMF902W 85A80 H8V901W	11C320 G12VPS81 53A240 H15VPMF302W
	high-alloy > 64 HRc:	11C120 F15VPMF 32B91 P5V600C100	11C80 F13VPMF	11C240 F15VPMF 11C320/400 F20VPK
Stainless steel (acid and heat resistant steel)	unhardened	28A80 H15VPLF300W	28A80 H8V300W	11C280 G12VPS77
	hardened, high-alloy	54A120 H15VPMF904W 11C120 F15VPMF 93A80 H8V901W 32B91 P5CV600C100	54A80 H15VPMF904W 11C80 F13VPMF 93A80 H8V901W	11C320 G12VPS81
Hardchrome plated steel	solid pieces	54A120 H15VPMF904W	54A80 H15VPMF904W	42A280 H7B200MC
	thin walled pieces	54A80 H15VPMF904W 93N120 H15VPMF302W	54A80 H15VPMF904W 93N80 H15VPMF902W	42A280 H7B200MC
Cast iron and cast steel	Universal application for all types	93A80 H8V601W	93A80 H8V901W	
	grey cast iron	11C80 H5V	11C60 H6V	11C120 H15VPMF
	cast steel	54A80 H8V904W	54A80 H8V904W	11C120 H15VPMF
	annealed cast iron and nodular cast iron	93N120 H8V902W	93N80 H8V902W	11C120 H15VPMF
Tungsten carbide and ceramics		11C80 H5V 1D91 P5CV734C100	11C60 H6V	11C240 F15VPMF
Non-ferrous metals aluminium, copper, bronze		11C80 H15VP	11C60 H15VP	
Plastics		11C80 H15VP	11C60 H15VP	
Rubber	Shore hardness > 70	11C80 H18VP	11C80 H18VP	
	Shore hardness < 70*	57A60 H18VPHHGG900W	57A60 H18VPHHGG900W	

*(max. 30 m/s)

Angle Plunge Grinding

Application	Height of Shoulder «X»	Specification
Soft steel	≤ 7 mm	54A80 H8V904W 93A80 H8V601W 57A80 J7V300W
	> 7 mm	54A80 L15VPMF904W 93A80 G8V601W
Hardened steel	≤ 7 mm	57A80 H8V300W 54A80 L15VPMF904W* 93A60 H8V601W 93N120 H15VPMF902W
	> 7 mm	54A80 H15VPMF904W 81A80 H15VPMF601W

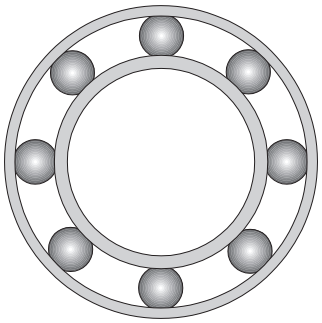
* interrupted cut

Camshaft Grinding

Material	Application	Conventional abrasives	Ceramic abrasives, vitriefied CBN
Cams			
Cast steel alloys (chilled casting steel)	roughing	31A60 L6V600W	93A60 M4V601W
	finishing	54A80 L6V604W	32B126 P15DVP600C125
Steel	unhardened roughing	31A60 L6V600W	93A60 M4V601W
	hardened finishing	62A120 K7V40	3B126 P15DVP600C125
Camshaft journals			
Cast steel alloys	roughing	54A60 J7V904W	93A60 J7V601W
	finishing	57A80 J7V300W	
Steel	unhardened roughing	54A60 J7V604W	
	hardened finishing	57A80 J7V300W	

Crankshaft Grinding

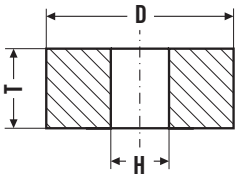
Application	Conventional abrasives	Ceramic abrasives, vitriefied CBN
Roughing	61A60 K5V600W	93A60 N4V601W 93A60 M4V601W
Finishing	57A80 J7V300W	93N80 H8V902W



Grinding of Ball Bearings

Ball and roller bearing race

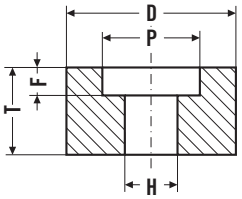
Type of bearings	OD grinding inner race	ID grinding outer race
Single row angular bearings	A100 K7V15 3A70-2 K8V20	59A90-2 K7V39 95A120 H6V601W
Double row angular bearings	A100 K7V15 3A70-2 K8V20	95A120 H7J6V601W
Cylindrical roller bearings	A100 K7V15 3A70-2 K8V20	60A70 K7V39 57A120 L7V39
Deep groove ball bearings	A100 K7V15 3A70-2 K8V20	42A90 K7V39



Straight Grinding Wheels

Type 1 D x T x H

Wheel Dimensions (Type 1)		
D	**T**	**H**
6	6, 10, 13	2.5, 3
8	8, 10, 16	2.5, 3
10	2, 6, 10, 13, 20	3, 4
13	3, 6, 13, 20, 25	4
16	6, 10, 16	6
20	6, 13, 20, 25, 32	6
25	6, 10, 13, 16, 20, 25, 32, 40	6, 8
32	6, 10, 13, 20, 32, 40	6, 10, 13
40	6, 10, 13, 20, 32, 40	6, 13
50	6, 10, 13, 25, 40	13, 16, 20
63	6, 10, 13, 20, 25, 40	13, 20
80	6, 10, 20, 25, 32, 40	20
100	13, 20, 25, 32, 40, 50	20
Type 1 Ordering data	50 x 25 x 20 57A80 K5V300W 50 m/s	



Straight Grinding Wheels recessed on one side

Type 5 D x T x H / 1- P x F

Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F**
16	10, 16	6	10	F = max. T/2
20	13, 20	6	13	
25	10, 16, 25	10	16	
32	13, 20, 32	10	16	
40	16, 25, 40	13	20	
50	16, 25, 40	16	25	
63	25, 40, 50	20	32	
80	40, 50, 63	20	40	
100	40, 50, 63	32	50	
Type 5 Ordering data	50 x 16 x 16 57A80 K5V300W 50 m/s 1 - 25 x 4			

With Straight Grinding Wheels

Types 1, 5, 1A1, 1A8

Universal Application:

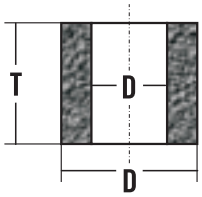
Grinding wheels	≤ ∅ 20 mm	∅ 21–40 mm	> ∅ 40 mm
in general:			
Unhardened steel	54A80 H8V604W	64A80 H8V300W	54A60 H8V604W
Hardened steel	93A120 H13VP601 32B91 P5CV600C150	93A80 H13VP601 32B91 P5CV600C150	93A80 H13VP601 32B91 P5CV600C150

Specific Application:

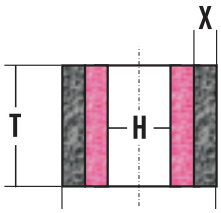
Finishing	Application	≤ ∅ 20 mm	∅ 21–40 mm	> ∅ 40 mm
Soft steel	machining or general purpose constructional steel	54A80 J7V604W 93A80 J7V601W	54A60 H8V604W	54A60 H8V604W
Hardened steel low-alloy up to 62 HRc	case hardened, quenched and tempered steel:	54A80 H9V904W 93A80 J7V601W	54A120 H15VPMF904W 93A80 H13VP601	54A80 H15VPMF904W 93A80 H13VP601
	flame hardened and induction hardened steel	54A80 H9V904W	54A120 H15VPMF904W	54A80 H15VPMF904W
	in general	32B91 P5CV600C150	32B91 P3CV600C100	32B91 P3CV600C100
High-alloy hardened steel > 62 HRc for example: high speed steel		11C80 G6V 93N80 H15VPMF902W 93A120 H13VP601 32B91 P5CV600C150	11C120 H18VP 93A80 H13VP601 32B91 P3CV600C100	11C60 H15VP 93A80 H13VP601 32B91 P3CV600C100
Stainless steel (e.g. INOX, acid and heat resistant steel)	unhardened	54A120 H15VPMF904W	54A120 H15VPMF904W	54A80 H15VPMF904W
	hardened, high-alloy	11C120 H18VP	11C120 H18VP	11C120 H18VP
Hardchrome plated steel		54A120 H15VPMF904W 93N80 H15VPMF902W 93A80 H13VP601	54A80 H15VPMF904W 93A80 H13VP601	54A80 H15VPMF904W 93A80 H13VP601
Nitriding steel	untreated	54A80 H8V904W	54A80 H8V904W	54A80 H8V904W
	hardened			
	< 62 HRC (gas-nitrided)	93N80 H15VPMF902W	93N80 H15VPMF902W	93N80 H15VPMF902W
	> 62 HRC (bath-nitrided)	11C120 H18VP	11C120 H18VP	11C60 H15VP
Cast iron and cast steel	cast steel	93N80 H8V902W	93N80 H8V902W	93N80 H8V902W
	gray cast iron	93A120 H13VP601	93A120 H13VP601	93A80 H13VP601
	annealed cast iron and nodular cast iron	93N80 H8V902W	93N80 H15VPMF902W	93N80 H15VPMF902W
Tungsten carbide and ceramics		11C80 G6V 1D91 P5CV734C150	11C120 H18VP 1D91 P3CV734C100	11C120 H18VP 1D91 P3CV734C100
Non-ferrous metals		11C80 G6V 11C120 L15VPMF	11C120 H18VP	11C60 H15VP
Plastics		11C80 G6V	11C120 H18VP	11C60 H15VP
Rubber		11C80 G6V	11C120 H18VP	11C60 H15VP

Internal Cylindrical Grinding

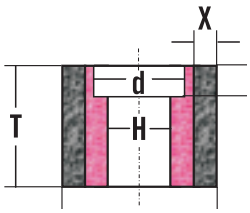
Type 1A8 < ∅ 25mm
D x T x H
Straight grinding wheel



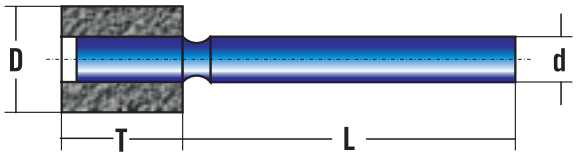
Type 1A1 ≥ ∅ 25mm
D x T x H
Rim D - T - X
Straight grinding wheel
with x-mm rim thickness



Type 6A1 ≥ ∅ 25mm
D x T x H
Rim D - T - X / 1 - P x F
Straight grinding wheel
recessed on one side with
x-mm rim thickness



Type ZYA8 < ∅ 25mm
D x T x H
Shaft S x L
Cylindrical Grinding wheel

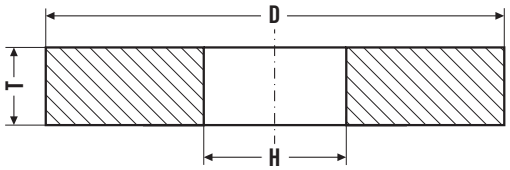


Universal Application:

Material	< ∅ 25 mm	25 - 40 mm	> ∅ 40 mm
in general:			
Unhardened steel	32B91 P3CV600C150	32B91 P3CV600C150	32B126 P3CV600C150

Specific Application:

Material	< ∅ 25 mm	25 - 40 mm	> ∅ 40 mm
Hardened steel, general, low-alloy up to 62 HRc	32B91 P3CV600C150	32B91 P3CV600C100	32B91 P3CV600C100
Hardened steel, high-alloy above 62 HRc,	32B91 P3CV600C150	32B91 P3CV600C100	32B91 P3CV600C100
Tungsten carbide and ceramics	1D91 P5CV734C150	1D91 P3CV734C100	1D91 P3CV734C100



Straight Grinding Wheels

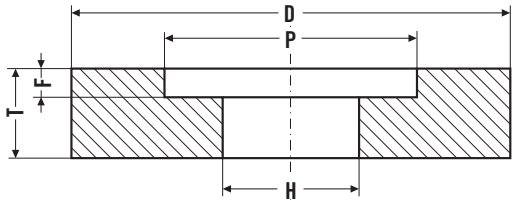
Type 1 D x T x H

Wheel Dimensions (Type 1)		
D	**T**	**H**
100	20, 25, 32, 40, 50	40
150	20, 25, 32, 40, 50, 63	50.8
200	20, 25, 32, 40, 50, 63	50.8
300	25, 40, 63, 100, 125	127
350	25, 40, 63, 100, 125, 160	203.2
400	25, 40, 63, 100, 125, 160, 200, 250	203.2
500	40, 63, 100, 125, 160, 200, 250	304.8
600	100, 125, 160, 200, 250, 315, 400	304.8
Type 1 Ordering data	500 x 200 x 304.8 31A80 L5V301W 35 m/s	

Control Wheels

Type 1 D x T x H

Wheel Dimensions (Control wheels for Type 1)		
D	**T**	**H**
100	10, 20, 25, 32, 40, 50	40
200	25, 32, 40, 50, 63, 100, 125	76.2
250	25, 32, 40, 50, 63, 100, 125, 160, 200, 250	127
300	40, 63, 100, 125, 160, 200, 250	127
350	100, 125, 160, 200, 250, 315	127, 203.2
Type 1 Ordering data	350 x 200 x 127 A80 P5R 35 m/s	



Straight Grinding Wheels recessed on one side

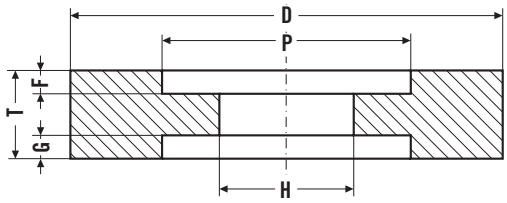
Type 5 D x T x H / 1- P x F

Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F**
100	20, 25, 32, 40, 50	40	60	F = max. T/2
150	20, 25, 32, 40, 50, 63	50.8	80	
200	20, 25, 32, 40, 50, 63	50.8	110	
300	25, 40, 63, 100, 125	127	190	
350	25, 40, 63, 100, 125, 160	203.2	270	
400	25, 40, 63, 100, 125, 160, 200, 250	203.2	390	
500	40, 63, 100, 125, 160, 200, 250	304.8	390	
600	100, 125, 160, 200, 250, 315, 400	304.8	390	
Type 5 Ordering data	300 x 63 x 127 31A80 L6V301W 50 m/s 1 - 190 x 25			

Control Wheels

Type 5 D x T x H / 1- P x F

Wheel Dimensions (Control wheels for Type 5)				
D	**T**	**H**	**P**	**F**
100	10, 20, 25, 32, 40, 50	40	80	F = max. T/2
200	25, 32, 40, 50, 63	76.2	114	
300	40, 50, 63, 100, 125	127	190	
350	100, 125, 160, 200, 250, 315	127	190	
350	100, 125, 160, 200, 250, 315	203.2	270	
Type 5 Ordering data	200 x 63 x 76.2 A80 P5R 35 m/s 1 - 114 x 25			



Straight Grinding Wheels recessed on both sides

Type 7 D x T x H / 2 - P x F/G

Wheel Dimensions (Type 7)				
D	**T**	**H**	**P**	**F/G**
100	20, 25, 32, 40, 50	40	60	F + G = max. T/2
150	20, 25, 32, 40, 50, 63	50.8	80	
200	20, 25, 32, 40, 50, 63	50.8	110	
300	25, 32, 40, 50, 63, 100, 125, 160	127	190	
350	25, 32, 40, 50, 63, 100, 125, 160	127 203.2	215 290	
400	25, 32, 40, 50, 63, 100, 125, 160, 200, 250	203.2	290	
500	40, 50, 63, 100, 125, 160, 200, 250, 300	203.2 304.8	290 390	
600	100, 125, 160, 200, 250, 315	304.8	390	
Type 7 Ordering data	500 x 100 x 203.2 31A80 L6V301W 50 m/s 2 - 290 x 25/25			

Control Wheels

Type 7 D x T x H / 2 - P x F/G

Wheel Dimensions (Control wheels for Type 7)				
D	**T**	**H**	**P**	**F/G**
100	10, 20, 25, 32, 40, 50	40	80	F + G = max. T/2
200	25, 32, 40, 50, 63	76.2	114	
250	40, 50, 63, 100, 125	127	190	
300	100, 125, 160, 200, 250, 315	127	190	
350	100, 125, 160, 200, 250, 315	203.2	290	
Type 7 Ordering data	350 x 100 x 127 A80 P5R 35 m/s 2 - 190 x 16/16			

Control Wheel Specifications

(Through-feed and plunge grinding)

Finishing	Application	Specification
Standard rubber bonded wheels	standard applications	A80P5R
	finishing	A120 P5R
	superfinishing surface finish < R_t 0.6 in combination with fine grit grinding wheels (400 & 500 grit size)	A180 P5R
Hard wheel bonds (two grades harder than standard P5R)	high material removal	A80 Q5R A120 Q5R
Very hard wheel bonds (3-4 grades harder than standard P5R)	for heavy roughing operations, plunge grinding and high feed rates	A80 R3R A120 R3R
	for extreme roughing, plunge and profile grinding operations	A120 S3R A180 S3R
Hardest available rubber bond	for very precise operations and close tolerances alternative to vitrified bonded wheels	A80 T2R A120 T2R A180 T2R

Through-feed grinding with wheel types 1, 5, and 7

Universal Application:

Material	≤ ∅ 300 mm	> ∅ 300 mm
In general:		
Unhardened steel	31A80 L6V301W	31A60 L6V301W
Hardened steel	54A80 L6V604W	54A60 L6V604W
Hardened/ Unhardened	93A120 L6V601W	93A80 L6V601W

Specific Application:

Material	Application	≤ ∅ 300 mm	> ∅ 300 mm
Unhardened steel (machining or constructional steel)		31A80 L6V301W 93A120 L6V601W	31A60 L6V301W 93A80 L6V601W
Hardened steel, low-alloy up to 62 HRc	case hardened, quenched and tempered steel	31A80 L6V301W	31A80 L6V301W
	flame and induction hardened steel	54A80 L6V604W	54A60 L6V604W
	universal	32B126 P3CV600C100	32B126 P3CV600C100
Hardened steel, high-alloy above 62 HRc, for example HSS, tool steel etc.		93A80 J7V601W 11C80 K4V 32B126 Q5CV600C100	93A80 J7V601W 11C80 K4V 32B126 Q5CV600C100
Stainless steel, acid and heat resistant steel	unhardened	31A80 L6V301W 54A80 L15VPMF604W 93A120 L6V601W	31A60 L6V301W 93A80 L6V601W
	hardened, high-alloy	11C120 K4V 32B126 05CV800C100	11C80 K4V 32B126 05CV800C100
Hardchrome plated steel	solid pieces	54A80 J7V604W	54A60 J7V604W
	thin-walled pieces	54A80 H13VPMF604W 93N80 J7V902W	54A60 H13VPMF604W 93N80 J7V902W
Nitriding steel	untreated	31A80 L6V301W 93A120 L6V601W	31A60 L6V301W 93A80 L6V601W
	hardened up to 62 HRc (gas nitrided)	11C80 K4V	11C80 K4V
	hardened above 62 HRc (bath nitrided)	11C80 K4V	11C80 K4V
Cast iron and cast	cast steel	31A80 L6V301W 93A120 L6V601W	31A60 L6V301W 93A80 L6V601W
	grey cast iron	11C80 K4V	11C60 K4V
	annealed cast iron and nodular cast iron	31A80 L6V301W 93A120 L6V601W	31A60 L6V301W 93A80 L6V601W
Tungsten carbide and ceramics		11C80 H5V 1D126 P3CV734C100	11C60 H6V
Non-ferrous metals (aluminium, copper, bronze)		11C80 H15VP	11C60 H15VP
Plastics		11C80 H15VP	11C80 H15VP
Rubber		11C80 H15VP	11C60 H15VP

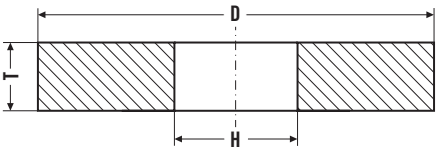
Plunge grinding with wheel types 1, 5, and 7

Universal Application:

Material	≤ ∅ 300 mm	> ∅ 300 mm
In general:		
Unhardened steel	31A120 L6V301W	31A80 L6V301W
Hardened steel	54A180 K5V604W	54A120 K5V604W
Hardened/ Unhardened	93A120 L6V601W	93A80 L6V601W

Specific Application:

Material	Application	≤ ∅ 300 mm	> ∅ 300 mm
Unhardened steel (machining or constructional steel)		31A120 L6V301W 93A120 L6V601W	31A80 L6V301W 93A80 L6V601W
Hardened steel, low-alloy up to 62 HRc	case hardened, quenched and tempered steel	54A180 K5V604W 93A120 L6V601W 32B126 N5CV800C100	54A120 K5V604W 93A80 L6V601W 32B126 N5CV800C100
	flame and induction hardened steel	31A180 L6V301W	31A120 L6V301W
Hardened steel, high-alloy above 62 HRc, for example HSS, tool steel etc.		11C120 K4V 32B126 N5CV800C100	11C120 K4V 32B126 N5CV800C100
Stainless steel, acid and heat resistant steel	unhardened	31A120 L6V301W 54A120 L15VPMF604W 93A120 L6V601W	31A80 L6V301W 93A80 L6V601W
	hardened, high-alloy	11C120 G6V 32B126 05CV800C100	11C120 J5V
Hardchrome plated steel	solid pieces	54A120 J7V604W	54A80 K5V604W
	thin-walled pieces	54A80 L13VPMF604W 93N120 J6V902W	54A60 L13VPMF604W 93N120 J6V902W
Nitriding steel	untreated	31A120 L6V301W 93A120 L6V601W	31A80 L6V301W 93A80 L6V601W
Cast iron and cast	cast steel	31A120 L6V301W 93A120 L6V601W	31A80 L6V301W 93A80 L6V601W
	grey cast iron	11C120 K4V	11C80 K4V
	annealed cast iron and nodular cast iron	31A120 L6V301W 93A120 L6V601W	31A80 L6V301W 93A80 L6V601W
Tungsten carbide and ceramics		11C80 H5V 1D126 P3CV734C100	11C60 H6V
Non-ferrous metals (aluminium, copper, bronze)		11C120 H15VP	11C80 H15VP
Plastics		11C120 H15VP	11C120 H15VP
Rubber		11C80 H15VP	11C60 H15VP



Straight Grinding Wheels

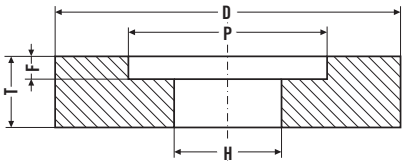
Type 1 D x T x H

Wheel Dimensions (Type 1)		
D	**T**	**H**
50	6, 13	13, (10)
80	6, 13	13, (10)
100	6, 13, 20	10, 20
125	6, 13, 16, 20	20
150	6, 10, 13, 16, 20	32, (20)
175	6, 10, 13, 16, 20	32
200	6, 10, 13, 16, 20	32
Type 1 Ordering data	175 x 16 x 32 64A60 H8V300W 40 m/s	

Saw Sharpening

Type 1 D x T x H

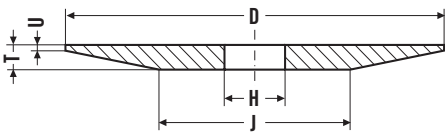
Wheel Dimensions Saw Sharpening (Type 1)		
D	**T**	**H**
100	2, 2.5, 3, 3.2, 4	10, (20)
150	2, 2.5, 3, 3.2, 4, 5, 6, 8, 10	20, 32
200	2, 2.5, 3, 3.2, 4, 5, 6, 8, 10, 13	32
250	3.2, 4, 5, 6, 8, 10, 13, 16, 20	32
300	5, 6, 8, 10, 13, 16, 20, 25, 32	32



Straight Grinding Wheels recessed on one side

Type 5 D x T x H / 1- P x F

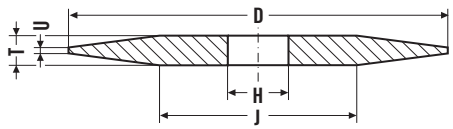
Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F**
150	32	20, 32	80	F = max. T/2
175	32	32, 50.8	90	
200	40	32, 50.8	110	
250	40	50.8, 76.2	150	
300	40 50	76.2 76.2	150 150	
Type 5 Ordering data	200 x 40 x 32 64A80 H8V300W 40 m/s 1 - 80 x 15			



Grinding Wheels tapered on one side

Type 3 D x T x H / U J

Wheel Dimensions (Type 3)				
D	**T**	**H**	**U**	**J**
80	5	20	1	40
100	6	32, (20)	1.5	50
125	8	32, (20)	2	63
150	8	32	2	75
175	10	32	3	85
200	13	32	3	100
250	14		3	125
Type 3 Ordering data	150 x 8 x 32 64A60 H8V300W 40 m/s U2, J75			

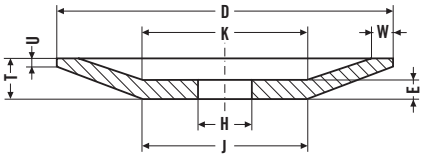


Grinding Wheels tapered on both sides

Type 4 D x T x H / U J

Wheel Dimensions (Type 4)				
D	**T**	**H**	**U**	**J**
80	8	13	2	35
100	10	20	2	40
125	10	32, (20)	2	65
150	13	32, (20)	2	65
175	13	32	3	100
200	16	32	3	100
250	20	32	4	130

Type 4 Ordering dat	125 x 10 x 32 64A80 J7V300W 50 m/s U2, J65

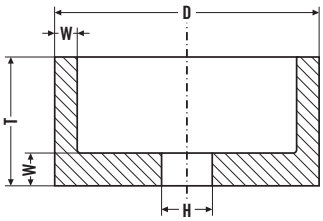


Dish Grinding Wheels

Type 12 D x T x H / W U E J K

Wheel Dimensions (Type 12)						
D	**T**	**H**	**W**	**U**	**E**	**J=K**
50	10	13, (10)	4	2	6	25
80	10	13, (20)	4	2.5	6	31
100	13	20	5	3	7	36
125	13	32, (20)	6	3	7	61
150	16	32, (20)	8	3	9	66
200	20	32	10	3	12	90

Type 12 Ordering data	125 x 13 x 32 W6 U3 E7 J/K61 93A60 G8V601W - 40 m/s

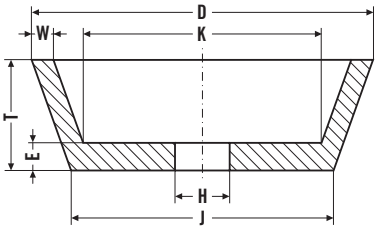


Straight Cup Grinding Wheels

Type 6 D x T x H / W E

Wheel Dimensions (Type 6)				
D	**T**	**H**	**W**	**E**
50	32	13, (10)	5	8
80	40	13, (20)	6	10
100	50	20	8	10
125	63	32, (20)	8	13
150	80	32, (20)	10	16
175	80 100	32 32	20 20	20 20

Type 6 Ordering data	100 x 50 x 20 W8 E10 64A60 H8V300W 40 m/s



Flaring Cup Grinding Wheels

Type 11 D x T x H / W E J K

Wheel Dimensions (Type 11)						
D	**T**	**H**	**W**	**E**	**J**	**K**
50	32		4	8	27	22
80	32	13, (20)	6	8	57	46
100	40	20	8	10	71	56
125	40	32, (20)	8	10	96	81
150	50	32, (20)	10	13	114	96

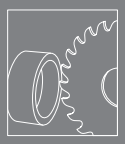
Type 11 Ordering data	125 x 40 x 20 W8 E10 J96 K81 64A80 H8V300W 40 m/s

Tool Grinding with Wheel Types 1, 5, 7

Grinding Wheels	Material	Application	≤ ∅ 225 mm	> ∅ 225 mm
Hand Tools	Unhardened steel		A60 M4V	A46 M5V
	Tool steel		42A60-3 K7V600	42A60-3 K7V600
	High speed steel		64A60 H8V300W	64A60 H8V300W
Lathe and planing tools	Tool steel		42A60-3 K7V600	42A60-3 K7V600
	High speed steel		64A60 H8V300W	64A60 H8V300W
	Tungsten carbide tipped	Roughing Finishing	11C60 H6V 11C80 H5V	11C60 H6V 11C80 H5V
Twist Drills	Tool steel	up to ∅ 10 mm over ∅ 10 mm	42A80 K7V600 42A60-3 K7V600	42A60-3 K7V600 42A60-3 K7V600
	High speed steel	up to ∅ 10 mm over ∅ 10 mm	64A80 H8V300W 93A80 H8V601W	64A60 H8V300W 93A80 H8V601W
	Tungsten carbide tipped	up to ∅ 10 mm over ∅ 10 mm	11C80 H5V 11C60 H6V	11C60 H6V 11C46 H6V

Tool Grinding with Wheel Types 2, 3, 4, 6, 11, 12

Grinding Wheels	Material	Application	≤ ∅ 100 mm	> ∅ 100 mm
Cutting Tools	Tool steel		54A60 H8V604W	54A60 H8V604W
	High speed steel		42A60-318V39 4B126 R75 BX506/BA	42A60-318V39 4B126 R75 BX506/BA
	Tungsten carbide tipped		11C80 H5V 77D126 R75 B52/BA	11C60 H6V 77D126 R75 B52
Gear hobs (wheel type 3)			64A80 H8V300W	93A60 F15VPHF601W 4B126 R75 BX5067BA
Planing and cutting blades (wheels types 2 and 6)	Tool steel		A54 H8/4BW10	93A46 F15VPHF601W
	High speed steel	up to 62 HRc over 62 HRc	A54 H8/4BW10 25A54 F15/04VPHF900W	93A60 F15VPHF601W
Grooving cutters for woodworking (dish wheel type 12)	High speed steel	up to 62 HRc over 62 HRc	42A36 F16VPLF300W A60 H8BW	
Hand tools	Chisels for woodworking		61A80 H17VP300W	A60 J7BW13



Saw Sharpening with Straight Grinding Wheels

Types 1, [14F1]

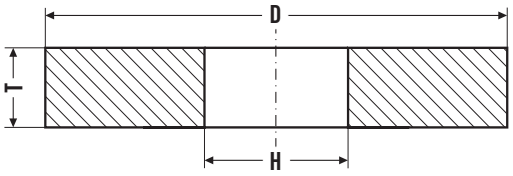
Wheel width	< 3.2 mm * fine teeth	3.5 - 6 mm medium teeth	> 7 mm coarse teeth
Metall cutting saws Type 14F1	42A80 J7B13 63A80 N7V900 93A80 M7V601	63A80 M7V900 63A54-2 M6V900 42A80 M7V900	53A60 L5V302W 63A54-2 M6V900 93A54-2 M6V601 4B151 R100BTX20/BA
Band saws	53A80 P13VPMF302W	53A80 P13VPMF302W 93A54-2 M7V601	63A54-2 M6V900
Stellite with edge reinforcement	63A60 N6V900	77A60 J7V900	77A60 J7V900
Saws mill blades	63A80 M7V900 54A80 K5V604W	53A60 K5V302W 63A80 M7V900 95A80 L7BS	63A54-2 M6V900
Slitting saws	42A80 J7B13	42A60 M3BW 95A80 L7BS 77A80 L7BS	54A60 M4V604W 77A60 L7BS 95A60L7BS 95N60 M7B945
Chain saws	53A80 J7V302W	42A60 K7V900	42A60 K7V900

With Straight Grinding Wheels

Types 6

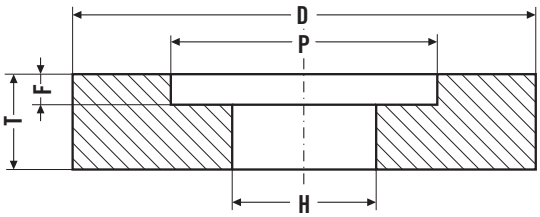
Wheel width	Application	< 3.2 mm * fine teeth	3.5 - 6 mm medium teeth	> 7 mm coarse teeth
Band saws	reinforced edges	42A80 K7V900T8	42A80 K7V900T8	42A60 K7V900T8

* **Resinoid bond** — **Wheel width**
wheel-∅ 150 — < 2.5 mm
wheel-∅ 200, 250, 300 — < 3.2 mm



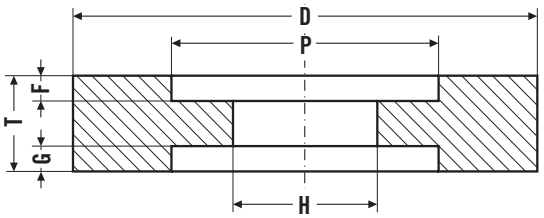
Straight Grinding Wheels
Type 1 D x T x H

Wheel Dimensions (Type 1)		
D	**T**	**H**
150	13	32
175	13	32, 50.8
200	13, 20	32, 50.8
225	13, 20, 25	50.8
250	20, 25, 32	50.8, 76.2
300	20, 25, 32, 50, 80	76.2, 127
350	32, 50	76.2, 127
400	32, 50, 80, 100	127
450	50, 80, 100, 160	203.2, 304.8
500	50, 80, 100, 160	203.2, 304.8
600	50, 80, 100, 160	203.2, 304.8
650	50, 80, 100, 160	304.8
750	50, 80, 100, 160	304.8
Type 1 Ordering data	500 x 50 x 203.2 64A46 H15VP300W 40 m/s	



Straight Grinding Wheels recessed on one side
Type 5 D x T x H / 1 - P x F

Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F**
150	32	20, 32	80	F = max. T/2
175	32	32, 50.8	90	
200	40	32, 50.8	110	
	25, 40, 63, 100, 125	76.2	114	
225	40	50.8	150	
250	40	50.8, 76.2	150	
	25, 40, 63, 100, 125, 160, 200, 250	127	160	
300	40, 50	76.2	150	
	25, 40, 50, 63, 100, 125, 160, 200, 250	127	190	
350	40, 50, 100, 125, 160, 200, 250, 315, 400	127	190	
400	40, 50, 63, 80, 100	127	190	
	25, 40, 63, 100, 125, 160, 200, 250	203.2	270	
450	40, 50, 63, 80, 100	127	215	
	40, 50, 63, 80, 100	203.2	290	
500	40, 50, 63, 80, 100	203.2	290	
	40, 50, 63, 80, 100, 125, 160, 200, 250	304.8	390	
600	63, 80	203.2	290	
	63, 80, 100, 125, 160, 200, 250, 315, 400	304.8	390	
650	50, 63, 80, 100, 125, 160	304.8	390	
750	63, 80, 100, 125, 160, 200, 250, 315, 400	304.8	410	
Type 5 Ordering data	500 x 50 x 203.2 64A46 H15VP300W 40 m/s 1 - 290 x 10			

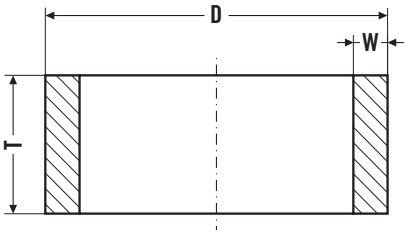


Straight Grinding Wheels recessed on both sides

Type 7 D x T x H / 2 - P x F/G

Wheel Dimensions (Type 5)				
D	**T**	**H**	**P**	**F/G**
200	25, 40, 63, 100, 125	50.8, 76.2	114	F+G = max. T/2
225	40	50.8	150	
250	25, 40, 63, 100, 125, 160, 200, 250	127	160	
300	25, 40, 50, 63, 100, 125, 160, 200, 250	127	190	
350	40, 50, 100, 125, 160, 200, 250, 315, 400	127	190	
350	40, 50, 100, 125, 160, 200, 250, 315, 400	127	190	
400	40, 50, 63, 80, 100	127	190	
	25, 40, 63, 100, 125, 160, 200, 250	203.2	270	
450	40, 50, 63, 80, 100	127	215	
	40, 50, 63, 80, 100	203.2	290	
500	40, 50, 63, 80, 100	203.2	290	
	40, 50, 63, 80, 100, 125, 160, 200, 250	304.8	390	
600	50, 63, 80	203.2	290	
	50, 63, 80, 100, 125, 200, 250, 315, 400	304.8	390	
750	80, 100, 125, 160, 200, 250, 315, 400	304.8	410	

Type 7	500 x 50 x 304.8
Ordering data	54A46 H15VPH604W 40 m/s 2 - 270 x 6/10

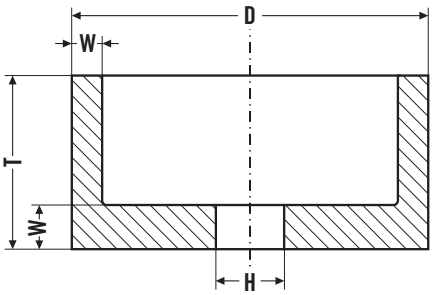


Grinding Cylinders

Type 2 D x T / W

Wheel Dimensions (Type 2)		
D	**T**	**W**
125	80	13
150	80	16
175	80	20
200	100	20, 25
250	100	25
300	100	32
350	125	40
400	125	40
450	125	40

Type 2	300 x 100
Ordering data	W32 93A80 F15 VPMF601W 35 m/s

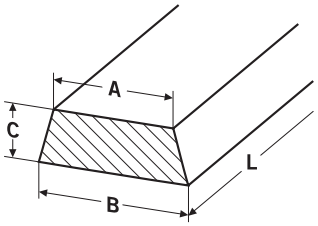


Straight Cup Wheels

Type 6 D x T / W E

Wheel Dimensions (Type 6)				
D	**T**	**H**	**W**	**E**
125	63	32	13	13
150	80	32, 50.8	16	16
175	80, 100	32, 50.8, 76.2	20	20
200	100	32, 76.2	20, 25	20
250	100	76.2	25	25
300	100	127	32	32

Type 6	200 x 100 x 32
Ordering data	W25 E20 11C46 J5V 35 m/s

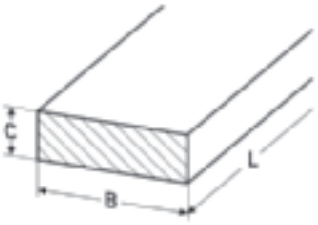


Grinding Segments

Type 3109 B/A x C x L

Segment Dimensions (Type 3109)			
B	**A**	**C**	**L**
55	45	38	80
60	54	22	110
70	64	25	150
80	70	40	150
103	94	38	180
103	82	38	203
152	135	63	200
210	184	86	250

Type 3109 Ordering data	80/70 x 40 x 150 64A46 H18VPH900W

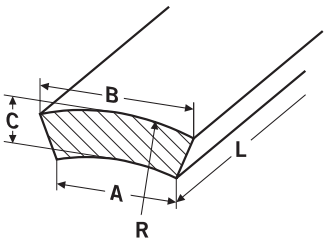


Grinding Segments

Type 3101 B x C x L

Segment Dimensions (Type 3109)		
B	**C**	**L**
50	25	100, 150, 200
60	20	100
60	25	125, 150
65	20	125
80	25	150
80	30	150
90	25	150
90	35	150
120	30	160, 180
120	35	180
120	40	180, 200, 225
120	50	200
180	63	250

Type 3101 Ordering data	120 x 40 x 180 64A46 H18VPH900W

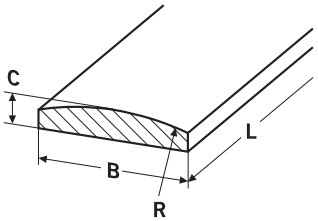


Grinding Segments

Type 3104 B/A x C x L / R

Segment Dimensions (Type 3104)				
B	**A**	**C**	**L**	**R**
58	48	18	110	100
70	39	28	150	150
79	70	20	140	180
80	55	18	95	100
80	55	18	120	100
80	70.5	25	160	210
87	56	25	130	140
87	59	22	100	140
95	72	25	120	150
	72	30	120	150
115	87	25	120	175
	90	25	150	200
143	103.5	38	200	273

Type 3104 80/55 x 18 x 95
Ordering data R100
93A46 H18VPH601W

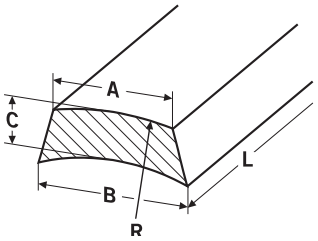


Grinding Segments

Type 3108 B x C x L / R

Segment Dimensions (Type 3108)			
B	**C**	**L**	**R**
286.5	55	155	230
286.5	59.5	155	230

Type 3108 286.5 x 55 x 155
Ordering data R230
54A46 H18VP904W

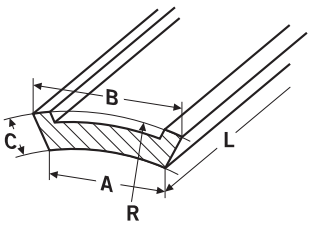


Grinding Segments

Type 3105 B/A x C x L / R

Segment Dimensions (Type 3105)				
B	**A**	**C**	**L**	**R**
53	48	15	60	75
63	57	25	150	155
69	60	20	100	150
87	79	24	149	220
87	79	30	149	220

Type 3105 69/60 x 20 x 100
Ordering data R150
54A46 H18VPH904W

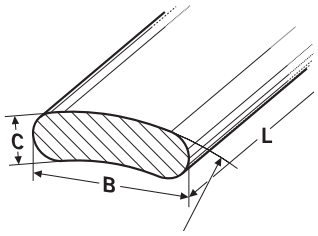


Grinding Segments

Type Sp.I B/A x C x L / R

Segment Dimensions (Type 3105)				
B	**A**	**C**	**L**	**R**
116	73	39	120	171.5
141	102	38	180	220

Type Sp.I 116/73 x 39 x 120
Ordering data R171.5
54A46 H18VP904W

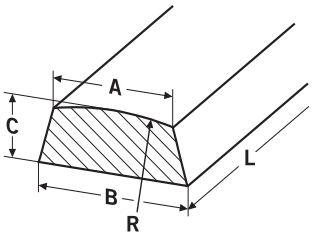


Grinding Segments

Type 3104/SP.II B x C x L / R

Segment Dimensions (Type 3104/SP.II)			
B	**C**	**L**	**R**
159	32	127	140
179.5	44.5	150	228.5

Type 3104/SP.II	159 x 32 x 127
Ordering data	R140 54A46 H18VP904W

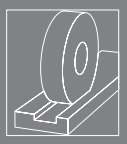


Grinding Segments

Type 3102 B/A x C x L / R

Segment Dimensions (Type 3102)				
B	**A**	**C**	**L**	**R**
64	52	25	104	125
69	60	20	100	150
86	70	25	130	150
86	70	25	150	150
104	82	38	150	240

Type 3102	86/70 x 25 x 150
Ordering data	R150 64A46 F18VP300W



With Type 2 Grinding Cylinders, Type 6 Straight Cup Wheels and Grinding Segments Types 3101 to 3109

Universal Application:

In general	Grinding cylinders (type 2, 6)	Grinding segments
Unhardened steel	64A46 H9V300W	42A24 J8V300W
Hardened steel	64A46 H18VP300W	54A46 H18VP604W

Specific Application:

Grinding Wheels	Application	Grinding cylinders (Type 2, 6)	Grinding segments
Soft steel	free cutting, machining steel	54A46 H9V904W	42A24 H9V300W 93A46 F13VPMF601W
	general purpose constructional steel	64A46 H15VP300W	42A36 H9V300W
Hardened steel, low-alloy up to 62 HRc	case hardened, quenched and tempered steel	64A54 E15VPHF300W	54A36 H18VP904W
	flame-hardened and induction hardened steel	57A46 G16VPLF300W	54A36 H18VP904W
High-alloy hardened steel, > 62 HRc	tool steel	64A46 F18VP300W	57A36 E9V300W
	high speed steel	A54 H8/4BW10 93A60F15VPH901W	A36 H7BW 92A36-2 H13VP601
Stainless steel, acid and heat resistant steel (e.g. INOX),	unhardened	64A46 H9V300W	42A24 H9V300W
	hardened, high-alloy	64A46 H18VP300W 93A60 F15VPMF901W	42A36 G9V300W 93A60 F15VPMF901W
Nitriding steel	untreated	64A60 H8V300W	42A24 H9V300W
Cast iron and cast	cast steel	64A46 H15VP300W	42A24 H9V300W
	grey cast iron	64A46 H15VP300W	42A24 H9V300W
	annealed cast iron and nodular cast iron	11C60 H18VP	11C46 H18VP
Tungsten carbide and ceramics		C46 H7BW	C36 H7BW
Non-ferrous metals	aluminium, copper, bronze etc.	11C46 H18VP	11C36 H18VP

Profile Grinding with Straight Grinding Wheels

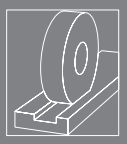
Types 1, 5, 7, 1A1

Universal Application:

Grinding Wheels	≤ ∅ 300 mm	> ∅ 300 mm
In general:		
Unhardened steel	53A36 H8V302W 64A46 J8V300W	64A46 H9V300W 54A46 H15VPMF904W
Hardened steel	64A60 H15VP300W 32B126 L16CVPMF800C75	64A46 H15VP300W 93A46 H15VPH601W

Specific Application:

Grinding Wheels	Application	≤ ∅ 300 mm	> ∅ 300 mm
Soft steel	machining or constructional steel	64A46 H9V300W	64A46 H9V300W
Hardened steel, low-alloy up to 62 HRc	case hardened, quenched and tempered steel	64A46 H15VP300W	64A46 H15VP300W
	flame-hardened and induction hardened steel	64A60 H15VP300W	64A60 H15VP300W
	in general	93A60 H15VPH601W 32B126L16CVPMF800C75	93A46 H15VPH601W
High-alloy hardened steel, > 62 HRc	tool steel	93A60 F15VPH601W	93A60 F15VPH601W
	high speed steel	93N60 H15VPMF902W 81A60 F15VPH601W 11C80 F18VP 32B126 L16CVPMF800C75	93N60 H15VPMF902W 81A60 F15VPH601W 32B126 L16CVPMF800C75
Stainless steel (e.g. INOX), acid and heat resistant steel	unhardened	54A60 H15VPH904W 11C60 H15VP	54A60 H15VPH904W 11C60 H15VP
	hardened, high-alloy	54A60 F15VPH904W 93A60 F15VPH601W 11C80 H18VP 32B126 L16CVPMF800C75	93N60 F15VPMF902W 93A60 F15VPH601W 32B126 L16CVPMF800C75
Nitriding steel	untreated	64A46 H9V300W	64A46 H15VP300W
	hardened up to 62 HRc (gas nitrided)	93A60 F15VPH901W	93A60 F15VPH901W
	hardened above 62 HRc (bath nitrided)	11C60 F15VPMF	11C60 F18VPMF 32B126 L16CVPMF800C75
Cast iron and cast	cast steel	64A60 H15VP300W	64A60 H15VP300W
	grey cast iron	11C60 H15VP	11C60 H15VP
	annealed cast iron and nodular cast iron	64A60 H18VP300W	64A60 H18VP300W
Tungsten carbide and ceramics		11C60 H15VP 1D126 L16CVPMF734C75	11C60 H15VP
Non-ferrous metals	aluminium, copper, bronze etc.	11C60 H15VP 11C60 H18VP	11C60 H15VP 11C60 H18VP



Profile Surface Grinding with Straight Wheels

Types 1, 5, 7

Slot Grinding (Grinding Wheels with Calibrated Width)

Material	Application		Reciprocating grinding	Creep-feed grinding
Steel	unhardened	Roughing Finishing	54A60 H15VPMF904W 54A80 H15VPMF904W	54A60 H15VPMF904W 54A80 H15VPMF904W
	hardened	Roughing Finishing	64A60 H15VP300W 64A80 H15VP300W	54A60 F15VPMF904W 54A80 F15VPMF904W
	in general			93A120 F15VPMF601W
Stainless steel, acid and heat resistant (gas turbine and aero space components) (e.g. Nimonic, Inconel, Udimet)			54A80 H15VPMF904W 93N80 H15VP902W 93N80 H15VPMF902W	54A80 H15VPMF904W 54A80 F15VPMF904W 54A60 H15VPH904W

Grinding Wheels Profiled with Fixed Diamond Tool and/or CNC Dressing Disk

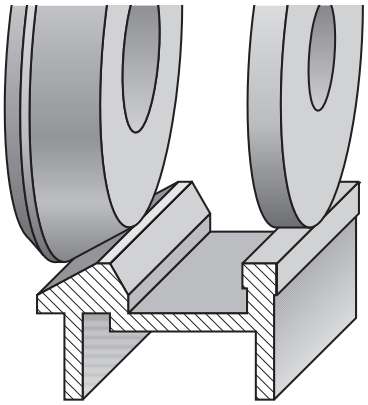
Material	Application	Reciprocating grinding	Creep-feed grinding
Steel	unhardened	54A60 VPH904W	54A60 H15VPH904W
	hardened	54A80 H15VPMF904W 54A120 F15VPH904W	54A80 F15VPMF904W 93A80 F15VPH601W

Grinding Wheels Profiled with Steel Crush Forming Rolls

Material	Application		Reciprocating grinding	Creep-feed grinding
Steel	unhardened	Roughing Finishing	64A120 F8V300W 54A180 H15VPMF904W	54A60 H15VPH904W 54A120 F15VPMF904W
	hardened	Roughing Finishing	54A80 H8V904W 54A180 G8V904W	54A80 F15VPH904W 54A120 H15VPMF904W
Cast alloys			11C60 H15VP	11C80 F15VPMF
Thread rolling dies and thread chasing tools	pitch in mm 0,25 – 0,80 1,00 – 1,25 1,50 – 1,75 ≥ 2,00	min. radius (mm) 0,03 0,10 0,16 0,22	 11C320/400 H10V 11C280/320 K3V 11C240 K3V 11C180 K3V	 11C400 F20VP 11C320/400 F20VPLF 11C320 G12VPS81 11C280 G12VPS77

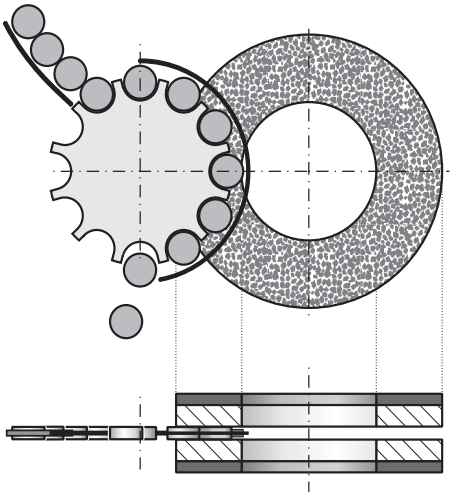
Grinding Wheels Profiled with Rotary Diamond Truers

Material	Application	Reciprocating grinding	Creep-feed grinding
Steel	unhardened	54A60 H8V904W	54A46 H15VPMF904W
	hardened	53A60 H15VPMF	54A80 F15VPH904W 57A60 H15VPH 54A60 H15VPH904W
Stainless steel, acid and heat resistant (e.g. Nimonic, Inconel, Udimet) (large profiles)		54A80 H15VPMF904W 93N80 H15VP902W 93N80 H15VPMF902W	54A80 H15VPH904W 54A80 F15VPMF904W 54A60H15VPH904W



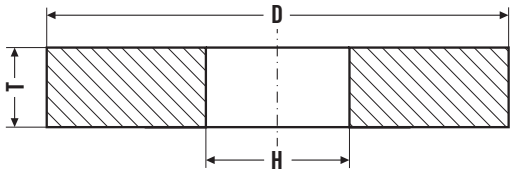
Slideway Grinding
Types 1, 5, 7, 11sp.

Application	Flaring cup wheels Type 11 sp	Wheels Types 1, 5, 7 with face Type N
Gray cast iron	11C46 H15VP	11C46 H15VP
Cast Steel	64A46 H15VPH300W	64A60 H15VPH300W 93N60 H15VP302W



Twin Wheel Surface Grinding
Types 35, 36

Material	Application	Large workpieces	Small workpieces
Steel	unhardened	A46 H4BW	A120 L8BW
	hardened	35A60 M10B202MPMC	35A80 M10B202MPMC
Springs	hardened	95AN20 N6B200SMC	90N24-2 07B200
Gray cast iron	Roughing	C24 L5BW	
	Finishing	C60 L7BW	
Non-ferrous metals	Roughing		C80L7BW
Con rods		63A46 L10B200MCP	63A60 M10B200MCP



Straight Grinding Wheels

Type 1 D x T x H

For Floorstand and Swing Frame Machines at 40 m/s:

Wheel Dimensions (Type 1)		
D	**T**	**H**
80	6, 10	13
100	13, 20	16, 20
125	20, 25	20
150	20, 25	20, 32
175	25	50.8
200	20, 25, 32	20, 32
225	32	25, 32
250	20, 25, 32	32
300	25, 32, 40	32, 76.2
350	32, 40, 50	32
400	40, 50, 63	40, 127
500	50, 63, 80	50.8, 203.2
600	63, 80	76.2, 203.2
750	63, 80	76.2, 304.8
Type 1 Ordering data	250 x 32 x 32 A46 M5V 40 m/s	

For Floorstand and Swing Frame Machines at 63m/s:

Wheel Dimensions (Type 1)		
D	**T**	**H**
350	50	127
400	50, 63	127
500	50, 63, 80	127, 203.2
600	63, 80	203.2, 304.8
750	80, 100	304.8
800	63, 80	203.2, 304.8
900	80, 100	304.8
Type 1 Ordering data	350 x 50 x 127 A46 M5V 63 m/s	

Non standard intermediate dimensions avaible at extra cost.

Grinding on Bench and Floor Stand Grinders with Type 1 Vitrified Grinding Wheels up to 40 m/s

Universal Application:

≤ ∅ 300 mm	> ∅ 300 mm
A36 O5V A60 M4V	A24 P5V A46 M5V

Specific Application:

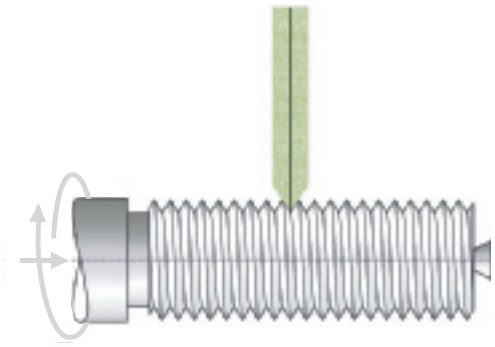
Material	Application	≤ ∅ 250 mm	≤ ∅ 300 mm	> ∅ 300 mm
Lathe tools and twist drills		42A60-3 K7V600 42A60-3 M6V600	42A60-3 K7V600 42A60-3 M6V600	42A60-3 K7V600
Gray cast iron		11C80 H5V	A24 P5V	A24 P5V
Nodular cast iron		11C80 H5V	C20 Q4V81	C20 Q4V81
Aluminium alloys		11C80 H5V	C24 M5V75	C24 M5V75
Non-ferrous metals	bronze and bass	11C80 H5V	C24 M5V75	C24 M5V75

Floorstand and Swing Frame Grinders with Type 1 Resin Grinding Wheels from 45 to 80 m/s

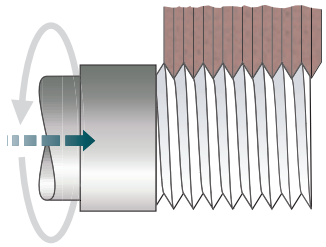
Material	Application	50 m/s	63 m/s	80 m/s Fiberreinforced
Steel, cast steel	standard applications	125ZF16 P5B25A	150ZF16 O5B25A	3A16-7 NB501F
	for high performance machines	150ZF16 Q5B25A	150ZF16 P5B25A	125ZF16 0B501
Gray cast iron, nodular cast iron	standard applications	C25ZF14 Q5B25A	C50ZF14 P5B25A	1A16-7 0B501
	for high performance machines	C50ZF14 R5B25A	C50ZF16 P5B25A	150ZF16 PB501F

THREAD AND WORM GRINDING

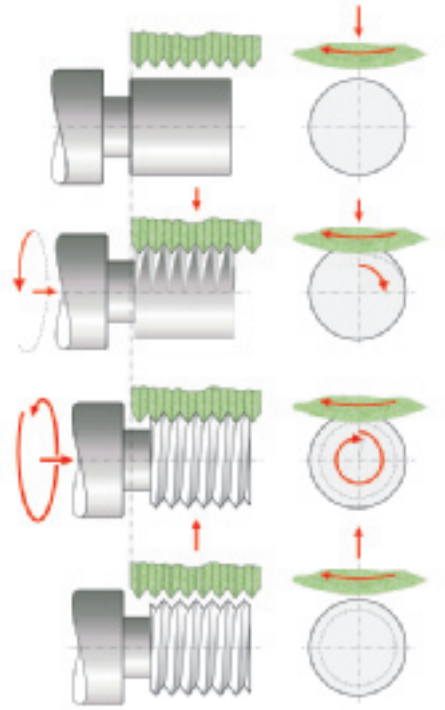
Single-Rib Thread Grinding

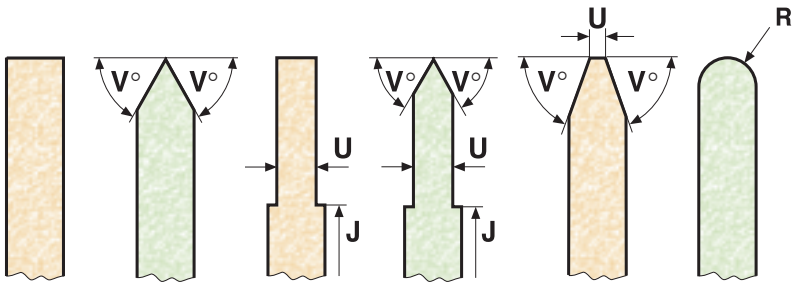


Traverse Grinding with Multi-Rib Wheels



Plunge Grinding with Multi-Rib Wheels





Single-Rib Thread Grinding

Wheel size: 250 x 6 x 155, 350 x 8 x 160

Material	Pitch mm	T.p.i. SAE/Imp	Specification
Carbon steel, soft and case hardened	0.3–0.6	32–56	42A400/500 M10V300W
	0.7–1	24–28	42A350/400 M10V300W
	1.25	20–22	42A320 M10V300W
	1.5	18–19	42A250 M10V300W
	1.75–2	12–16	42A200 L/M10V300W
	2.5–3	8–11	42A180 L/M10V300W
	3.5–4	6–7	42A150 K/L10V300W
	4.5–6	4–5	42A120 K10V300W
Ordering data : **Type 1** 350 x 8 x 160 42A320/400 M10V300W 40 m/s	**Type 1E** 250 x 6 x 155 11C220/240 K3V 40 m/s V = 60°		

Material	Pitch / mm	T.p.i.	Reishauer Designation	Specification
Tool and high speed steel	0.5–0.8	32–50	SS-0	11C400/500 H10V
	0.9–1.25	20–28	SS-1	11C320/400 H10V
	1.25–1.5	17–20	SS-2	11C280/320 G10V
	1.5–1.75	15–17	SS-3	11C220/240 K4V
	1.75–2	12–15	SS-4	11C180 K3V
	2–3	8–12	SS-5	11C150 K3V
	3–6	4–8	SS-6	11C120 K3V

Specifications and dimensions are related to Reishauer machines.
SAE/Imperial dimensions are available on request.
The specifications are also valid for other thread grinding machines.

MULTI-RIB WHEELS

Traverse Grinding Operation

Wheel Size: 350 x T x 160

Workpieces	Material	Pitch mm	T.p.i. SAE/Imp	Thickness Specification T (mm)	Specification
Thread rolling dies etc.	Tool and high speed steel up to 65 HRc	0.4 - 0.5	50 - 60	8, 12, 16, 20, 30, 40	11C400 F20VP030G
		0.6 - 0.8	36 - 48	8, 12, 16, 20, 30, 40	11C320 G12VPS81
		0.9 - 1.5	19 - 32	16, 20, 30, 40	11C280 G12VPS77
		1.75 - 2.5	10 - 18	20, 30, 40	11C220 G12VPS77
		2.75 - 6	4 - 9	20, 30, 40	11C180 G12VPS77
Type 1 Ordering data	350 x 40 x 160 11C400 F20VP030G 40 m/s				

Plunge Grinding Operation

Wheel Size: 350 x T x 160 / T= 20, 30, 40

Pitch mm	T.p.i. SAE/Imp	Specification
0.4 - 0.5	50 - 60	11C500 E/F20VP
0.6 - 0.8	36 - 48	11C400 F20VP030G
0.9 - 1.5	19 - 32	11C320/400F20VPK
1.75 - 2.5	10 - 18	11C320 G12VPS81
2.75 - 6	4 - 9	11C280 G12VPS77

The grinding wheels are profiled on the machine with a crushing roll.

Dimensions and specifications are related to Reishauer machines.
However, the recommended specifications are applicable to other thread grinding machines.

MULTI-RIB WHEELS

Traverse grinding Operation

Wheel Size: 350 x T x 160

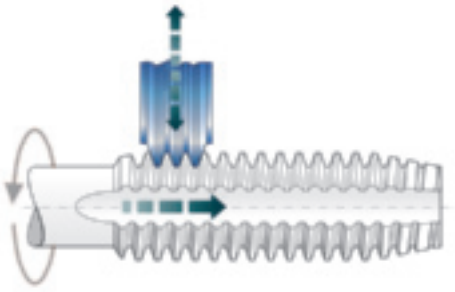
Material	Pitch mm	T.p.i. SAE/Imp	Thickness Specification T (mm)	Specification
Carbon steel, soft and case hardened up to 62 HRc	0.6–0.9	26–48	8	42A350/400 M10V300W
	1–1.25	20–25	8, 12	42A320 M10V300W
	1.5–1.75	14–19	12, 16	42A250 M10V300W
	2	11–13	12, 16, 20	42A180 L/M10V300W
	2.5	10	16, 20	42A150 K/L10V300W
	3	8–9	20, 25	42A120 K10V300W
	3.5–4.5	6–7	25	42A100 K10V300W
	5–6	4–5	30	42A100 K10V300W

Plunge Grinding Operation

Wheel Size: 350 x T x 160 / T= 20, 30, 40

Material	Pitch mm	T.p.i. SAE/Imp	Specification
Carbon steel, soft and case hardened	0.4–0.5	50–60	42A320/400 K4V300W
	0.6–0.8	36–48	42A280/320 J5/6V300W
	0.8–1	19–32	42A240 K4V300W
	1.25–1.5	19–32	42A180 J6V300W
	1.75–2.5	10–18	42A100/120 H/J7V300W
	2.75–6	4–9	57A80 J7V300W

Dimensions and specifications are related to Reishauer machines.
However, the recommended specifications are applicable to other thread grinding machines



REISHAUER RGB TAP GRINDING

Type 1, Dimension: 400 x T x 160
max. operating speed 80 m/s (15,750 SFPM)

Reishauer Designation	Nominal size metric	T.p.i. SAE/Imp	Thickness T (mm)	Specification
GM 0	M3 – M6	25 – 50	10	49A280/320 I4V2A21W
GBM 1	”	”	13	”
GBM 2	”	”	16	”
GBM 3	”	”	20	”
GBM 4	M6 – M10	18 – 24	16	28A220/280 I4V2A21W
GBM 5	”	”	20	”
GBM 6	”	”	25	”
GBM 7	”	”	32	”
GBM 8	M10 – M16	12 – 18	20	28A150/220 I4V2A21W
GBM 9	”	”	25	”
GBM 10	”	”	32	”
GBM 11	”	”	40	”
GM 12	M16 – M24	8 – 12	20	28A100/150 I1V4A21W
GBM 13	”	”	25	”
GBM 14	”	”	32	”
GBM 15	”	”	40	”

REISHAUER GBA (SMS) TAP GRINDING

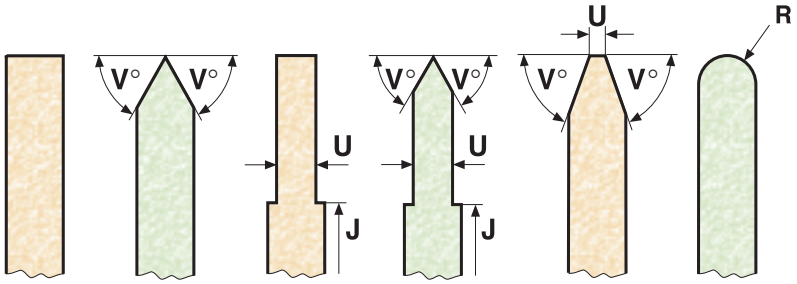
Type 1, Dimension: 500 x T x 203.2
max. operating speed: 80 m/s (15,750 SFPM)

Reishauer Designation	Nominal size metric	Pitch (mm)	T.p.i. SAE/Imp	Thickness T (mm)	Specification
GM 00	M2.5–M4	0.35–0.7	36–72	10	49A280/320 J3V2A21W
”	”	”	”	”	”
GM 0	M4–M5	0.7–1	28–48	10	”
”	”	”	”	13	28A220/280 J3V2A21W
”	”	”	”	16	”
GM 1	M5–M6	1	24–28	13	28A150/220 J3V2A21W
”	”	”	”	16	”
GM 2	M6–M8	1.25	20–24	13	28A150/220 J3V2A21W
”	”	”	”	16	”
GM 3	M9–M10	1.5	18–20	16	28A100/150 J2V3A21W
”	M12–M16	1.75–2	12–18	20	”

JUNKER TAPOMAT TAP GRINDING

Type 1, Dimension: 400 x T x 160
max. operating speed: 80 m/s (15,750 SFPM)

Nominal size metric	Pitch (mm)	T.p.i. SAE/Imp	Thickness T (mm)	Specification
M2.5-M4	0.35–0.7	36–72	7–8	49A280/320 J3V2A21W
M4–M5	0.7–1	24–36	7–11	49A220/280 J3V2A21W
M6–M8	1–1.25	20–24	12–16	49A220/240 J3V2A21W
M8-M12	1.25–1.75	14–20	14–16	49A150/220 J3V2A21W
M12-M16	1.75–2	12–14	12–18	49A100/150 J2V3A21W



Type 1 Type 1E Type 39 Type 39E Type 1Esp. Type 1F

WORMS, BALLSCREWS AND LEADSCREWS

Finish Grinding

Dimension: 350 x T x 160

Material	Module	Metric pitch	Thickness T (mm)	Specification
Case hardened steel	–0.75	–2.3	8	53A220 F10V302W
	0.8–1.75	2.5–5	8	53A180 F/G10V302W
	2–4	5.5–12	12	53A150 F/G10V302W
	4.25–6	14–18	16	53A100 G10V302W
	6.25–8	19–25	20	53A80 G10V302W
	8.25–10	26–30	25	53A80 G10V302W

Type 1 1Esp Ordering data	350 x 12 x 160 53A220 F10V302W 50 m/s V = 70°, U = 5

Ball screws

Dimension: 350 x T x 160

Material	Module	Metric pitch	Thickness T (mm)	Specification
Case hardened steel HRc 58 - 62	–1	–3.5	8	54A120 H15VPMF904W
	1.25–3.75	4–8	10	54A80 H15VPMF904W
	2.75–4	9–13	12	54A80 H15VPMF904W
	4.25–6	14–18	16	54A60 H15VPMF904W

Trapezoidal lead screws

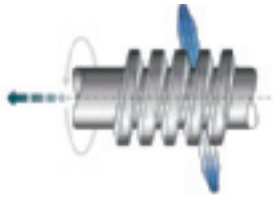
Dimension: 350 x T x 160

Material	Module	Metric pitch	Thickness T (mm)	Specification
Case hardened steel HRc 58 - 62	0.5–0.7	1.5–2	8	42A150 K/L10V300W
	0.75–2.5	2.25–8	8	42A120 K10V300W
	2.75–4	9–13	12	42A120 J10V300W
	4.25–6	14–18	16	42A100 H/J10V300W

Dimensions and specifications are related to Reishauer machines.
However, the recommended specifications are applicable to other thread grinding machines.

WORM GRINDING WITH REISHAUER, MIKROMAT, KLINGELNBERG AND SAMPUTENSILI M/C

Finishing Grinding



Tensile strength	Wheel diameter
700 to 800 Newton/mm^2	up to 500 mm

Material	Module	DP	Conventional abrasive	Ceramic abrasive
Hardened steel HRc 58 - 62	0.5–1	50–25	42A240 J6V300W	
	1–3	25–8	42A180 H8V300W	93A150/180 F8V601W
	3–4	8–6	42A120 H7V300W	
	4–7	6–3.5	42A80 H8V300W	93A100/120 F8V601W 93A80 H15VPMF601W
	7–9	3.5–2.5	42A60 J7V300W	
	9–16	2.5–1.5	42A54 J7V300W	93A60 F8V601W

Tensile strength	Wheel diameter
800 to 1000 Newton/mm^2	up to 500 mm

Material	Module	DP	Conventional abrasive	Ceramic abrasive
Hardened steel HRc 58 - 62	0.5–1	50–25	54A240 F10V904W	
	1–3	25–8	54A180 F7G10V904W	93A150/180 F8V601W
	3–4	8–6	54A150 F7G10V904W	93150 F8V601W
	4–7	6–3.5	54A80 G10V904W	93A100/120 F8V601W
	7–9	3.5–2.5	54A60 G10V904W	93A80 F8V601W
	9–16	2.5–1.5	54A46 H9V904W	93A60 F8V601W

Number of grinding passes per workpiece (Finish Grinding)
1) based on grinding allowance of 0.15 mm/flank (0.006 in/flank)
For module > 10 (DP< 2.5) more passes are needed.

Module	DP	No. of passes
0.5–1	50–25	1
2–4	12–6	1 to 2
5–7	5–3.5	2
8–10	3–2.5	2 to 3

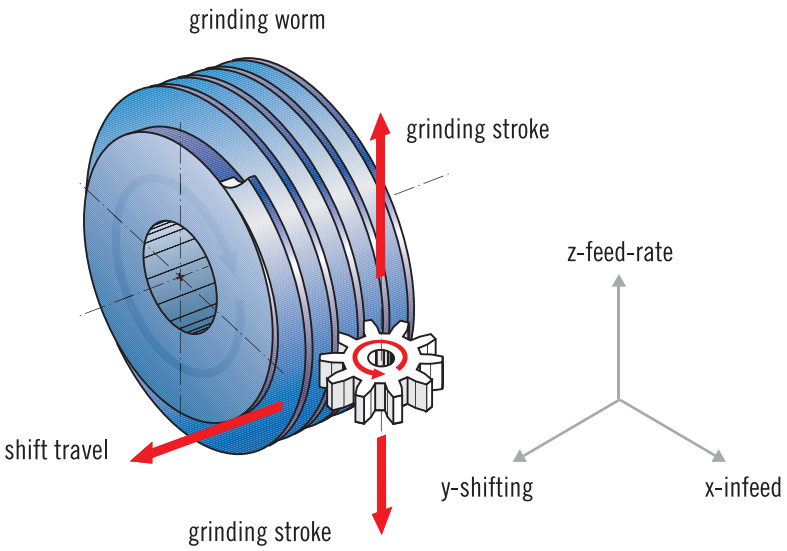
Grinding from Solid

Tensile strength	Workpiece	Wheel diameter
700 to 1000 Newton/mm^2	extruder feed screws, pump components, etc.	up to 500 mm

Material	Module	DP	Conventional abrasive	Ceramic abrasive
Soft steel HRc 58 - 62	0.5–1	50–25	54A180 H15VPMF604W	
	1–4	25–6	54A120 H15VPMF604W	93A120 F15VPMF601W
	4–6	6–4	54A80 H15VPMF604W	93A80 F15VPMF601W
	6–8	4–3	54A60 H15VPMF604W	93N60 F15VP902W
	8–16	3–1.5	54A46 H15VPMF604W	

Number of grinding passes per workpiece (Grinding from solid)

Module	DP	No. of passes
0.5–4	50–6	1
5–6	5–5	2
7	4	3
8–10	3–2.5	4



Gear Grinding with Grinding Worms

The worm wheel has a rack or straight sided shape with the side angle corrsponding to the pressure angle of the gear. This rack is in continuous contact with the gear during the grinding operation while the involute generation is occurring.

Advantages: low cumulative pitch error
constant involute and helix over the whole gear geometry

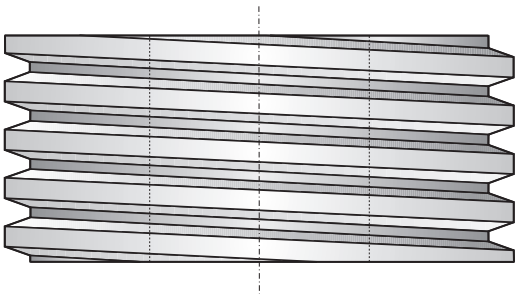
Wheel Dimensions for Reishauer Gear Grinders

Machine model	Wheel Dimensions		
	D	T	H
NZA, OZA, NZA-F, RZ 300E	350	62, 84	160
AZA, AZO, SZA, AZA 360, AZA-K	350	62, 84, 104	160
RZ 301S, RZ 301A, RZ 361S	350	84, 104	160
RZ 362A	350	84, 104	160
ZB, (AM), ZB 770	400	84, 104	160
RZ 70, RZ 770, RZ 801	400	84, 104	160
RZ 820	400	84, 104	160
RKZ 400	350	13 - 25	160
RZP	400	25 - 60	203.2
RZF	400	25 - 80	203.2
RZ 400	300	125	160
RZ 150	275	125	160
RZ 1000	300	145	160

Wheel Designation

Reishauer Nomenclature

Machine model	Wheel Dimensions		No. of starts	Code
	D	T		
NZA, AZA, RZ300E, RZ 301S & AS	350	84	1, 2 3	NZ
AZA, RZ 301S & AS, RZ 362A	350	104	1, 2 3	AZ
ZB, RZ 701, RZ 801, RZ 820	400	84	1, 2	NZB
ZB, RZ 701, RZ 801, RZ 820	400	104	1, 2	AZB
RZP	400	25 - 60		RZP
RZF	400	25 - 60		RZF
RZ 400	300	125	1-7	RZ 400
RZ 150	275	125	1-7	RZ 150



REISHAUER GEAR GRINDING WITH CONVENTIONAL ABRASIVES

Machines with Wheel-Ø 350 mm (14”):
OZA, NZA, AZA, AZO, RZ 301S,
RZ 301AS, RZ 361S

Module	DP	Specification
0.5–0.7	50–36	53A180 L13VPMF 53A240 H15VPMF
0.7–1	36–25	67A150 G/H10V042 55A80 F15VPMF604W
0.7–1.25	36–20	67A120 G/H10V042 55A120 G15VPLF604W
1–1.75	25–15	53A120/150 H15VPM* 54A120 F15VPMF604W
1.25–2	20–13	53A100 G8V
1.75–6	15–4.5	53A120 H15VPMF*
2–6	13–4	64A80/100 F8V042 54A80 F15VPMF604W 93A80 H8V601W

Wheel Dimension
350 x 62x 160
350 x 84x 160
350 x 104x 160
400 x 84 x 160
400 x 104 x 160

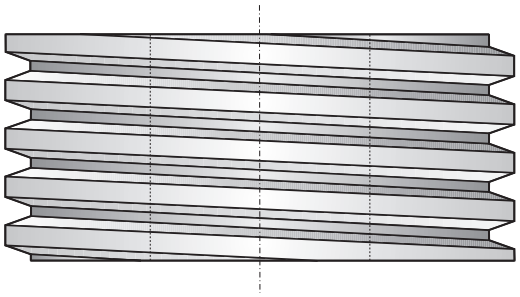
*) No. of teeth: ≤ 15

Ordering data:	
Pre-profiled wheel: Type 1sp	350 x 104 x 160 64A80/100 F8V042 50 m/s Mod. 6, PA 20°one start
Straight non-profiled wheel: Type 1	350 x 104 x 160 64A80/100 F8V042 50 m/s

Machines with Wheel-Ø 400 mm
ZB, RZ 701, RZ 801, RZ 802

Module	DP	Specification
1–1.75	28–15	53A100 G8V
2–6	12–4	64A80/100 F8V042
6–7	4–3	64A80 F8V042

The specifications as listed refer in the main to case-hardened and heat-treated steel.



REISHAUER GEAR GRINDING WITH CERAMIC ABRASIVES

Ceramic Micro-Crystalline Abrasives

Wheel Ø 350 & 400 mm (14" & 16")
for newer m/c types starting from RZ 301S (AZA)

Module	DP	Specification
1.5–4	17–6.5	93A120 G12VP601
2.75–6	9–4	93A90-2 H11VP601
6 and >	4 and <	93A80 H11VP601
Ordering data:		
Pre-profiled wheel: Type 1sp	350 x 104 x 160 93A120 G12VP601 50 m/s DP 4, PA 20° one start	
Straight non-profiled wheel: Type 1	350 x 104 x 160 93A120 G12VP601 50 m/s	

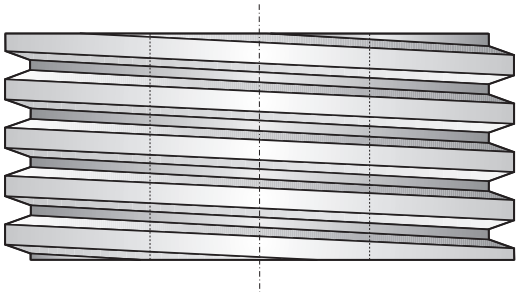
Wheel Dimension
350 x 62 x 160
350 x 84 x 160
350 x 104 x 160
400 x 84 x 160
400 x 104 x 160

Universal-Ceramic Wheels

for m/c: RZ 301S, RZ 301AS, RZ 361S, RZ 362A

Module	DP	Specification
1–3.5	25–7	93A120 J18VPLF29/601W
3.5–7	7–3.5	93A120 H18VPLF29/601W 93S120 J18VPLF29/601W

The specifications as listed refer in the main to case-hardened and heat-treated steel.



REISHAUER GEAR GRINDING WITH SPECIAL ABRASIVE NANO WIN®

Nano Win®

For RZ362A (RZ400) machines

Module	DP	Specification
1.5–4	17–6.5	A120 JV1005
2.75–6	9–4	A90 JV1008 A90 JV1785*
6 and >	4 and <	A80 JV1007
Ordering data		
Pre-profiled wheel Type 1sp	300 x 125 x 160 A120 JV1005 63 m/s Mod. 3, PA 20°, 7-starts	
Straight non-profiled wheel: Type 1	300 x 125 x 160 A120 JV1005 63 m/s	

Wheel Dimension
350 x 104 x 160
300 x 125 x 160
275 x 125 x 160

*) Standard for medium stock removal rate

Nano Win®

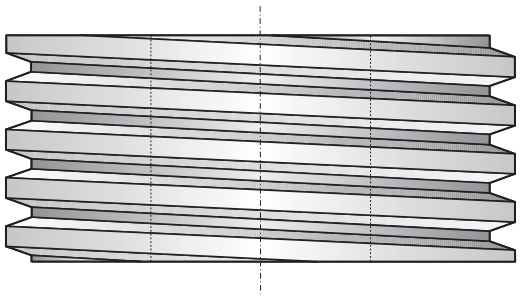
Universal wheel for RZ400 machines

Module	DP	Specification
3.5–8	7–3	93N80 J18VPLF68/602WS1
1–3	25–8	93N120 J18VPLF68/602WS1

Nano Win®

Universal wheel for RZ150 machines

Module	DP	Specification
2–3.5	12–7	93N80 J18VPLF68/602WS1
1–2	25–12	93N120 J18VPLF68/602WS1

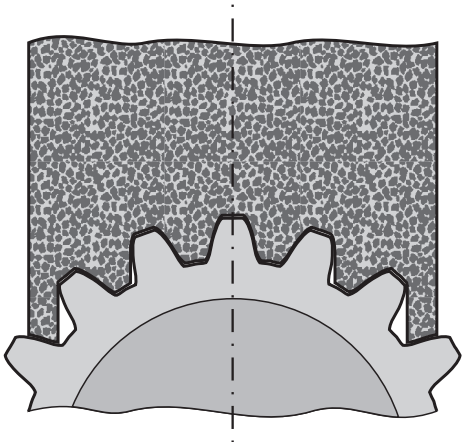


REISHAUER GEAR GRINDING OF SOFT STEEL

Ceramic Micro-Crystalline Abrasives

Wheel Ø 350 & 400 mm (14" & 16")
for newer m/c types starting from RZ 301S (AZA)

Module	DP	Specification
1.5–2	17–12	67A120 K4V042
2–6	12–4	42A80 K5V
Pre-profiled wheel **Type 1sp** **Ordering data**	350 x 104 x 160 42A80 K5V 50 m/s DP 4, PA 20° one start	

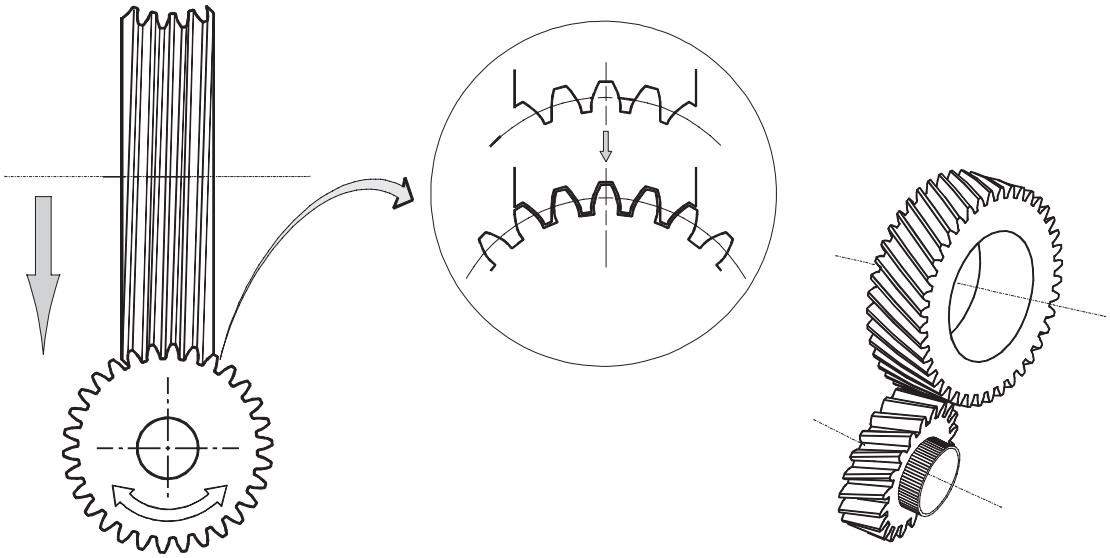


REISHAUER RZP

Module	DP
1.5–3	17–8.5
Type 1 **Ordering data**	400 x 27 x 203.2 42A100/120 D/E6/7V 50m/s

Globoidal wheel shape can be profiled on machine only.
Wheel width is determined by module/DP and helix angle; usually selected by Reishauer.

Wheel Dimension	Specification	Reishauer No.
400 x 25 x 203.2	42A 100/120 D/E6/7V	RZP 4/25
400 x 27 x 203.2	42A 100/120 D/E6/7V	RZP 4/27
400 x 30 x 203.2	42A 100/120 D/E6/7V	RZP 4/30
400 x 32 x 203.2	42A 100/120 D/E6/7V	RZP 4/32
400 x 35 x 203.2	42A 100/120 D/E7V	RZP 4/35
400 x 40 x 203.2	42A 100/120 D/E7V	RZP 4/40
400 x 45 x 203.2	42A 100/120 D/E7V	RZP 4/45
400 x 50 x 203.2	42A 100/120 D/E7V	RZP 4/50
400 x 60 x 203.2	42A 100/120 D/E7V	RZP 4/60



RZF Machine: Continuous Profile Plunge Grinding

Form involute grinding with a globoidal wheel gear grinder allows grinding and honing of the workpiece in one clamping position. This process features very short grinding times and high accuracy regarding cumulative pitch error, tooth form and consistent tooth thickness. Gears produced by that process are honed by a subsequent process on the RZF machine to further improve the gear quality to DIN 4 to 5 in high volume gear production. This system eliminates all the disadvantages of the two separate processes; grinding and honing. The most outstanding features are:

- economic high volume production at high quality
- improved noise characteristics of gears

Reishauer RZF Grinding Wheels

Working Range of RZP

Module	DP
1.5–5	17–5
Type 1 Ordering data	400 x 32 x 203.2 63 m/s 93S120 F8V601P

The globoidal wheel shape can only be profiled on the RZF machine itself by a diamond plated master quality gear wheel. For this reason, the wheel is always supplied without profile as a Type 1 wheel. The wheel's width is determined by the gear helix angle, the angle between the axes of the grinding wheel and by the module or DP. The width is generally determined by Reishauer.

RZF Wheel Dimensions

Dimensions	DP
400 x 25 x 203.2	93S120-2 F8V601P
400 x 27 x 203.2	93S120-2 F8V601P
400 x 30 x 203.2	93S120-2 F8V601P
400 x 32 x 203.2	93S120-2 F8V601P
400 x 35 x 203.2	93S120-2 F8V601P
400 x 40 x 203.2	93S120-2 F8V601P
400 x 45 203.2	93S120-2 F8V601P
400 x 50 203.2	93S120-2 F8V601P
400 x 60 203.2	93S120-2 F8V601P
400 x 70 203.2	93S120-2 F8V601P
400 x 80 203.2	93S120-2 F8V601P

RZF Honing Rings

The patented RZF honing rings were specifically developed jointly by Reishauer and Winterthur and feature the following advantages:

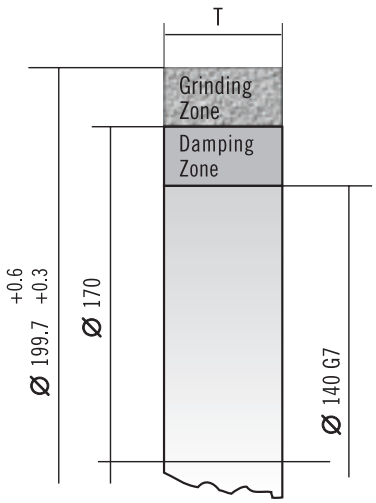
- The tooth profile of the honing ring is ground by the continuous generation method on a high precision gear grinder in order to avoid detrimental cumulative pitch errors. This protects the very costly diamond dressing master gears from damage and/or destruction; it increases the life of the dressing tool and decreases the initial dressing time.
- Vibration dampening centre to eliminate all residual vibrations during honing. This increases the tool life of the honing ring and the dressing tool, and also improves the final surface finish.
- Self-centring bore material guarantees optimal true-running. As the ring is clamped in the tool holder, the clamping pressure induces to honing ring bore to contract and to centre itself perfectly on the flange ring. This reduces the initial dressing time and protects the diamond dressing gear.

Design and specification of the honing rings are determined by Reishauer. When ordering honing rings from Winterthur or Reishauer, please specify in accordance with the following sample ordering data:

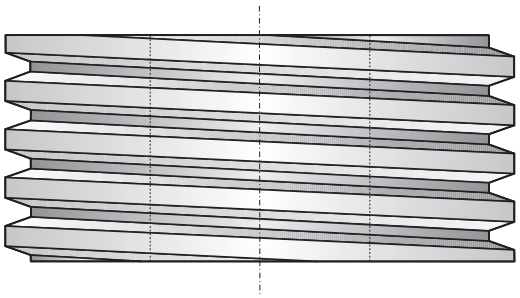
Ordering Data

Honing Ring No (Reishauer)	Grain	Standard Module mn	Angle of axes γ	No. of teeth z	Helix angle ß	Width b
384132	150	2.5	15°	57	-41.10°	50

Honing Ring Drawing



Item No.	Width T
1	20
2	25
3	30
4	35
5	40
6	45
7	50
8	55
9	60



LIEBHERR GEAR GRINDING

For Machines:
LCS150, LCS200, LCS, LCS300, LCS380

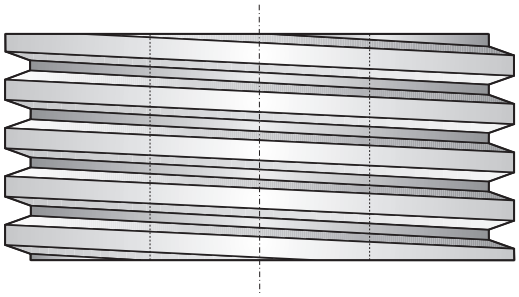
Standard Universal

Module	DP	Specification
1.5–4	25–12	A120 JV6501
2.75–6	12–8	A90 JV6517
6 and >	4 and <	A80 JV6505

Wheel Dimension
195 x 200 x 90

Nano Win®

Module	DP	Specification
1.5–4	25–12	A120 JV6005
2.75–6	12–8	A90 JV6008
6 and >	4 and <	A80 JV6007
Ordering data: **Pre-profiled wheel Type 1sp**	195 x 200 x 90 A120 JV6005 63 m/s DP 3, PA 20°, 5-starts	
Straight non-profiled wheel Type 1	195 x 200 x 90 A120 JV6005 63 m/s	



GLEASON TAG 400

Module	DP	Specification
2– 6	13–4	64A80/100 F8V042

Wheel Dimension
350 x 64 x 160
350 x 84 x 160
350 x 104 x 160

For high performance use

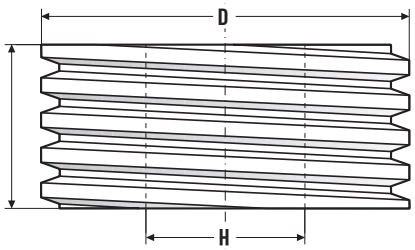
Module	DP	Specification
1–3	25–8	93A120 G12VP601
3–6	13–4	93A90-2 H11VP601
Ordering data: **Pre-profiled wheel Type 1sp**	350 x 104 x 160 93A120 G12VP601 50 m/s DP 6, PA 20° one start	
Straight non-profiled wheel Type 1	350 x 104 x 160 93A120 G12VP601 50 m/s	

The specifications as listed refer in the main to case-hardened and heat-treated steel.

GLEASON-HURTH 245 TWG

Module	DP	Specification
1.5–4	17–6	A120 JV8501
2.75–6	25–16	A90 JV8517
6 and >	4 and <	A80 JV8516
Ordering data: **Pre-profiled wheel Type 1sp**	220 x 180 x 76.2 A120 JV8501 63m/s DP 3.25, PA 20°, 3-starts	
Straight non-profiled wheel Type 1	220 x 180 x 76.2 A120 JV8501 63m/s	

Wheel Dimension
220 x 180 x 76.2



CSEPEL MACHINES

Module	DP	Specification
> 4.00	< 6	42A80 K5V
< 4.00	> 6	42A120 K5V 53A120 L13VPMF
Pre-profiled wheel	450 x 104 x 203	
Type 1sp	42A80 K5V 50 m/s	
Ordering data	DP 5, PA 20° one start	

Wheel Dimension
450 x 63/84/104 x 203.0

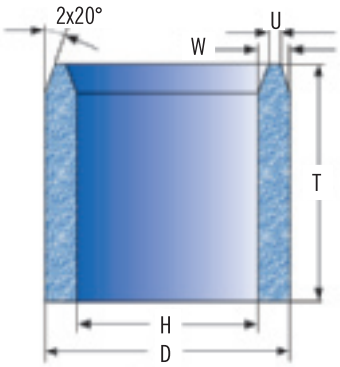
Or alternatively the following specifications are also successful

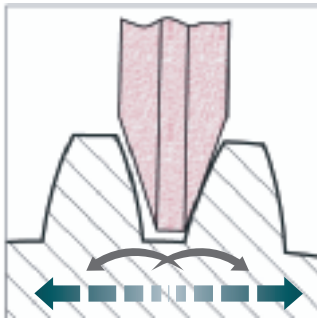
Module	DP	Specification
1–1.75	25–12	67A180 G/H10V042
2–2.75	12–8	67A150 G/H10V042
3–3.75	8–6	67A120 G/H10V042
4–4.75	6–5	67A100 G/H10V042
5–6	5–4	53A100 G8V
6–7	4–3.5	64A80/100 F8V042

The specifications as listed refer in the main to case-hardened and heat-treated steel.

SPIRAL BEVEL GEAR GRINDING WITH KLINGELNBERG AND GLEASON GRINDING MACHINES

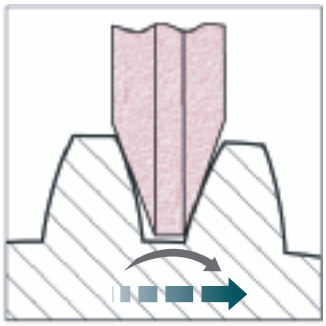
Application	Specification
Universal Application for case-hardened steel	93A70-2 J7V601W
Automative gears case-hardened steel	93A80 G13VPMF601W 93A80 H12VP601W
Gears with large contact areas and high load bearing for example: fork lifts	93A80 H15VP601W 93A120 F15VP601W
Bevel gears made of aeros- pace materials (Inconel etc.)	53A80 F15VPMF302W 53A120 F15VPMF302W
Form 2sp **Ordering Data**	120 x 80 x 80 93A70-2 J7V601 40 m/s W = 20, U = 3, V = 20°





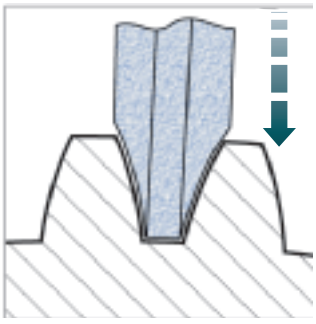
Single flank grinding

One tooth flank is ground per gap and generating direction. This process makes it possible to grind different modules with the same thickness “T” of a given grinding wheel. This method allows to have different infeeds for left and right flanks depending on heat treatment distortion. Separate lead modifications for left and right flanks are also possible.



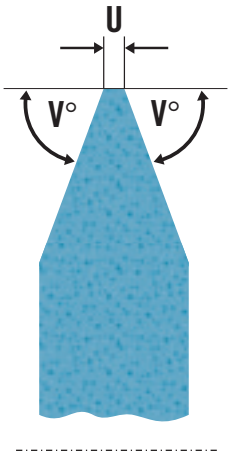
Double flank grinding

Both tooth flank of a given gap are ground simultaneously in a single generating direction. This requires a corresponding wheel thickness “T” for a given module. This process is most suitable for large batch production.



Form grinding method

Simply stated, this means that the form required on the workpiece is the exact reverse to the form or shape put into the grinding wheel. CNC contour dressing technology will ensure that this method will gain dominance.



OERLIKON GEARTEC MAAG OPAL 500, 800, 1200 (LIEBHERR)

Wheel Dimension	
Type 1Esp	250 (300) x 25/32/40 x 127
Type 7Esp	250 (300) x 50/63 x 127

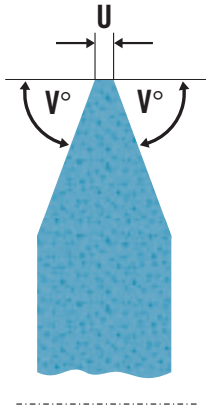
Standard Abrasives

Material / Application	Module	DP	Specification	Specification Liebherr
High Material Removal	> 4	< 6	54A80 F15VPMF904W	55N80 H15VPH902W
Finish Grinding high surface quality)	> 4	< 6	54A120 F15VPMF904W 54A120 F15VPMF904W 54A180 F15VPMF904W 54A120 F15VPMF904W	55N80 F15VPH902W
For hard-to-grind materials up to HRc 62 Full mod/ DP range			64A120 F15VPMF300W 64A120 F18VPMF300W 64A180 F15VPMF300W 64A180 F18VPMF300W	93S60 H15VPH601W
Ordering data **Type 1Esp**	250 x 32 x 127 53A80 F15VPMF 50m/s V° = 70, U = 5			

Ceramic Abrasives

Module DP	Specification
Full mod/ DP range	85S80 F15VPMF601W 85S120 F15VPMF601W
Internal gearing ∅ 150	93S80 H15VPH601W
External gearing ∅ 150	93S60 H15VPH601W

The specifications as listed refer in the main to case-hardened and heat-treated steel.



HOEFLER, NILES, PFAUTER KAPP, REFORM, SAMPUTENSILI

Standard Abrasives Profile Grinding

Module	DP	Specification
1–3	25–8	54A120 F15VPMF604W
3–6	8–4	54A80 F15VPMF604W
6–10	4–2.5	54A80 H15VPH604W
10–25	2.5–1	54A60 H15VPH604W
Ordering data Type 1Esp	300 x 32 x 127 53A80 H15VPMF 50 m/s V° = 70, U = 5	

Standard Abrasives Generating Grinding

Module	DP	Specification
Universal	25–8	54A80 F15VPMF604W
Universal older M/C	12–4	57A60 J7V

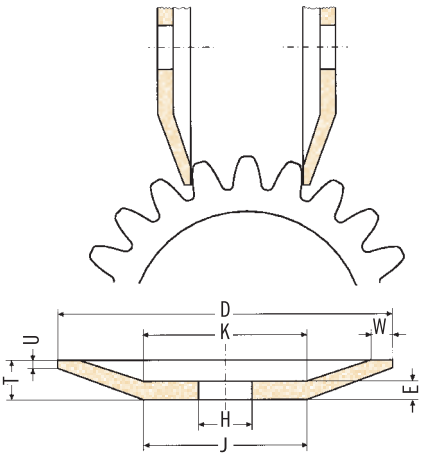
Ceramic Abrasives and Nano Win® Profile Grinding

Module	DP	Specification
1–3	25–8	93120 F15VPMF601W 85S120 H15VP601W 55N120 H15VPH902W
3–10	8–2.5	93A80 F15VPMF601W 85S80 H15VPH601W 55N60 H15VPH902W
10–25	2.5–1	93A60 H15VPH601W 85S60 H15VPH601W 55N60 F15VPH902W

Ceramic Abrasives and Nano Win® Generating Grinding

Module	DP	Specification
3–6	25–8	93S80 H15VPMF601W 93A60 H15VP601W 85S80 H15VPMF601W 93N80 H18VPLF68/602W
> 4	< 6	93S60 H15VP601W 93A60 H15VP601W 85S60 H15VP601W 93N80 H18VPLF68/602W

The specifications as listed refer in the main to case-hardened and heat-treated steel.



GEAR GRINDING WITH DISH GRINDING WHEELS MAAG MACHINES

Maag machines

Wheel Dimensions

D x T x H	U	Module	DP
220 x 20 x 90	2	2–4	12–6
280 x 32 x 90	6	3–6	8–4
340 x 28.5 x 150	12	3.5–9	3–2
450 x 29 x 127	10	4–15	6–1.5
Dish grinding wheel **Type 12sp** **Ordering data**	280 x 32 x 90 64A60 G9V 40 m/s J 145,U 6,W 10, E 16, K155		

Specification

Roughing	Intermediate	Finishing
42A46 H9V	42A60 H8V	42A80 H8V
42A54 G9V	42A60 G9V	42A80 G8V
64A54 G9V042	64A60 G9V042	64A80 G8V042
64A60 F9V042	64A80 F8V042	64A100 F8V042 11C80 H14VPLF

Recommendations for wheel selection

Abrasive	Material
42A	for case hardened steel up to 60 HRc
64A	for case hardened and tool steel to 63 HRc
11C	for nitrided steel up to 65 HRc

Grit Size	Profiled wheel
46 to 60	for larger modules (> mod 5.00, < DP 5)
60, 80, 100	for smaller modules (< mod 5.00, > DP 5)

NOTES

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