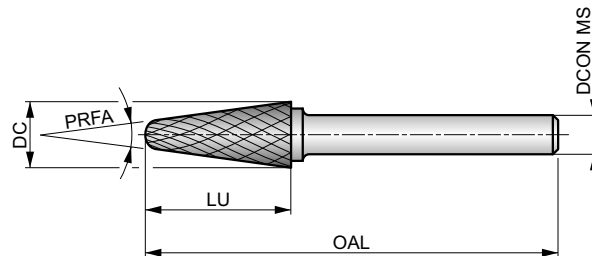


P821



Rotary Burr - Ball Nosed Cone, Shape L, Bright Finish

DC double cut flute style with close spaced edges for enlarging holes, rounding edges and surface finishing in tight narrow angles or other hard to reach areas. Carbide design for cutting diameter up to 6 mm; above 6 mm carbide head with toughened and hardened steel shank.



HM		Bright
DC		



Workpiece material group suitability. Recommended operating speed (RPM) on page 6.

P1.1	P1.2	P1.3	P2.1	P2.2	P2.3	P3.1	P3.2	P3.3	P4.1	P4.2	P4.3	M1.1	M1.2
M2.1	M2.2	M2.3	M3.1	M3.2	M3.3	M4.1	M4.2	K1.1	K1.2	K1.3	K2.1	K2.2	K2.3
K3.1	K3.2	K3.3	K4.1	K4.2	K4.3	K4.4	K4.5	K5.1	K5.2	K5.3	N3.1	N3.2	N3.3
S1.1	S1.2	S1.3	S2.1	S2.2	S3.1	S3.2	S4.1	S4.2	H1.1	H2.1	H2.2	H3.1	H3.2
H4.1	H4.2												

DC≤6.00 mm: DCON MS tolerance h6; DC>6.00 mm: Brazed on steel shank with DCON MS tolerance h7.
Products from this series are also available in set. Please see P880 or P890.

Product	DC	DCON MS	LU	OAL	PRFA
	[mm]	[mm]	[mm]	[mm]	[°]
P8213.0X3.0	3.00	3.00	14.00	38.0	8
P8216.0X6.0	6.00	6.00	18.00	50.0	14
P8218.0X6.0	8.00	6.00	25.40	70.0	14
P8219.6X6.0	9.60	6.00	30.00	76.0	14
P82112.7X6.0	12.70	6.00	32.00	77.0	14
P82116.0X6.0	16.00	6.00	33.00	78.0	14

ROTARY BURRS – ICONS OVERVIEW














General Icons

	Primary use
	Possible use

Material Code (BMC)

HM	Hard Material (Solid Carbide)
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Burr Shape

A 	Cylinder Shape without endcut	F 	Ball Nosed Tree Shape	L 	Ball Nosed Cone Shape
B 	Cylinder Shape with endcut	G 	Pointed Tree Shape	M 	Cone Shape
C 	Ball Nosed Cylinder Shape	H 	Flame Shape	N 	Inverted Cone Shape
D 	Ball Shape	J 	60° Countersink Shape		
E 	Oval Shape	K 	90° Countersink Shape		

Burr End Shot

	Drill Point Burr End
	End Cut Burr End
	End Mill Burr End


Coating

	Bright (uncoated)
	Titanium Aluminium Nitride Coating

ROTARY BURRS – ICONS OVERVIEW

Application Angle

	60° Countersink
	90° Countersink

	Drill Point 135°
	Drill Point 180°

	Spot Drill Point 150°
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Burr Cut Flute Style (BTC)

DC	Double Cut Geometry
ST	Steel Cut Geometry
VA	Stainless Steel Cut Geometry





AL	Aluminium Cut Geometry
GRP	Fibreglass and Composite Materials Cut Geometry
BR	Bolt Removal Cut Geometry





AS	Superalloy Cut Geometry
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Basic Standard Group (BSG)

	Dormer Standards
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Operations Deburring

	Deburring - Bolt removal operation 1
	Deburring - Bolt removal operation 2
	Closed groove deburring and carving
	Composite fibre routing

	Curved surface deburring and carving
	Fillet radii deburring
	Free hand deburring and carving
	Chamfer deburring


	Inverted back deburring
	Plain surface deburring
	Shoulder deburring
	V-groove deburring

Other Icons


	Bolt size
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ROTARY BURRS – SURFACE AND TREATMENTS COATINGS NAVIGATOR

Surface Treatments


Bright (uncoated)		Bright finish (uncoated surface) improves chip flow in soft or non-ferrous materials and maintains sharp cutting edges in abrasive materials.
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Surface Coatings

Titanium Aluminium Nitride Coating (TiAlN)		Titanium Aluminium Nitride is a multi layer ceramic coating applied by PVD coating technology, which exhibits high toughness and oxidation stability. These properties make it ideal for higher speeds and feeds, while at the same time improving tool life. TiAlN is used in drilling, tapping, and milling applications and can be suitable for use when machining without coolant.
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ROTARY BURRS – TOOL MATERIALS NAVIGATOR

HM materials

Carbide Materials (or Hard Materials)		<p>A sintered powder metallurgy substrate, consisting of a metallic carbide composite with binder metal. The most central raw material is tungsten carbide (WC). Tungsten carbide contributes to the hardness of the material. Tantalum carbide (TaC), titanium carbide (TiC) and niobium carbide (NbC) complements WC and adjusts the properties to what is desired. These three materials are called cubic carbides. Cobalt (Co) acts as a binder and keeps the material together.</p> <p>Carbide materials are often characterised by high compression strength, high hardness and therefore high wear resistance, but also by limited flexural strength and toughness. Carbide is used in taps, reamers, milling cutters, drills and thread milling cutters.</p>
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WMG (WORK MATERIAL GROUP)

ISO group	WMG (Work Material Group)		Hardness (HB or HRC)	Ultimate Tensile Strength (MPa)		
P	P1	P1.1	Sulfurized	< 240 HB	≤ 830	
		P1.2	Free machining steel	Sulfurized and phosphorized	< 180 HB	≤ 620
		P1.3	(carbon steels with increased machinability)	Sulfurized/phosphorized and leaded	< 180 HB	≤ 620
	P2	P2.1	Plain carbon steel (steels comprised of mainly iron and carbon)	Containing <0.25 % C	< 180 HB	≤ 620
		P2.2		Containing <0.55 % C	< 240 HB	≤ 830
		P2.3		Containing >0.55 % C	< 300 HB	≤ 1030
	P3	P3.1	Alloy steel (carbon steels with an alloying content ≤ 10%)	Annealed	< 180 HB	≤ 620
		P3.2		Hardened and tempered	180 – 260 HB	> 620 ≤ 900
		P3.3			260 – 360 HB	> 900 ≤ 1240
	P4	P4.1	Tool steel (special alloy steel for tools, dies and molds)	Annealed	< 26 HRC	≤ 900
P4.2		Hardened and tempered		26 – 39 HRC	> 900 ≤ 1240	
P4.3				39 – 45 HRC	> 1240 ≤ 1450	
M	M1	M1.1	Ferritic stainless steel (straight chromium non-hardenable alloys)	< 160 HB	≤ 520	
		M1.2		160 – 220 HB	> 520 ≤ 700	
	M2	M2.1	Martensitic stainless steel (straight chromium hardenable alloys)	Annealed	< 200 HB	≤ 670
		M2.2		Quenched and tempered	200 – 280 HB	> 670 ≤ 950
		M2.3		Precipitation-hardened	280 – 380 HB	> 950 ≤ 1300
	M3	M3.1	Austenitic stainless steel (chromium-nickel and chromium-nickel-manganese alloys)	< 200 HB	≤ 750	
		M3.2		200 – 260 HB	> 750 ≤ 870	
		M3.3		260 – 300 HB	> 870 ≤ 1040	
	M4	M4.1	Austenitic-ferritic (DUPLEX) or super-austenitic stainless steel	< 300 HB	≤ 990	
		M4.2	Precipitation hardening austenitic stainless steel	300 – 380 HB	≤ 1320	
K	K1	K1.1	Gray iron or Automotive Gray iron (GG) (iron-carbon castings with a lamellar graphite microstructure)	Ferritic or ferritic-pearlitic	< 180 HB	≤ 190
		K1.2		Ferritic-pearlitic or pearlitic	180 – 240 HB	> 190 ≤ 310
		K1.3		Pearlitic	240 – 280 HB	> 310 ≤ 390
	K2	K2.1	Malleable iron (GTS/GTW) (iron-carbon castings with a graphite-free microstructure)	Ferritic	< 160 HB	≤ 400
		K2.2		Ferritic or pearlitic	160 – 200 HB	> 400 ≤ 550
		K2.3		Pearlitic	200 – 240 HB	> 550 ≤ 660
	K3	K3.1	Ductile iron (GGG) (iron-carbon castings with a nodular graphite microstructure)	Ferritic	< 180 HB	≤ 560
		K3.2		Ferritic or pearlitic	180 – 220 HB	> 560 ≤ 680
		K3.3		Pearlitic	220 – 260 HB	> 680 ≤ 800
	K4	K4.1	Austenitic gray iron (ASTM A436) (iron-carbon alloy castings with an austenitic lamellar graphite microstructure)		< 180 HB	≤ 190
K4.2		Austenitic ductile iron (ASTM A439 or ASTM A571) (iron-carbon alloy castings with an austenitic nodular graphite microstructure)		< 240 HB	≤ 740	
K4.3		Austempered ductile iron (ASTM A897) (iron-carbon alloy castings with an ausferrite microstructure)	< 280 HB	> 840 ≤ 980		
K4.4			280 – 320 HB	> 980 ≤ 1130		
K4.5			320 – 360 HB	> 1130 ≤ 1280		
K5	K5.1	Compacted graphite iron CGI (ASTM A842) (iron-carbon castings with a vermicular graphite structure)	Ferritic	< 180 HB	≤ 400	
	K5.2		Ferritic-pearlitic	180 – 220 HB	> 400 ≤ 450	
	K5.3		Pearlitic	220 – 260 HB	> 450 ≤ 500	
N	N1	N1.1	Commercially pure wrought aluminium	< 60 HB	≤ 240	
		N1.2	Wrought aluminium alloys	Half hard tempered	60 – 100 HB	> 240 ≤ 400
		N1.3		Full hard tempered	100 – 150 HB	> 400 ≤ 590
	N2	N2.1	Cast aluminium alloys	< 75 HB	≤ 240	
		N2.2		75 – 90 HB	> 240 ≤ 270	
		N2.3		90 – 140 HB	> 270 ≤ 440	
	N3	N3.1	Free-cutting copper-alloys materials with excellent machining properties	–	–	
		N3.2	Short-chip copper-alloys with good to moderate machining properties	–	–	
		N3.3	Electrolytic copper and long-chip copper-alloys with moderate to poor machining properties	–	–	
	N4	N4.1	Thermoplastic polymers	–	–	
N4.2		Thermosetting polymers	–	–		
N4.3		Reinforced polymers or composites	–	–		
N5	N5.1	Graphite	–	–		
S	S1	S1.1	Titanium or titanium alloys	< 200 HB	≤ 660	
		S1.2		200 – 280 HB	> 660 ≤ 950	
		S1.3		280 – 360 HB	> 950 ≤ 1200	
	S2	S2.1	Fe-based high-temperature alloys	< 200 HB	≤ 690	
		S2.2		200 – 280 HB	> 690 ≤ 970	
	S3	S3.1	Ni-based high-temperature alloys	< 280 HB	≤ 940	
		S3.2		280 – 360 HB	> 940 ≤ 1200	
	S4	S4.1	Co-based high-temperature alloys	< 240 HB	≤ 800	
S4.2		240 – 320 HB		> 800 ≤ 1070		
H	H1	H1.1	Chilled cast iron	< 440 HB	–	
	H2	H2.1	Hardened cast iron	< 55 HRC	–	
		H2.2		> 55 HRC	–	
	H3	H3.1	Hardened steel <55 HRC	< 51 HRC	–	
		H3.2		51 – 55 HRC	–	
	H4	H4.1	Hardened steel >55 HRC	55 – 59 HRC	–	
H4.2		> 59 HRC		–		

RECOMMENDED OPERATING SPEED (RPM)

AL

DC

ISO		RPM						
		DC [mm]						
		3	6	8	10	12	16	20
P	min	64 000	32 000	24 000	20 000	16 000	12 000	10 000
	max	83 000	42 000	32 000	25 000	21 000	16 000	13 000
M	min	45 000	23 000	17 000	14 000	12 000	9 000	7 000
	max	64 000	32 000	24 000	20 000	16 000	12 000	10 000
K	min	58 000	29 000	22 000	19 000	15 000	11 000	9 000
	max	77 000	39 000	29 000	23 000	20 000	15 000	12 000
N	min	64 000	32 000	24 000	20 000	16 000	12 000	10 000
	max	96 000	48 000	36 000	29 000	24 000	18 000	15 000
S	min	45 000	23 000	17 000	14 000	12 000	9 000	7 000
	max	58 000	29 000	22 000	18 000	15 000	11 000	9 000
H	min	51 000	26 000	20 000	16 000	13 000	10 000	8 000
	max	71 000	36 000	27 000	22 000	18 000	14 000	11 000

ST

BR

ISO		RPM				
		DC [mm]				
		3	6	8	10	12
P	min	100 000	65 000	60 000	55 000	35 000
	max	60 000	45 000	35 000	30 000	20 000

VA

BR

ISO		RPM				
		DC [mm]				
		3	6	8	10	12
M	min	100 000	65 000	60 000	55 000	35 000
	max	60 000	30 000	25 000	20 000	15 000

GRP

ISO		RPM		
		DC [mm]		
		3	6	8
N4	min	25 000	20 000	18 000
	max	30 000	25 000	22 000

AS

ISO		RPM
		DC [mm]
		3
S	min	60 000
	max	80 000