



Hermes grinding wheels for gear manufacturing

Hermes grinding wheels for gear manufacturing

Hermes manufactures high-quality, proven grinding wheel specifications for tooth flank grinding, cylindrical grinding and ID grinding in gear manufacturing.

Conventional aluminum oxide and Sapphire Blue wheels are used for tooth flank grinding on various Reishauer and Gleason rolling and profile grinding machines, and on Gleason, Hoefler, Maag and Niles grinding machines.

The new ceramic grain “CB Sapphire Blue” (microcrystalline aluminum oxide) gives considerable process improvements in

tooth machining with grinding wheels. Major improvements have been achieved, particularly in grinding tooth flanks on Reishauer and Gleason grinding machines. Also in generating grinding with a grinding worm and in form grinding with a globoidal worm. The differences between generating grinding and form grinding are explained in the comparison given below.

CB Sapphire Blue grinding wheels also feature improved process parameters for machining tooth flanks of gears on Hoefler, Maag and Niles grinding machines.

Process comparison: generating grinding vs. form grinding		
Process	Generating grinding	Form grinding
Machine	Reishauer RZ 301 S, Gleason	Reishauer RZP 200, Gleason
Gear pitch	50 to 4	25 to 8
Grinding wheel dimensions	D = 14" T = 3 10/32" and 4"	D = 14" and 16" T = 1" to 2 23/64"
Profile	Rack-shaped	Globoidal
Dressing (truing)	With diamond wheels designed for indexing and pressure angle areas	With diamond gear dresser
Grinding strategy	1 or 2 roughing passes, 1 finishing pass The dressed wheel profile is fully used by means of “shifting”. (“Shifting” means tangential moving of the workpiece along the grinding worm. The “shift distance” is the length of the tangential shifting during one workpiece revolution.)	Rotating feed process Feed corresponds to profile depth. The right-hand and left-hand gear teeth are finish ground one after the other, by changing the speeds of workpiece and grinding worm. RZP grinding is often followed by finish machining in the form of gear honing.

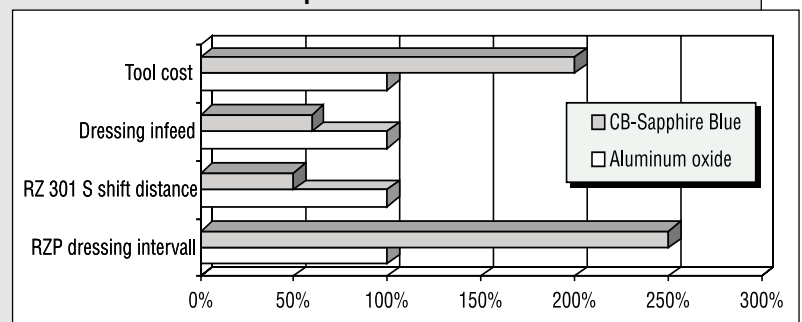
Grinding cost

The higher tool cost of CB Sapphire Blue wheels is offset by considerably higher output potential, with optimal adaptation to the grinding process. The chart and table on the right show the cost reductions that can be achieved in gear grinding thanks to the longer life of CB-Sapphire Blue wheels compared with conventional aluminum oxide wheels.

These cost benefits are particularly significant where CB Sapphire Blue wheels are used in high-volume production grinding; for grinding small series, it is generally better to continue using standard aluminum oxide wheels.

The use of CB Sapphire Blue wheels generally increases the dressing interval by a factor of up to 2.5. The dressing volume can also be reduced by 30 to 50%, the “shift distance” for generating grinding on Reishauer machine type RZ301S can often be halved, and in many cases it is possible to omit the roughing pass. Fewer dressing cycles are needed, thanks to improved profile retention.

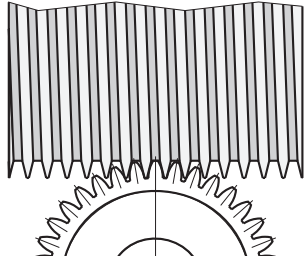
Performance and cost comparisons



Cost	Grinding wheel		Savings - per annum -	
	Al. oxide \$	CB-Sapphire Blue \$	\$	%
Grinding wheel	2.785	1.575	1.210	43
Machine	528.520	406.245	122.275	23
Tool change	410	140	270	33
Tool setting	110	40	70	67
Total	531.825	408.000	123.825	23

The cost comparison is based on results using the grinding wheel specification 3CB3 120/3 F6 V09/R in grinding transmission gears made of 16MnCr45, 1.7131 (60 + 2 HRC) with a milled initial surface quality of $R_z \leq 118$ μ m on a Reishauer RZP grinding machine.

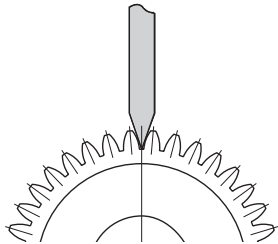
Grinding tooth flanks of transmission gears

	Generating grinding and form grinding with CB Sapphire Blue wheels		
	Machine	DP	Specification
	Reishauer - NZA, AZA, ZB	≤ 17 > 17 to 10	3CB3/9 150 I6 VEZ1 3CB3/9 120 H6 VEZ1
	Gleason	> 10 to 7 > 7	3CB3 100 H7 VEZ1 3CB3 100 H7 VEZ1
	Reishauer - RZ 301 S	≤ 17 > 17 to 10	3CB3/9 120 G6 VEZ1 3CB3 100 G7 VEZ1
	Gleason	> 10 to 7 > 7	3CB3 80 F12 VEZ1 3CB3 80 F12 VEZ1
	Reishauer - RZP	≤ 17 > 17 to 10	3CB3 150 G6 VEZ1 3CB3 120/3 F6 VEZ1
	Gleason	> 10 to 7 > 7	3CB3 100 F6 VEZ1 3CB3 100 F6 VEZ1

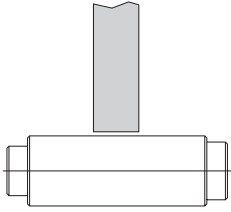
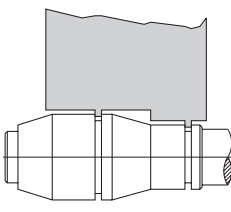
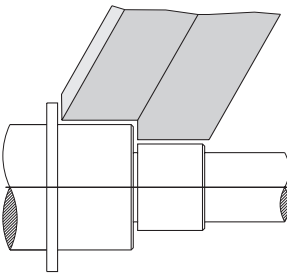
Generating grinding and form grinding with conventional wheels

Machine	DP	Specification for		
		Medium quantity	Higher quantity	Very high quantity
Reishauer - NZA, AZA, ZB Gleason	≤ 17 > 17 to 13 > 13	EKW 150 I5 V61 EKW 120 I5 V61 EKW 100 I5 V61	ERT 150 G/H6 V61 ERE 120 G/H6 V61 ERE 100 H5 V61	EKT 150 H6 V61 EKT 120 H6 V61 EKT 100 H5 V61
Reishauer - RZ 301 S Gleason	≤ 17 > 17 to 13 > 13	EKW 150 I13 V61Z P44 EKW 120 I13 V61Z P44 EKW 100 I13 V61Z P44	ERT 150 H/I13 V61Z P44 ERT 120 H/I13 V61Z P44 ERT 100 H/I13 V61Z P44	EKT 150 H13 V61Z P44 EKT 120 H13 V61Z P44 EKT 100 H13 V61Z P44
Reishauer - RZP Gleason	≤ 17 > 17 to 13 > 13	EKW 150/3 F/G8 V61YK P41 EKW 120/3 F/G8 V61YK P41 EKW 100/3 F/G8 V61YK P41	ERT 150/3 F8 V61YK P41 ERT 120/3 F8 V61YK P41 ERT 100/3 F8 V61YK P41	EKT 150/3 F8 V61YK P41 EKT 120/3 F8 V61YK P41 EKT 100/3 F8 V61YK P41

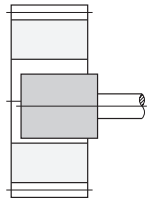
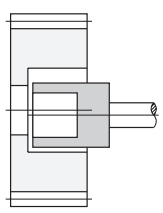
Generating grinding on Maag, Hoefler and Niles grinding machines

	Machine	DP	Specification	
	 <p>(Schematic: Hoefler, Niles)</p>	Maag		EKR 80 G9 VHK EKR 80 H9 VHK 3CB3 100 G10 VE
Hoefler		6 to 1,5	3CB3 36/1 JOT10 VEZ1	
Niles		6 to 1,5 3	3CB3 36/1 H/I10 VE 3CB3 54/1 H8 VE	
Form grinding on Hoefler, Niles and Pfauter grinding machines				
Machine		DP	Specification	
Hoefler		3	3CB3/9 54 H7 V09A	
Niles			3CB3/9 54 H7 V09A	
Pfauter		1,5	EKW 70/2 H10/28 V14	

Grinding of shafts

Cylindrical - oscillating	Workpiece	Specification	Remarks
	Bearing seats, Sliding seats	EKW 60/1 JOT5 V62 EKR 60 K3 VC EKW 70 I3 VE 3CB3 60/1 K4 VE	$R_a \leq 12 \mu\text{inch}$ $R_z = 118 \text{ to } 157 \mu\text{inch}$
Cylindrical - straight plunge	Workpiece	Specification	Remarks
	Retaining grooves	EKW 100 K3 V62 EKW 100 JOT3 V62 EKW 120 L3 V62	$R_a = 12 \text{ to } 16 \mu\text{inch}$ Attainable corner radii .008 to .010"
Cylindrical - angle approach	Workpiece	Specification	Remarks
	Bearing seats with shoulders	Single-layer wheels HKW 60/1 to 80/1* JOT6 V62 EKR 54/1 to 100/1* JOT6 VC 3CB3 60 to 120* K4 to L6 VEZ1 * finer grit, e.g. for sealing surfaces	$R_a = 24 \text{ to } 32 \mu\text{inch}$ for longer dressing intervals
		Two-layer wheels HKW 80 I11 V62 with infeed layer EKW 54 I6 V62 HKW 100 JOT11 V62 with infeed layer EKW 54 I6 V62 KR 60/2 I11 V62 with infeed layer EKW 54 G6 V62	for higher shoulders for higher shoulders for lower shoulders

Grinding bores

ID - oscillating	Workpiece	Specification
	Gear bores, Sliding sleeve bores	EKR 60 to 80* K4 VC EKW 60 to 80* JOT4 V61 3CB3 70/1 K6 VEZ1 1SK3 70/1 K6 VEZ1 * coarser grain for higher material removal rate
ID - oscillating and facing	Workpiece	Specification
	Gear bores, Sliding sleeve bores	EKW 60 to 80* JOT4 to Jot6* V61 3CB3 60 JOT4 VEZ1 1SK3 60 JOT4 VEZ1 * coarser grain for higher material removal rate * more open structure for increased material removal