



MILLING

Solid Carbide Milling



Solid Carbide Milling

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XER 100 N N 4 - E

1 2 3 4 5 6

1 End mill Family

B - Ball Nosed End Mill	HER - High Performance End Mill with Radius
E - Standard End Mill (Square Ended)	HMN - High Performance Multiflute End Mill (Negative)
EA - End Mill - Aluminium	HMR - High Performance Multiflute End Mill with Radius
ER - Standard End Mill with Radius	HPA - High Performance End Mill - Aluminium
ERC - Roughing End Mill with Chamfer	RSM - Reduced Shank - Multiflute End Mill
HB - High Performance End Mill - Ball Nosed	XE - Unequal Form Aerospace End Mill
HE - High Performance End Mill	XER - Unequal Form Aerospace End Mill with Radius

2 Cutting Diameter



3 Overall Length

N = Normal
S = Short
M = Medium
K = Intermediate
L = Long
XL = Extra Long
T* = Taper
X = Special

4 Flute length

N = Normal
S = Short
M = Medium
K = Intermediate
L = Long
XL = Extra Long
X = Special

5 Number of Flutes



Z** = 2 - 10

6 Radius

C = 0,25
D = 0,30
E = 0,50
F = 0,75
G = 1,00
H = 1,25
J = 1,50
K = 2,00
L = 2,50
M = 3,00
P = 4,00
Q = 5,00

* When cutting diameter (D) is smaller than the shank diameter (d1), the overall length designation is followed by a "T".

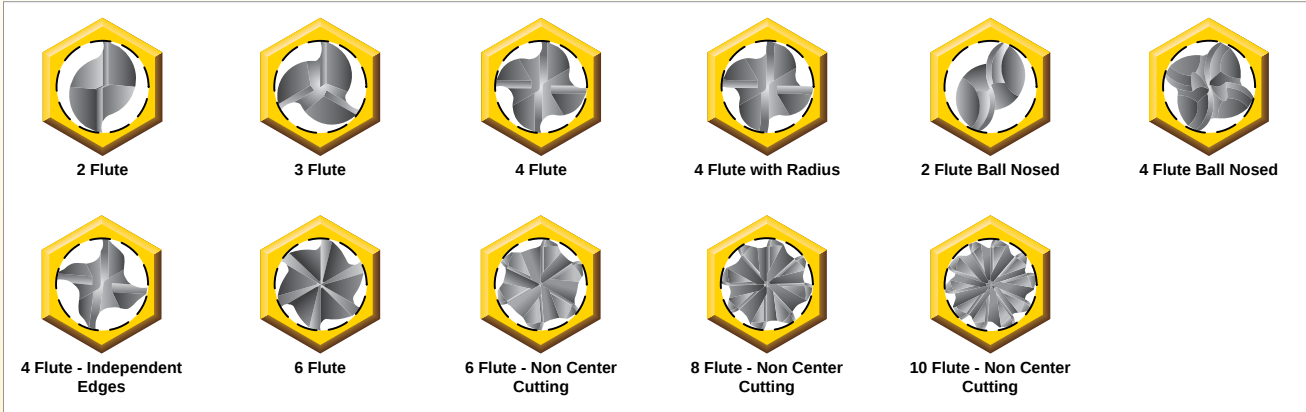
eg. XER030NTN4-C

** An "X" following the number of flutes designation signifies the use of special geometry.

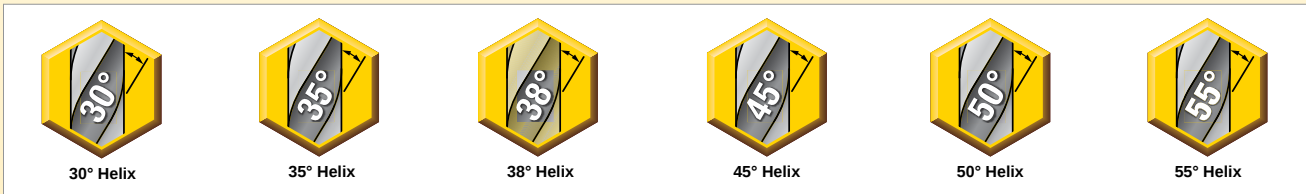
eg. RSM250LM10X-M



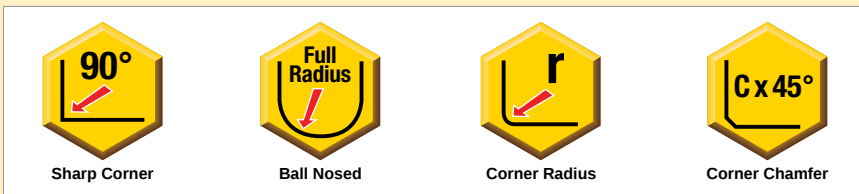
Number of Flutes / Cutting Edges



Helix



Corner Style



Shank Style



Shank Tolerance

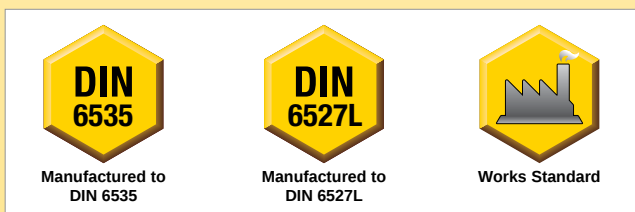


Performance

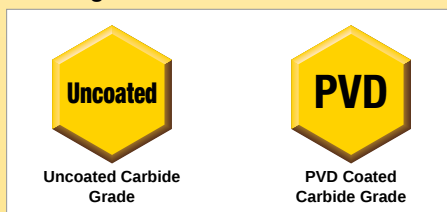


* Available on request

Manufacturing Standards



Coating





General Applications



Slotting - Square Ended



Slotting - Ball Nosed

Slotting Application

Technical information provided with each family.



Shoulder Milling - Square Ended



Shoulder Milling - Ball Nosed

Profiling / Shoulder Milling Application

Technical information provided with each family.

Tool Path Strategies



Pocketing

Tool Suitable for Pocketing

Technical information provided with each family. (As Slotting Parameters)



Drilling

Tool Suitable for Drilling

See Page B89 - for Technical Details



Helical Interpolation

Tool Suitable for Helical Interpolation

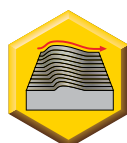
See Page B89 - for Technical Details



Ramping

Tool Suitable for Ramping

See Page B88 - for Technical Details



Copy / 3D

Tool Suitable for Copy Milling

See Page B90 - for Technical Details



Facing

Tool Suitable for Facing



Trochoidal

Tool Suitable for Trochoidal Milling

See Page B89 - for Technical Details

			Aerospace			Rapide® High Speed / High Performance Machining Series							
													
Family Range			XE	XER	RSM	ERC	HE	HER	HB	HMR	HMN	EA	HPA
Number of Flutes / Cutting Edges			4	4	6 - 8 - 10	3	4	4	2	6	6	2	2
Length			Medium	Normal	Long	Normal/Long	Normal	Normal	Long	Normal	Normal	Normal	Normal
Corner style			Radius			Chamfer	Sharp	Radius	Ball Nose	Radius	Sharp	Sharp	Sharp
Helix angle			35° - 38°			45°	30°	30°	30°	45°	50°	30°	55°
Coating			PVD		Uncoated	PVD						Uncoated	
Shank Style			HA Cylindrical			HA Cylindrical							
Manufacturing Standards			DIN³			DIN³							
mm	Diameter Range	mm	2,00 - 20,00	2,00 - 20,00	10,00 - 25,00	3,00 - 20,00	2,00 - 16,00	6,00 - 12,00	3,00 - 12,00	3,00 - 20,00	6,00 - 20,00	2,00 - 20,00	3,00 - 20,00
Page			B9 - B13	B9 - B13	B15 - B18	B19 - B22	B23 - B25	B26 - B28	B29 - B31	B32 - B36	B37 - B39	B40 - B42	B43 - B45
General Application	Slotting - Square Ended 		  	 		  	 	 		  	 		
	Slotting - Ball Nosed 								  				
	Shoulder Milling - Square Ended 		  	 		  	 	 		  			
	Shoulder Milling - Ball Nosed 								  				
Tool Path Strategy	Pocketing 		  	 		  	 	 	  	  			
	Drilling 					  							
	Helical Interpolation 		  	 		  							
	Ramping 					  							
	Copy / 3D 								  				
	Facing 		  	 		  	 	 		  	 		
	Trochoidal 		  	 		  	 	 		  	 		

Note: DIN¹ = DIN6535, DIN² = DIN6527L, DIN³ = DIN6535 and DIN 6527L.

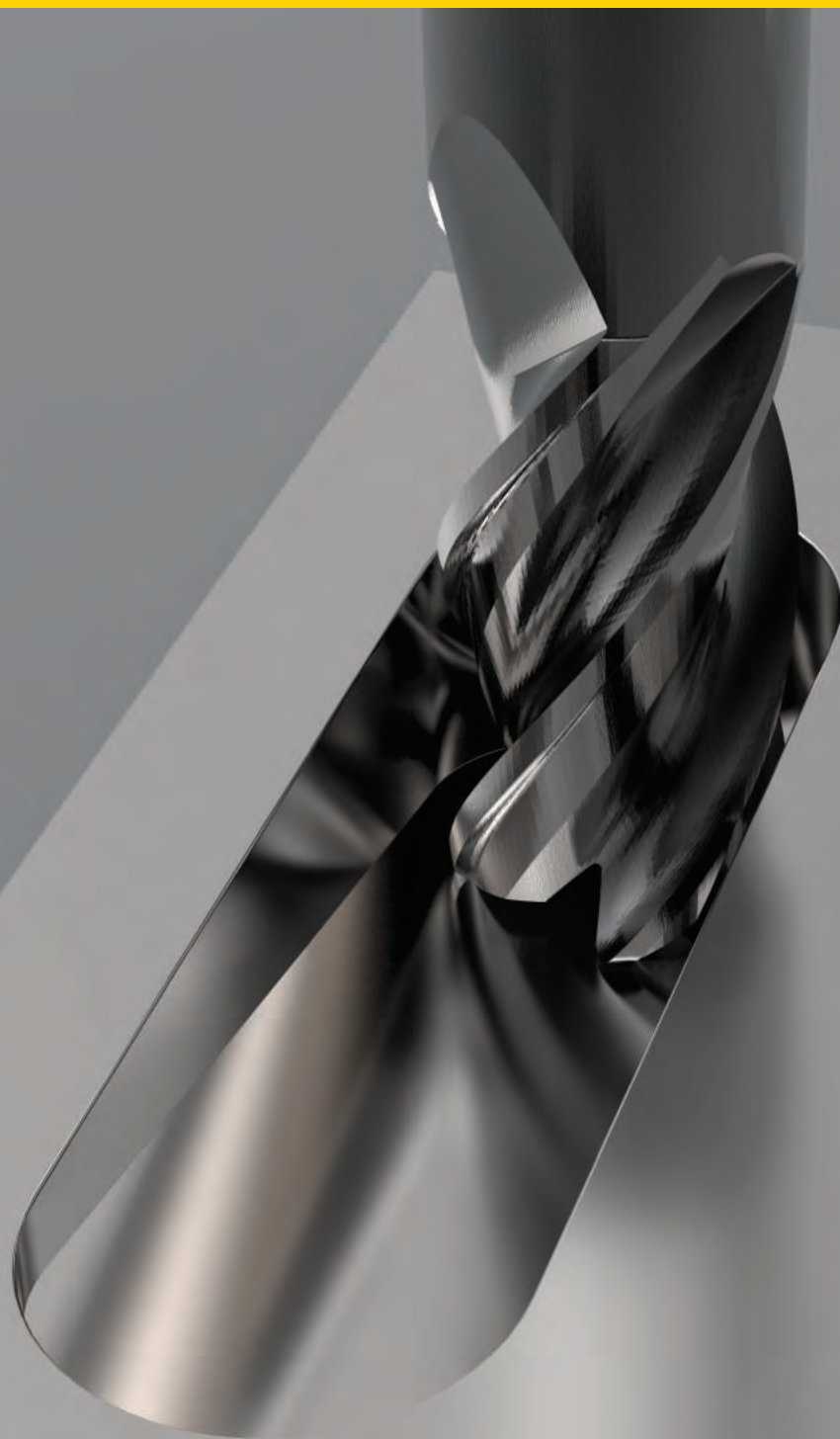


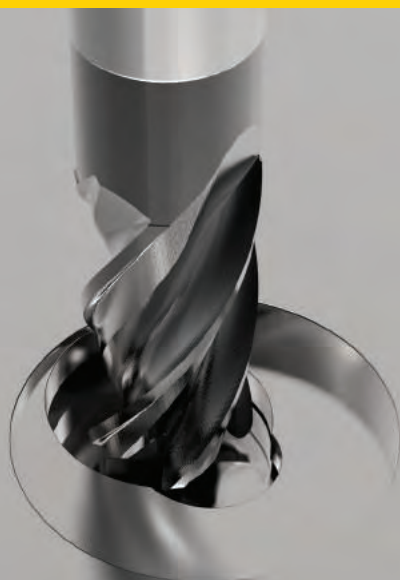
General Purpose Milling Series							
							
E			ER	B		E	B
2	3	4	4	2	4	4	2
Normal			Normal	Normal		Long	Long / X-Long
Sharp			Radius	Ball Nose		Sharp	Ball Nose
30°			30°	30°		30°	30°
PVD			PVD	PVD		PVD	PVD
HA Cylindrical			HA Cylindrical	HA Cylindrical		HA Cylindrical	HA Cylindrical
							DIN 6535
3,00 - 20,00	3,00 - 20,00	3,00 - 20,00	3,00 - 16,00	3,00 - 20,00	3,00 - 12,00	6,00 - 16,00	4,00 - 12,00
B47 - B50	B51 - B53	B54 - B56	B57 - B59	B60 - B62	B63 - B65	B66 - B68	B69 - B71
							
							
							
							
							
							
							
							
							
							
							

Note: DIN¹ = DIN6535, DIN² = DIN6527L, DIN³ = DIN6535 and DIN 6527L.

			Miniature Milling Series				
							
Family Range			E			B	
Number of Flutes / Cutting Edges			2	3	4	2	4
Length			Normal			Normal	
Corner style			Sharp			Ball Nose	
Helix angle			30°			30°	
Coating			PVD	PVD	PVD	PVD	PVD
Shank Style			HA Cylindrical			HA Cylindrical	
Manufacturing Standards							
mm	Diameter Range	mm	0,40 - 2,50	1,00 - 2,50	1,00 - 2,00	0,40 - 2,50	1,00 - 2,50
Page			B72 - B74	B75 - B77	B78 - B80	B81 - B83	B84 - B86
General Application	Slotting - Square Ended						
	Slotting - Ball Nosed						
	Shoulder Milling - Square Ended						
	Shoulder Milling - Ball Nosed						
Tool Path Strategy	Pocketing						
	Drilling						
	Helical Interpolation						
	Ramping						
	Copy / 3D						
	Facing						
	Trochoidal						

Note: DIN¹ = DIN6535, DIN² = DIN6527L, DIN³ = DIN6535 and DIN 6527L.





AEROSPACE RADIUS END MILL

XE & XER End Mills have been specifically designed and manufactured for the machining of Titanium and High Temperature Alloys that are typically found in Aerospace, Defence, Medical and Oils & Gas Segments.

Key Features

- Advanced Geometric design
- Tough and Wear resistant Submicron Substrate
- Advanced Nano - Composite PVD Coating
- High Precision Radii

Benefits

- Improved stability with the suppression of vibration & harmonics
- Excellent chip control
- Increased application capacity for Slotting and Profiling
- Increased metal removal rates by up to 2X against comparable tools



XE / XER

Range:

XE:
Ø: 2,00mm - 20,00mm
Radii : 0,25mm

XER:
Ø : 2,00mm - 20,00mm
Radii : 0,25mm - 4,00mm



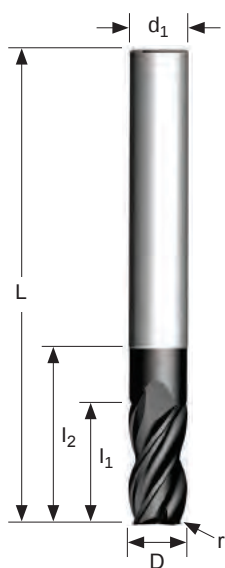


Materials Application

SP4060

P	M	K	N	S	H

PVD



4 - Flute End Mill

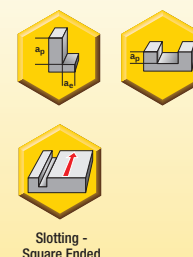
Solid Carbide
Aerospace End Mills

Metric Product		Dimensions (mm)										
EDP	Item Description	D	L	l ₁	l ₂	d ₁	r	ap max	No. of Teeth	Helical Hole min - max		Trochoidal min
031360	XE 020MTN4-C	2,00	65,00	4,00	-	6,00	0,25	4,00	4	2,86	3,41	2,86
031361	XE 025MTN4-C	2,50	65,00	5,00	-	6,00		5,00	4	3,58	4,39	3,58
031362	XE 030MTN4-C	3,00	65,00	6,00	-	6,00		6,00	4	4,29	5,36	4,29
031363	XE 035MTN4-C	3,50	65,00	7,00	-	6,00		7,00	4	5,01	6,34	5,01
031364	XE 040MTN4-C	4,00	65,00	8,00	-	6,00		4,00	4	5,72	7,31	5,72
031365	XE 045MTN4-C	4,50	65,00	9,00	-	6,00		9,00	4	6,44	8,29	6,44
031366	XE 050MTN4-C	5,00	75,00	10,00	-	6,00		10,00	4	7,15	9,26	7,15
031367	XE 060MN4-C	6,00	75,00	12,00	18,00	6,00		12,00	4	8,58	11,21	8,58
031368	XE 080MN4-C	8,00	75,00	16,00	24,00	8,00		16,00	4	11,44	15,11	11,44
031369	XE 100MN4-C	10,00	100,00	20,00	30,00	10,00		20,00	4	14,30	19,01	14,30
031370	XE 120MN4-C	12,00	100,00	24,00	36,00	12,00		24,00	4	17,16	22,91	17,16
031371	XE 160MN4-C	16,00	115,00	32,00	48,00	16,00		32,00	4	22,88	30,71	22,88
031372	XE 200MN4-C	20,00	120,00	40,00	60,00	20,00		40,00	4	28,60	38,51	28,60

Technical Information

XE - Radial a_e and Axial a_p depth of cut range							
Product	Dimensions						
Grade	Shoulder Milling						Slotting
	Roughing			Finishing			
	$a_e\%$	$a_p\%$	f_z	$a_e\%$	$a_p\%$	f_z	$a_p\%$
SP4060	0,2 - 0,5 D	0,5 - 2,0 D	Mid - High	0,05 - 0,2 D	0,1 - 2,0 D	Low - Mid	0,5 - 1,25

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.



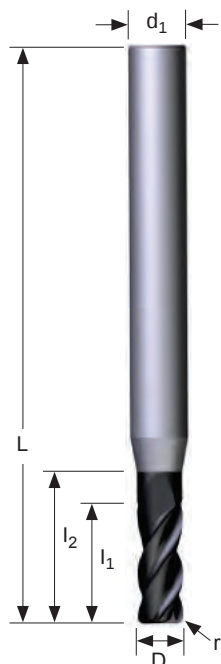


Materials Application

SP4060

P	M	K	N	S	H

PVD



4 - Flute End Mill

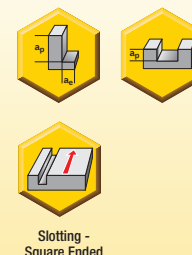
Solid Carbide
Aerospace End Mills

Metric Product		Dimensions (mm)										
EDP	Item Description	D	L	L ₁	L ₂	d ₁	r	a _p max	No. of Teeth	Helical Hole min - max		Trochoidal min
031936	XER 020NTN4-C	2,00	57,00	7,00	-	6,00	0,25	7,00	4	2,86	3,41	2,86
031937	XER 025NTN4-C	2,50	57,00	8,00	-	6,00	0,25	8,00	4	3,58	4,39	3,58
031938	XER 030NTN4-C	3,00	57,00	8,00	-	6,00	0,25	8,00	4	4,29	5,36	4,29
031939	XER 035NTN4-C	3,50	57,00	10,00	-	6,00	0,25	10,00	4	5,01	6,33	5,01
031940	XER 040NTN4-C	4,00	57,00	11,00	-	6,00	0,25	11,00	4	5,72	7,31	5,72
031941	XER 040NTN4-E	4,00	57,00	11,00	-	6,00	0,50	11,00	4	5,72	6,83	5,72
031942	XER 050NTN4-C	5,00	57,00	13,00	-	6,00	0,25	13,00	4	7,15	9,26	7,15
031943	XER 050NTN4-E	5,00	57,00	13,00	-	6,00	0,50	13,00	4	7,15	8,78	7,15
031944	XER 050NTN4-F	5,00	57,00	13,00	-	6,00	0,75	13,00	4	7,15	8,29	7,15
031945	XER 060NN4-C	6,00	57,00	13,00	21,00	6,00	0,25	13,00	4	8,58	11,21	8,58
031946	XER 060NN4-E	6,00	57,00	13,00	21,00	6,00	0,50	13,00	4	8,58	10,73	8,58
031947	XER 060NN4-G	6,00	57,00	13,00	21,00	6,00	1,00	13,00	4	8,58	9,75	8,58
031948	XER 080NN4-C	8,00	63,00	19,00	27,00	8,00	0,25	19,00	4	11,44	15,11	11,44
031949	XER 080NN4-E	8,00	63,00	19,00	27,00	8,00	0,50	19,00	4	11,44	14,63	11,44
031950	XER 080NN4-G	8,00	63,00	19,00	27,00	8,00	1,00	19,00	4	11,44	13,65	11,44
031951	XER 100NN4-C	10,00	72,00	22,00	32,00	10,00	0,25	22,00	4	14,30	19,01	14,30
031952	XER 100NN4-E	10,00	72,00	22,00	32,00	10,00	0,50	22,00	4	14,30	18,53	14,30
031953	XER 100NN4-G	10,00	72,00	22,00	32,00	10,00	1,00	22,00	4	14,30	17,55	14,30
031954	XER 100NN4-J	10,00	72,00	22,00	32,00	10,00	1,50	22,00	4	14,30	16,58	14,30
031955	XER 120NN4-C	12,00	83,00	26,00	38,00	12,00	0,25	26,00	4	17,16	22,91	17,16
031956	XER 120NN4-E	12,00	83,00	26,00	38,00	12,00	0,50	26,00	4	17,16	22,43	17,16
031957	XER 120NN4-G	12,00	83,00	26,00	38,00	12,00	1,00	26,00	4	17,16	21,45	17,16
031958	XER 120NN4-J	12,00	83,00	26,00	38,00	12,00	1,50	26,00	4	17,16	20,48	17,16
032269	XER 120NN4-L	12,00	83,00	26,00	38,00	12,00	2,50	26,00	4	17,16	18,53	17,16
031959	XER 160NN4-C	16,00	92,00	32,00	44,00	16,00	0,25	32,00	4	22,88	30,71	22,88
031960	XER 160NN4-G	16,00	92,00	32,00	44,00	16,00	1,00	32,00	4	22,88	29,25	22,88
031961	XER 160NN4-J	16,00	92,00	32,00	44,00	16,00	1,50	32,00	4	22,88	28,28	22,88
031962	XER 160NN4-K	16,00	92,00	32,00	44,00	16,00	2,00	32,00	4	22,88	27,30	22,88
032270	XER 160NN4-L	16,00	92,00	32,00	44,00	16,00	2,50	32,00	4	22,88	26,33	22,88
031963	XER 160NN4-M	16,00	92,00	32,00	44,00	16,00	3,00	32,00	4	22,88	25,35	22,88
032271	XER 160NN4-P	16,00	92,00	32,00	44,00	16,00	4,00	32,00	4	22,88	23,40	22,88
031964	XER 200NN4-C	20,00	104,00	38,00	54,00	20,00	0,25	38,00	4	28,60	38,51	28,60
031965	XER 200NN4-G	20,00	104,00	38,00	54,00	20,00	1,00	38,00	4	28,60	37,05	28,60
031966	XER 200NN4-J	20,00	104,00	38,00	54,00	20,00	1,50	38,00	4	28,60	36,08	28,60
031967	XER 200NN4-K	20,00	104,00	38,00	54,00	20,00	2,00	38,00	4	28,60	35,10	28,60
032272	XER 200NN4-L	20,00	104,00	38,00	54,00	20,00	2,50	38,00	4	28,60	34,13	28,60
031968	XER 200NN4-M	20,00	104,00	38,00	54,00	20,00	3,00	38,00	4	28,60	33,15	28,60
032273	XER 200NN4-P	20,00	104,00	38,00	54,00	20,00	4,00	38,00	4	28,60	31,20	28,60

Technical Information

XER - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	ap%
SP4060	0,2 - 0,5 D	0,5 - ap max*	Mid - High	0,05 - 0,2 D	0,5 - ap max*	Low - Mid	0,5 - 1,16 D

* Do not exceed 2 D for a_p max - where 2 D is availableNote: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

Slotting - Square Ended



Solid Carbide
Aerospace End Mills

Recommended Feeds

Aerospace End Mills

XE / XER Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal; Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
2,0	-	-	-	0,005 0,007	0,005 0,007	0,005 0,007	0,005 0,007	0,004 0,006	-	-	-	-	-	0,005 0,007	0,003 0,005	0,003 0,005	0,005 0,007	-	-
2,5	-	-	-	0,006 0,010	0,006 0,009	0,006 0,010	0,005 0,009	0,005 0,008	-	-	-	-	-	0,006 0,010	0,004 0,008	0,004 0,008	0,006 0,010	-	-
3,0	-	-	-	0,007 0,012	0,007 0,011	0,007 0,012	0,005 0,011	0,006 0,009	-	-	-	-	-	0,007 0,013	0,005 0,011	0,005 0,011	0,007 0,013	-	-
3,5	-	-	-	0,009 0,015	0,008 0,013	0,009 0,014	0,006 0,013	0,007 0,011	-	-	-	-	-	0,009 0,016	0,006 0,014	0,006 0,013	0,009 0,016	-	-
4,0	-	-	-	0,010 0,018	0,009 0,015	0,010 0,016	0,006 0,014	0,008 0,013	-	-	-	-	-	0,010 0,019	0,006 0,016	0,006 0,014	0,010 0,018	-	-
5,0	-	-	-	0,013 0,023	0,011 0,018	0,013 0,021	0,008 0,018	0,008 0,016	-	-	-	-	-	0,013 0,025	0,008 0,021	0,008 0,018	0,013 0,024	-	-
6,0	-	-	-	0,015 0,029	0,013 0,022	0,015 0,026	0,010 0,022	0,012 0,020	-	-	-	-	-	0,015 0,031	0,010 0,026	0,010 0,022	0,015 0,030	-	-
8,0	-	-	-	0,020 0,039	0,017 0,029	0,020 0,037	0,014 0,031	0,016 0,028	-	-	-	-	-	0,020 0,044	0,014 0,036	0,014 0,031	0,020 0,042	-	-
10,0	-	-	-	0,025 0,050	0,021 0,037	0,025 0,048	0,018 0,040	0,020 0,036	-	-	-	-	-	0,025 0,057	0,018 0,048	0,018 0,040	0,025 0,055	-	-
12,0	-	-	-	0,030 0,062	0,025 0,044	0,030 0,060	0,022 0,049	0,024 0,044	-	-	-	-	-	0,030 0,071	0,022 0,059	0,022 0,049	0,030 0,069	-	-
16,0	-	-	-	0,040 0,084	0,032 0,059	0,040 0,085	0,030 0,069	0,032 0,060	-	-	-	-	-	0,040 0,100	0,030 0,084	0,030 0,069	0,040 0,098	-	-
20,0	-	-	-	0,050 0,108	0,040 0,073	0,050 0,111	0,038 0,089	0,040 0,076	-	-	-	-	-	0,050 0,131	0,038 0,109	0,038 0,089	0,050 0,127	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling		Feed Correction Parameters	
		a_e	Correction Factor
		0,05 D	2,30 x f_z
		0,10 D	1,65 x f_z
		0,15 D	1,40 x f_z
		0,20 D	1,25 x f_z
		0,30 D	1,09 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

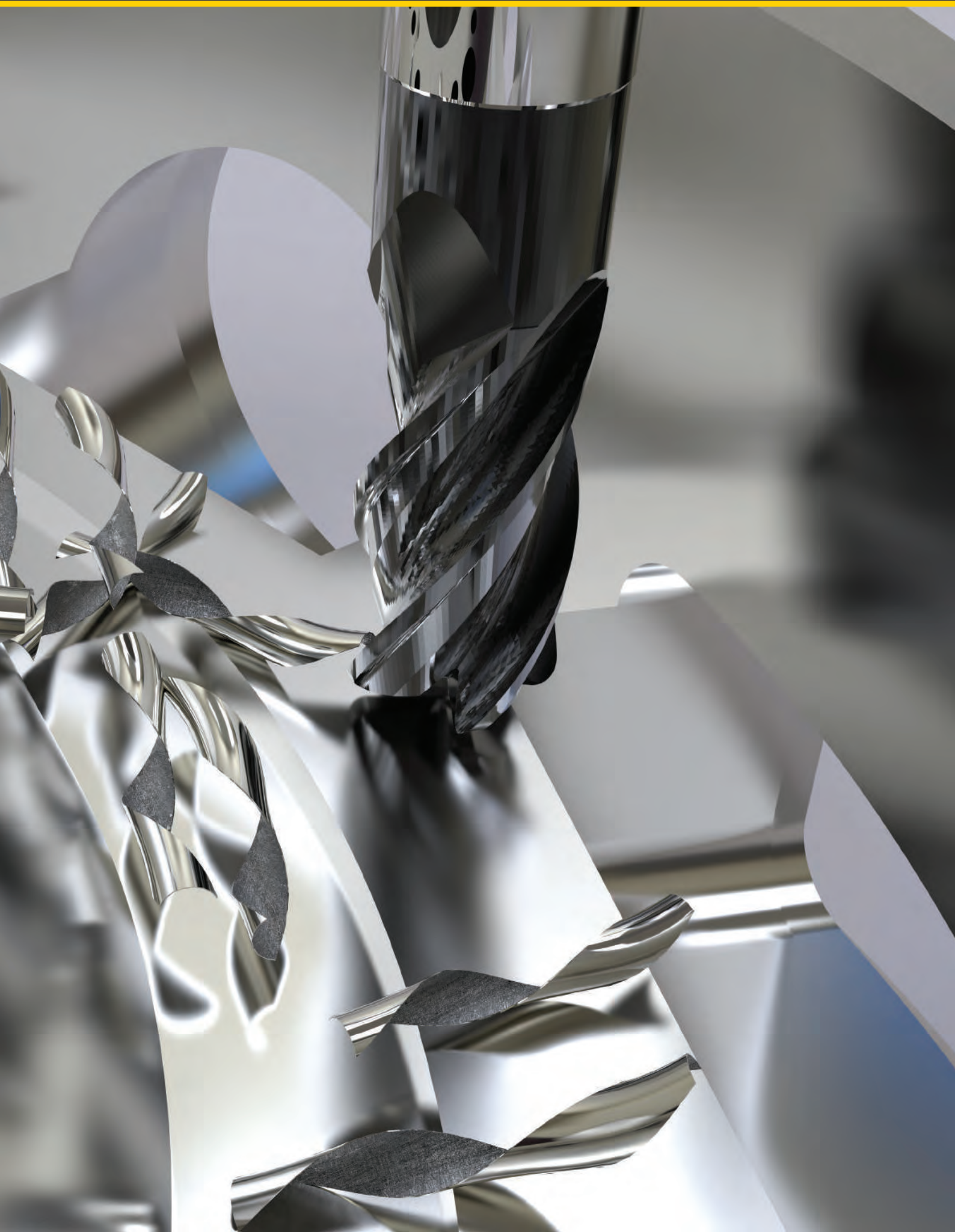


Solid Carbide
Aerospace End Mills

Aerospace End Mills

Recommended Speeds

Speed v_c (m/min)					
XE / XER Series			Speed min. - max.		
			Coolant Recommendation		PVD Standard
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4060
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			
		950-1200 N/mm ² 280-355 HBN	●	◎	50 - 280
		1200-1400 N/mm ² 355-415 HBN			45 - 160
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	95 - 200
		Martensitic 400 series			70 - 145
	PH Stainless	Refractory P.H.	●		60 - 110
K	Cast Iron	Grey GG-Ft			
		Spheroidal-Ductile GGG-FGS			
		Malleable GTS - MN/MP			
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			60 - 140
		Cobalt Based			20 - 75
		Nickel Based	●	◎	25 - 80
		Titanium Based			40 - 120
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			





RSM AEROSPACE PROGRAM

The RSM program is specially designed to overcome a number of problems usually associated with machining Titanium components, in particular the profiling of walls, pockets and surfaces in 2D and 3D applications.

Issues such as vibration and material tarnishing are significantly reduced by the tool's unique geometry. The tool also features a reduced shank which offers optimum flexibility. This allows the user to obtain maximum reach and workholding length* to suit individual requirements, thereby reducing required inventory.

* Recommended minimum secure clamping length is 2,5 x shank diameter.



CRSM / RSM

RSM Range:

Ø: 10,00mm - 25,00mm
Radii*: 0,50mm - 5,00mm

Z*: 6, 8 & 10

* Radii and Cutting edges dependent on diameter

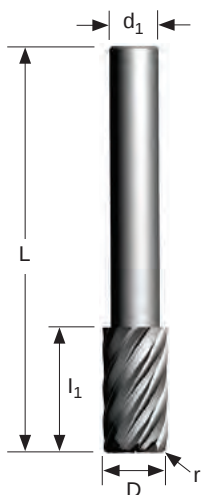




Materials Application

SU4000

P	M	K	N	S	H



Multi-Flute End Mill

Solid Carbide
Aerospace End Mills

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	a _p max	Radius r	No. of Teeth	Helical Hole min - max		Trochoidal min
031027	RSM100LM6X-E	10,00	125,00	20,00	9,00	20,00	0,50	6	-	-	-
031028	RSM100LM6X-G	10,00	125,00	20,00	9,00	20,00	1,00	6	-	-	-
031029	RSM100LM6X-K	10,00	125,00	20,00	9,00	20,00	2,00	6	-	-	-
031030	RSM100LM6X-M	10,00	125,00	20,00	9,00	20,00	3,00	6	-	-	-
031023	RSM120LM6X-E	12,00	125,00	24,00	10,00	24,00	0,50	6	-	-	-
031024	RSM120LM6X-G	12,00	125,00	24,00	10,00	24,00	1,00	6	-	-	-
031025	RSM120LM6X-K	12,00	125,00	24,00	10,00	24,00	2,00	6	-	-	-
031026	RSM120LM6X-M	12,00	125,00	24,00	10,00	24,00	3,00	6	-	-	-
031015	RSM160LM6X-G	16,00	150,00	32,00	14,00	32,00	1,00	6	-	-	-
031016	RSM160LM6X-K	16,00	150,00	32,00	14,00	32,00	2,00	6	-	-	-
031017	RSM160LM6X-M	16,00	150,00	32,00	14,00	32,00	3,00	6	-	-	-
031018	RSM160LM6X-P	16,00	150,00	32,00	14,00	32,00	4,00	6	-	-	-
031019	RSM160LM8X-G	16,00	150,00	32,00	14,00	32,00	1,00	8	-	-	-
031020	RSM160LM8X-K	16,00	150,00	32,00	14,00	32,00	2,00	8	-	-	-
031021	RSM160LM8X-M	16,00	150,00	32,00	14,00	32,00	3,00	8	-	-	-
031022	RSM160LM8X-P	16,00	150,00	32,00	14,00	32,00	4,00	8	-	-	-
031005	RSM200LM6X-G	20,00	160,00	39,00	18,00	39,00	1,00	6	-	-	-
031006	RSM200LM6X-K	20,00	160,00	39,00	18,00	39,00	2,00	6	-	-	-
031007	RSM200LM6X-M	20,00	160,00	39,00	18,00	39,00	3,00	6	-	-	-
031008	RSM200LM6X-P	20,00	160,00	39,00	18,00	39,00	4,00	6	-	-	-
031009	RSM200LM6X-Q	20,00	160,00	39,00	18,00	39,00	5,00	6	-	-	-
031010	RSM200LM8X-G	20,00	160,00	39,00	18,00	39,00	1,00	8	-	-	-
031011	RSM200LM8X-K	20,00	160,00	39,00	18,00	39,00	2,00	8	-	-	-
031012	RSM200LM8X-M	20,00	160,00	39,00	18,00	39,00	3,00	8	-	-	-
031013	RSM200LM8X-P	20,00	160,00	39,00	18,00	39,00	4,00	8	-	-	-
031014	RSM200LM8X-Q	20,00	160,00	39,00	18,00	39,00	5,00	8	-	-	-
033036	RSM250LM8X-K	25,00	160,00	47,00	22,00	47,00	2,00	8	-	-	-
033037	RSM250LM8X-M	25,00	160,00	47,00	22,00	47,00	3,00	8	-	-	-
033038	RSM250LM8X-P	25,00	160,00	47,00	22,00	47,00	4,00	8	-	-	-
033039	RSM250LM8X-Q	25,00	160,00	47,00	22,00	47,00	5,00	8	-	-	-
033040	RSM250LM10X-K	25,00	160,00	47,00	22,00	47,00	2,00	10	-	-	-
033041	RSM250LM10X-M	25,00	160,00	47,00	22,00	47,00	3,00	10	-	-	-
033042	RSM250LM10X-P	25,00	160,00	47,00	22,00	47,00	4,00	10	-	-	-
033043	RSM250LM10X-Q	25,00	160,00	47,00	22,00	47,00	5,00	10	-	-	-

For technical information, refer to page B87.

Solid Carbide
Aerospace End Mills

Aerospace End Mills

Recommended Feeds

RSM Technical Information																				
Product		Dimensions (mm)																		
Family Description	Diameter	Z	Profiling					Facing					Chip Thickness		Profiling (mm/z)				Facing (mm/z)	
			ae min	ae max	ap min	ap max	ad max mm²	ae min	ae max	ap min	ap max	ad max mm²	hm min	hm max	for ae min		for ae max		fz min	fz max
RSM100	10,00	6	0,17	0,67	10,30	13,00	6,87	Radius +0,50	7,50	0,20	Radius +0,50	1,25	0,02	0,05	0,078	0,195	0,040	0,100	0,020	0,057
RSM120	12,00	6	0,20	0,80	12,80	15,60	10,24		9,00			1,80			0,078	0,195	0,040	0,100		
RSM160	16,00	6	0,27	1,07	17,80	20,80	18,99		12,00			3,20			0,078	0,195	0,040	0,100		
RSM160	16,00	8	0,20	0,80	12,00	20,80	9,60		12,00			3,20			0,090	0,225	0,046	0,115		
RSM200	20,00	6	0,33	1,33	23,00	26,00	30,67		15,00			5,00			0,078	0,195	0,040	0,100		
RSM200	20,00	8	0,25	1,00	16,00	26,00	16,00		15,00			5,00			0,090	0,225	0,046	0,115		
RSM250	25,00	8	0,31	1,25	20,50	32,50	25,63		18,75			7,81			0,090	0,225	0,046	0,115		
RSM250	25,00	10	0,25	1,00	15,50	32,50	15,50		18,75			7,81			0,101	0,251	0,051	0,128		

In the application of RSM end mills, it is vital that a_d max mm² is not exceeded. For this, adjust a_e & a_p accordingly.

Example:

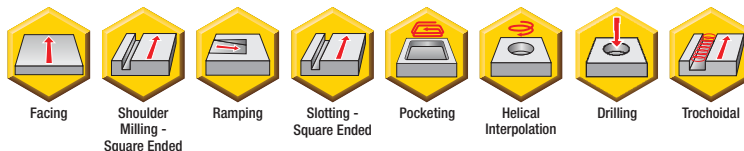
When using a_p max, then a_e = a_d max mm² / a_p max
= 15,50 / 32,50
= 0,47mm

When using a_e max, Then a_p = a_d max mm² / a_e max
= 15,5 / 1
= 15,50mm

Example based on values for RSM250 (Z=10)

**Solid Carbide**
Aerospace End Mills**Recommended Speeds****Material Reference Chart and Recommended Surface Speeds**

Type	Commercial Name	Designation	Hardness HRB HRC HB	Rm N/mm2	WC (0.15) W/cm³/min	WC (0.006) Hp/in³/min	Metric	
							V _c min (m/min)	V _c max (m/min)
Titanium a	Ti-5Al-2.5Sn	ATI 5-2.5	HRC36	1130	49	1,08	60	120
Titanium a	Ti-6Al-4Zr-2Mo-2Sn	ATI 6-2-4-2®	HRC28	900	31	0,67	60	130
Titanium a	Ti-6Al-4Zr-2Mo-2Sn-0.2Si	ATI 6-2-4-2Si	HRC28	900	31	0,67	60	130
Titanium a	Ti-8Al-1Mo-1V	ATI 8-1-1®	HRC35	1100	49	1,08	60	120
Titanium b	Ti-11.5Mo-6Zr-4.5Sn	-	-	-	45	0,99	35	70
Titanium b	Ti-13V-11Cr-3Al	-	-	-	45	0,99	35	70
Titanium b	Ti-3Al-8V-6Cr-4Mo-4Zr	ATI 38-644®	HRC32	1000	45	0,99	35	70
Titanium b	Ti-8Mo-8V-2Fe-3Al	-	-	-	45	0,99	35	70
Titanium b	Ti-13V-11Cr-3Al	ATI 13-11-3	HRC40	1270	70	1,53	30	60
Titanium b	Ti 10.2.3	ATI 10-2-3®	HRC35	1100	62	1,35	25	60
Titanium b	Ti-15Mo	ATI 15Mo®	HRC24	820	33	0,72	50	105
Titanium b	Ti-15-333	ATI 15-3-3-3®	HRC32	1000	45	0,99	35	70
Titanium b	Ti 45Nb	ATI 45Nb®	-	-	30	0,65	45	95
Titanium b - ab	5Al-5V-5Mo-3Cr	ATI Ti5-5-5-3 Alloy	HRC40	1270	70	1,53	30	60
Titanium ab	Ti-425	ATI 425® MIL	HRC36	1130	49	1,08	30	60
Titanium ab	Ti-6Al-4V	ATI 6-4®	HRC30-34	1130	49	1,08	60	120
Titanium ab	Ti-6Al-4V	ATI 6-4®	HRC35-39	1200	62	1,35	55	110
Titanium ab	Ti-6Al-5Zr-0.5Mo-0.25Si	-	-	-	49	1,08	50	105
Titanium ab	Ti-6Al-5Zr-4Mo-Cu-0.2Si	-	-	-	49	1,08	50	105
Titanium ab	Ti-6Al-6V-2Sn	ATI 6-6-2®	HRC35	1100	49	1,08	50	110
Titanium ab	Ti-7Al-4Mo	-	-	-	45	0,99	50	105
Titanium ab	3-2.5	ATI 3-2.5®	HRC24	820	33	0,72	60	130
Titanium ab	6-4ELI	ATI 6-4 ELI®	HRC32	1000	45	0,99	60	125
Titanium ab	6-2-4-6	ATI 6-2-4-6®	HRC36	1130	47	1,03	55	110
Titanium ab	Ti-17	ATI 17®	HRC38	1200	51	1,12	55	110
Titanium ab	Ti-4Al-4Mo-2Sn-0.5Si	ATI 4-4-2®	HRC35	1100	49	1,08	50	105
Titanium ab	Ti-4Al-4Mo-4Sn-0.5Si	-	-	-	49	1,08	50	105
Pure Titanium	Ti 99.5	ATI CP4®	HRB100	780	30	0,65	90	185
Pure Titanium	Ti 99.6	ATI CP3®	HRB90	600	30	0,65	95	205
Pure Titanium	Ti 99.7	ATI CP2®	HRB80	510	30	0,65	105	220
Pure Titanium	Ti 99.8	ATI CP1®	HRB70	430	30	0,65	115	240



RAPIDE END MILLS

The Rapide family offers a comprehensive range of end mills suitable for High Speed and High Performance Machining, in an array of materials including Steels, Stainless Steels, High Temperature Alloys, Cast Irons, Hard Materials and Aluminium Alloys.

Key Features

- Material Specific Geometries
- Advanced PVD coating
- Premium Micrograin Carbide

Benefits

- Higher speeds and feeds achievable
- Rapid material removal
- Suitable for machining materials up to 65 HRC
- Dry machining possible

Rapide

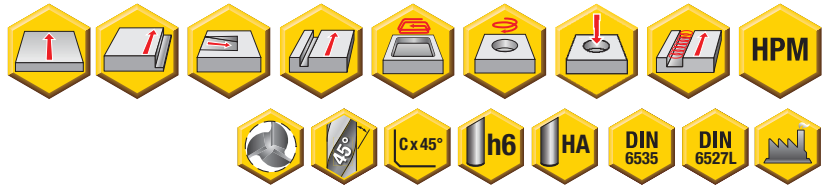
Range:

Ø: 2,00mm - 20,00mm

Z: 2,3,4 & 6

End Styles: Square Ended, Square Ended with Radius, Ball Nosed



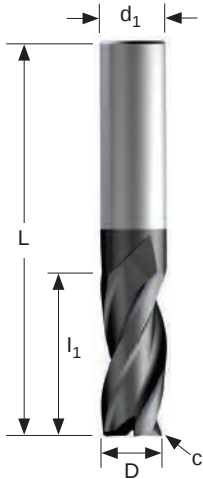


Materials Application

SP4060

P	M	K	N	S	H
◆	◆	◆	◆	◆	◆

PVD



3 - Flute End Mill

Solid Carbide
Rapide End Mill

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	c	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034343	ERC 030NTN3	3,00	57,00	8,00	6,00	0,10	8,00	3	4,29	5,85	4,29
034344	ERC 040NTN3	4,00	57,00	11,00	6,00	0,10	11,00	3	5,72	7,80	5,72
034345	ERC 050NTN3	5,00	57,00	13,00	6,00	0,20	13,00	3	7,15	9,75	7,15
034346	ERC 060NN3	6,00	57,00	13,00	6,00	0,20	13,00	3	8,58	11,70	8,58
034347	ERC 080NN3	8,00	63,00	20,00	8,00	0,20	20,00	3	11,44	15,60	11,44
034348	ERC 100NN3	10,00	72,00	22,00	10,00	0,20	22,00	3	14,30	19,50	14,30
034349	ERC 120NN3	12,00	75,00	25,00	12,00	0,25	25,00	3	17,16	23,40	17,16
034839	ERC 160NN3	16,00	93,00	35,00	16,00	0,25	35,00	3	22,88	31,20	22,88
034351	ERC 200NN3	20,00	100,00	44,00	20,00	0,25	44,00	3	28,60	39,00	28,60

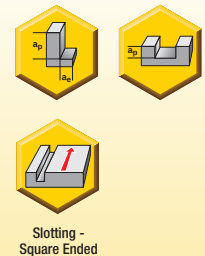
ERC - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
SP4035	0,1 - 0,5 D	0,05 - 2 D	Mid - High	0,05 - 0,1 D	0,05 - 2 D	Low - Mid	0,1 - 1,5 D

* For a_p max do not exceed 0,05 D (a_e)

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.





Recommended Feeds

Solid Carbide
Rapid End Mill

Rapid High Performance / High Speed End Mills

ERC Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,014	0,008 0,013	0,009 0,014	0,009 0,013	0,008 0,011	0,009 0,014	0,009 0,013	0,009 0,013	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	0,006 0,010	0,006 0,010
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	0,008 0,014	0,008 0,014
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,014 0,022	0,015 0,025	0,015 0,022	0,013 0,020	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	0,010 0,019	0,010 0,018
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	0,012 0,023	0,012 0,022
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	0,016 0,033	0,016 0,030
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	0,020 0,043	0,020 0,039
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	0,024 0,053	0,024 0,049
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	0,032 0,076	0,032 0,068
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	0,040 0,100	0,040 0,089

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	$2,30 \times f_z$
	0,10 D	$1,65 \times f_z$
	0,15 D	$1,40 \times f_z$
	0,20 D	$1,25 \times f_z$
	0,30 D	$1,09 \times f_z$

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Solid Carbide
Rapide End Mill

Recommended Speeds

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
ERC Series			Speed min. - max.		
			Coolant Recommendation		PVD Standard
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4035
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	80 - 360
		<950 N/mm ² <280 HBN			70 - 320
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	70 - 320
		950-1200 N/mm ² 280-355 HBN			50 - 280
		1200-1400 N/mm ² 355-415 HBN			45 - 160
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	80 - 160
		Martensitic 400 series			55 - 120
	PH Stainless	Refractory P.H.	●		50 - 90
K	Cast Iron	Grey GG-Ft	●	◎	100 - 225
		Spheroidal-Ductile GGG-FGS			70 - 155
		Malleable GTS - MN/MP			65 - 130
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	50 - 110
		Cobalt Based			15 - 60
		Nickel Based			20 - 65
		Titanium Based			30 - 100
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	60 - 140
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			50 - 130

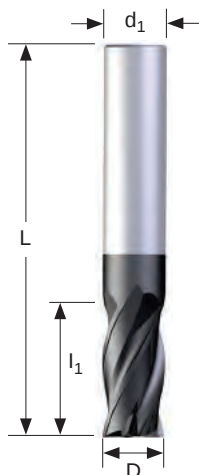


Materials Application

SP4060

P	M	K	N	S	H
◆		◆			◆

PVD



4 - Flute End Mill

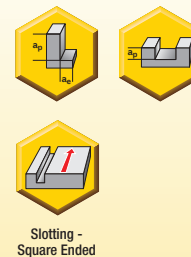
Solid Carbide
Rapid End Mill

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034352	HE 020NTN4	2,00	50,00	6,00	6,00	6,00	4	-	-	2,86
034353	HE 030NTN4	3,00	50,00	8,00	6,00	8,00	4	-	-	4,29
034354	HE 040NTN4	4,00	50,00	11,00	6,00	11,00	4	-	-	5,72
034355	HE 050NTN4	5,00	50,00	13,00	6,00	13,00	4	-	-	7,15
034356	HE 060NN4	6,00	50,00	13,00	6,00	13,00	4	-	-	8,58
034357	HE 080NN4	8,00	63,00	20,00	8,00	20,00	4	-	-	11,44
034358	HE 100NN4	10,00	72,00	22,00	10,00	22,00	4	-	-	14,30
034359	HE 120NN4	12,00	75,00	25,00	12,00	25,00	4	-	-	17,16
034360	HE 160NN4	16,00	88,00	32,00	16,00	32,00	4	-	-	22,88

Rapid High Performance / High Speed End Mills

HE - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Material	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
Alloyed Steel	-	-	-	0,01 - 0,05 D	0,1 - 1,25 D	-	0,05 - 0,2 D
Cast Iron	-	-	-	0,01 - 0,05 D	0,1 - 1,25 D	-	0,05 - 0,2 D
Hard Materials	-	-	-	0,01 - 0,03 D	0,1 - 1 D	-	0,05 - 0,1 D

* For a_p max do not exceed 0.05 D (a_e)

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide
Rapid End Mill

Recommended Feeds

Rapide High Performance / High Speed End Mills

HE Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
2,0	-	-	0,005 0,007	0,005 0,007	0,005 0,007	-	-	-	0,005 0,007	0,005 0,007	0,005 0,007	-	-	-	-	-	-	0,003 0,005	0,003 0,005
3,0	-	-	0,008 0,012	0,008 0,012	0,007 0,011	-	-	-	0,008 0,012	0,008 0,012	0,008 0,011	-	-	-	-	-	-	0,005 0,008	0,005 0,008
4,0	-	-	0,010 0,017	0,010 0,016	0,009 0,015	-	-	-	0,010 0,017	0,010 0,016	0,010 0,015	-	-	-	-	-	-	0,006 0,011	0,006 0,011
5,0	-	-	0,013 0,023	0,013 0,021	0,011 0,020	-	-	-	0,013 0,023	0,013 0,021	0,013 0,020	-	-	-	-	-	-	0,008 0,015	0,008 0,015
6,0	-	-	0,015 0,029	0,015 0,026	0,013 0,024	-	-	-	0,015 0,029	0,015 0,026	0,015 0,024	-	-	-	-	-	-	0,009 0,019	0,009 0,018
8,0	-	-	0,020 0,042	0,020 0,037	0,017 0,033	-	-	-	0,020 0,042	0,020 0,037	0,020 0,033	-	-	-	-	-	-	0,012 0,026	0,012 0,025
10,0	-	-	0,025 0,057	0,025 0,048	0,021 0,042	-	-	-	0,025 0,057	0,025 0,048	0,025 0,042	-	-	-	-	-	-	0,015 0,034	0,015 0,032
12,0	-	-	0,030 0,072	0,030 0,060	0,025 0,051	-	-	-	0,030 0,072	0,030 0,060	0,030 0,051	-	-	-	-	-	-	0,018 0,043	0,018 0,039
16,0	-	-	0,040 0,104	0,040 0,085	0,032 0,070	-	-	-	0,040 0,104	0,040 0,085	0,040 0,070	-	-	-	-	-	-	0,024 0,061	0,024 0,055

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,01	5,00 x f_z
	0,03	2,90 x f_z
	0,05	2,25 x f_z
	0,08	1,85 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Recommended Speeds

Solid Carbide Rapid End Mill

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HE Series			Speed min. - max.		
			Coolant Recommendation		PVD Standard
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4035
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			70 - 320
		950-1200 N/mm ² 280-355 HBN	●	◎	50 - 280
		1200-1400 N/mm ² 355-415 HBN			45 - 160
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			100 - 225
		Spheroidal-Ductile GGG-FGS	●	◎	70 - 155
		Malleable GTS - MN/MP			65 - 130
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	60 - 140
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			50 - 130

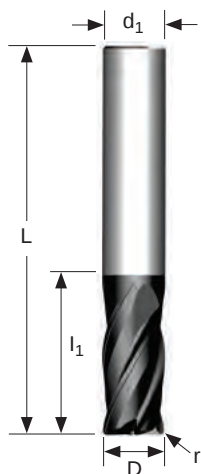


Materials Application

SP4060

P	M	K	N	S	H

PVD



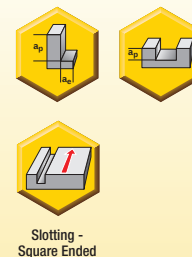
4 - Flute End Mill

Solid Carbide
Rapide End Mill

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	r	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034361	HER 060NN4-E	6,00	50,00	13,00	6,00	0,50	13,00	4	-	-	8,58
034362	HER 060NN4-G	6,00	50,00	13,00	6,00	1,00	13,00	4	-	-	8,58
034363	HER 080NN4-E	8,00	63,00	20,00	8,00	0,50	20,00	4	-	-	11,44
034364	HER 080NN4-G	8,00	63,00	20,00	8,00	1,00	20,00	4	-	-	11,44
034365	HER 100NN4-E	10,00	72,00	22,00	10,00	0,50	22,00	4	-	-	14,30
034366	HER 100NN4-G	10,00	72,00	22,00	10,00	1,00	22,00	4	-	-	14,30
034367	HER 120NN4-E	12,00	75,00	25,00	12,00	0,50	25,00	4	-	-	17,16
034368	HER 120NN4-G	12,00	75,00	25,00	12,00	1,00	25,00	4	-	-	17,16

HER - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Material	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
Alloyed Steel	-	-	-	0,01 - 0,05 D	0,1 - 1,25 D	Low - Mid	0,05 - 0,2 D
Cast Iron	-	-	-	0,01 - 0,03 D	0,1 - 1 D	Low - Mid	0,05 - 0,1 D
Hard Materials	-	-	-	0,01 - 0,03 D	0,1 - 1 D	Low - Mid	0,05 - 0,1 D



* For a_p max do not exceed 0,05 D (a_e)

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Recommended Feeds

Solid Carbide Rapid End Mill

HER Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
2,0	-	-	0,005 0,007	0,005 0,007	0,005 0,007	-	-	-	0,005 0,007	0,005 0,007	0,005 0,007	-	-	-	-	-	-	0,003 0,005	0,003 0,005
3,0	-	-	0,008 0,012	0,008 0,012	0,007 0,011	-	-	-	0,008 0,012	0,008 0,012	0,008 0,011	-	-	-	-	-	-	0,005 0,008	0,005 0,008
4,0	-	-	0,010 0,017	0,010 0,016	0,009 0,015	-	-	-	0,010 0,017	0,010 0,016	0,010 0,015	-	-	-	-	-	-	0,006 0,011	0,006 0,011
5,0	-	-	0,013 0,023	0,013 0,021	0,011 0,020	-	-	-	0,013 0,023	0,013 0,021	0,013 0,020	-	-	-	-	-	-	0,008 0,015	0,008 0,015
6,0	-	-	0,015 0,029	0,015 0,026	0,013 0,024	-	-	-	0,015 0,029	0,015 0,026	0,015 0,024	-	-	-	-	-	-	0,009 0,019	0,009 0,018
8,0	-	-	0,020 0,042	0,020 0,037	0,017 0,033	-	-	-	0,020 0,042	0,020 0,037	0,020 0,033	-	-	-	-	-	-	0,012 0,026	0,012 0,025
10,0	-	-	0,025 0,057	0,025 0,048	0,021 0,042	-	-	-	0,025 0,057	0,025 0,048	0,025 0,042	-	-	-	-	-	-	0,015 0,034	0,015 0,032
12,0	-	-	0,030 0,072	0,030 0,060	0,025 0,051	-	-	-	0,030 0,072	0,030 0,060	0,030 0,051	-	-	-	-	-	-	0,018 0,043	0,018 0,039
16,0	-	-	0,040 0,104	0,040 0,085	0,032 0,070	-	-	-	0,040 0,104	0,040 0,085	0,040 0,070	-	-	-	-	-	-	0,024 0,061	0,024 0,055

Note: HTA = High Temperature Alloys

Rapide High Performance / High Speed End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,01	$5,00 \times f_z$
	0,03	$2,90 \times f_z$
	0,05	$2,25 \times f_z$
	0,08	$1,85 \times f_z$

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

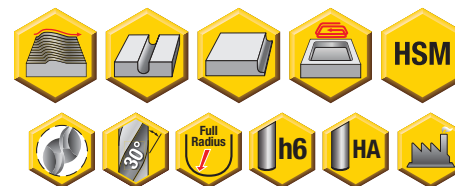


Solid Carbide
Rapide End Mill

Recommended Speeds

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HER Series			Speed min. - max.		
			Coolant Recommendation		PVD Standard
Recommended ● Possible ◎					SP4035
ISO	Materials	Rm and Hardness			
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			70 - 320
		950-1200 N/mm ² 280-355 HBN	●	◎	50 - 280
		1200-1400 N/mm ² 355-415 HBN			45 - 160
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			100 - 225
		Spheroidal-Ductile GGG-FGS	●	◎	70 - 155
		Malleable GTS - MN/MP			65 - 130
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	60 - 140
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			50 - 130

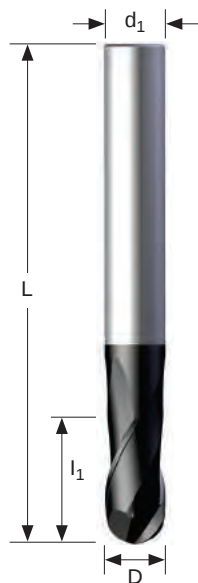


Materials Application

SP4060

P	M	K	N	S	H

PVD



2-Flute Ball Nose End Mill

Solid Carbide
Rapide End Mill

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max	No. of Teeth	Helical Hole min - max		Trochoidal min
034375	HB 030LT2	3,00	63,00	8,00	6,00	8,00	2	-	-	-
034376	HB 040LT2	4,00	63,00	8,00	6,00	8,00	2	-	-	-
034377	HB 060LL2	6,00	75,00	12,00	6,00	12,00	2	-	-	-
034378	HB 080LL2	8,00	75,00	14,00	8,00	14,00	2	-	-	-
034379	HB 100LL2	10,00	100,00	18,00	10,00	18,00	2	-	-	-
034380	HB 120LL2	12,00	100,00	22,00	12,00	22,00	2	-	-	-

Rapide High Performance / High Speed End Mills

HB - Radial a_e and Axial a_p depth of cut range

Product	Dimensions						
Material	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
Alloyed Steel	-	-	-	0,03 - 0,05 D	0,1 - 0,8 D	-	0,05 - 0,2 D
Cast Iron	-	-	-	0,03 - 0,05 D	0,1 - 0,8 D	-	0,05 - 0,2 D
Hard Materials	-	-	-	0,01 - 0,03 D	0,1 - 0,5 D	-	0,05 - 0,1 D



For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide
Rapide End Mill

Recommended Feeds

Rapide High Performance / High Speed End Mills

HB Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	-	-	0,008 0,012	0,008 0,012	0,007 0,011	-	-	-	0,008 0,012	0,008 0,012	0,008 0,011	-	-	-	-	-	-	0,005 0,008	0,005 0,008
4,0	-	-	0,010 0,017	0,010 0,016	0,009 0,015	-	-	-	0,010 0,017	0,010 0,016	0,010 0,015	-	-	-	-	-	-	0,006 0,011	0,006 0,011
6,0	-	-	0,015 0,029	0,015 0,026	0,013 0,024	-	-	-	0,015 0,029	0,015 0,026	0,015 0,024	-	-	-	-	-	-	0,009 0,019	0,009 0,018
8,0	-	-	0,020 0,042	0,020 0,037	0,017 0,033	-	-	-	0,020 0,042	0,020 0,037	0,020 0,033	-	-	-	-	-	-	0,012 0,026	0,012 0,025
10,0	-	-	0,025 0,057	0,025 0,048	0,021 0,042	-	-	-	0,025 0,057	0,025 0,048	0,025 0,042	-	-	-	-	-	-	0,015 0,034	0,015 0,032
12,0	-	-	0,030 0,072	0,030 0,060	0,025 0,051	-	-	-	0,030 0,072	0,030 0,060	0,030 0,051	-	-	-	-	-	-	0,018 0,043	0,018 0,039

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling



Feed Correction Parameters

a_e Correction Factor

For copy milling & shoulder milling applications, refer to page B90.



Recommended Speeds

Solid Carbide Rapide End Mill

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HB Series			Speed min. - max.		
			Coolant Recommendation		PVD Standard
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4035
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			90 - 400
		950-1200 N/mm ² 280-355 HBN	●	◎	60 - 350
		1200-1400 N/mm ² 355-415 HBN			55 - 200
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			120 - 280
		Spheroidal-Ductile GGG-FGS	●	◎	90 - 190
		Malleable GTS - MN/MP			80 - 160
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	80 - 175
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			70 - 160

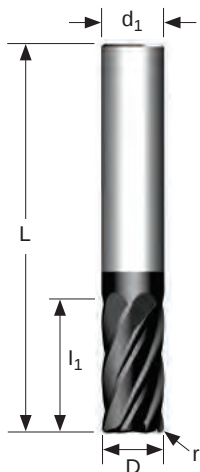


Materials Application

SP4060

P	M	K	N	S	H

PVD



6 - Flute End Mill

Solid Carbide
Rapid End Mill

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	r	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034333	HMR 030NTN6-C	3,00	50,00	10,00	6,00	0,25	10,00	6	-	-	4,29
034334	HMR 040NTN6-C	4,00	50,00	10,00	6,00	0,25	10,00	6	-	-	5,72
034335	HMR 050NTN6-C	5,00	50,00	15,00	6,00	0,25	15,00	6	-	-	7,15
034336	HMR 060NN6-C	6,00	50,00	20,00	6,00	0,25	20,00	6	-	-	8,58
034645	HMR 060NN6-E	6,00	50,00	20,00	6,00	0,50	20,00	6	-	-	8,58
034337	HMR 080NN6-C	8,00	63,00	20,00	8,00	0,25	20,00	6	-	-	11,44
034646	HMR 080NN6-E	8,00	63,00	20,00	8,00	0,50	20,00	6	-	-	11,44
034338	HMR 100NN6-C	10,00	72,00	25,00	10,00	0,25	25,00	6	-	-	14,30
034339	HMR 100NN6-E	10,00	72,00	25,00	10,00	0,50	25,00	6	-	-	14,30
034340	HMR 120NN6-C	12,00	75,00	25,00	12,00	0,25	25,00	6	-	-	17,16
034647	HMR 120NN6-E	12,00	75,00	25,00	12,00	0,50	25,00	6	-	-	17,16
034341	HMR 160NN6-C	16,00	93,00	30,00	16,00	0,25	30,00	6	-	-	22,88
034648	HMR 160NN6-E	16,00	93,00	30,00	16,00	0,50	30,00	6	-	-	22,88
034342	HMR 200NN6-C	20,00	100,00	44,00	20,00	0,25	44,00	6	-	-	28,60

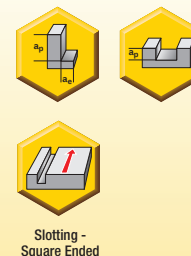
HMR - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
SP4035	-	-	-	0,01 - 0,1 D	0,05 - 2 D	-	0,05 D

* For a_p max do not exceed 0,05 D (a_e)

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.





Solid Carbide Rapide End Mill

Recommended Feeds

HMR Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,008 0,012	0,008 0,012	0,008 0,012	0,008 0,012	0,007 0,011	-	-	-	0,008 0,012	0,008 0,012	0,008 0,011	-	-	0,008 0,012	0,005 0,009	0,005 0,009	0,008 0,013	0,005 0,008	0,005 0,008
4,0	0,010 0,017	0,010 0,017	0,010 0,017	0,010 0,016	0,009 0,015	-	-	-	0,010 0,017	0,010 0,016	0,010 0,015	-	-	0,010 0,017	0,006 0,012	0,006 0,012	0,010 0,017	0,006 0,011	0,006 0,011
5,0	0,013 0,023	0,013 0,023	0,013 0,023	0,013 0,021	0,011 0,020	-	-	-	0,013 0,023	0,013 0,021	0,013 0,020	-	-	0,013 0,023	0,008 0,017	0,008 0,016	0,013 0,023	0,008 0,015	0,008 0,015
6,0	0,015 0,029	0,015 0,029	0,015 0,029	0,015 0,026	0,013 0,024	-	-	-	0,015 0,029	0,015 0,026	0,015 0,024	-	-	0,015 0,029	0,010 0,021	0,010 0,020	0,015 0,028	0,009 0,019	0,009 0,018
8,0	0,020 0,042	0,020 0,042	0,020 0,042	0,020 0,037	0,017 0,033	-	-	-	0,020 0,042	0,020 0,037	0,020 0,033	-	-	0,020 0,042	0,014 0,030	0,014 0,028	0,020 0,041	0,012 0,026	0,012 0,025
10,0	0,025 0,057	0,025 0,057	0,025 0,057	0,025 0,048	0,021 0,042	-	-	-	0,025 0,057	0,025 0,048	0,025 0,042	-	-	0,025 0,057	0,018 0,041	0,018 0,037	0,025 0,054	0,015 0,034	0,015 0,032
12,0	0,030 0,072	0,030 0,072	0,030 0,072	0,030 0,060	0,025 0,051	-	-	-	0,030 0,072	0,030 0,060	0,030 0,051	-	-	0,030 0,072	0,022 0,051	0,022 0,047	0,030 0,068	0,018 0,043	0,018 0,039
16,0	0,040 0,104	0,040 0,104	0,040 0,104	0,040 0,085	0,032 0,070	-	-	-	0,040 0,104	0,040 0,085	0,040 0,070	-	-	0,040 0,104	0,030 0,075	0,030 0,067	0,040 0,098	0,024 0,061	0,024 0,055
20,0	0,050 0,140	0,050 0,140	0,050 0,140	0,050 0,111	0,040 0,090	-	-	-	0,050 0,140	0,050 0,111	0,050 0,090	-	-	0,050 0,140	0,038 0,100	0,038 0,089	0,050 0,130	0,030 0,079	0,030 0,071

Note: HTA = High Temperature Alloys

Rapide High Performance / High Speed End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,01	$5,00 \times f_z$
	0,03	$2,90 \times f_z$
	0,05	$2,25 \times f_z$
	0,08	$1,85 \times f_z$

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Solid Carbide
Rapide End Mill

Recommended Speeds

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HMR Series			Speed min. - max.		
			Coolant Recommendation		
Recommended ● Possible ◎			PVD Standard		
ISO	Materials	Rm and Hardness			SP4035
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	100 - 450
		<950 N/mm ² <280 HBN			90 - 400
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	90 - 400
		950-1200 N/mm ² 280-355 HBN			60 - 350
		1200-1400 N/mm ² 355-415 HBN			55 - 200
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft	●	◎	120 - 280
		Spheroidal-Ductile GGG-FGS			90 - 190
		Malleable GTS - MN/MP			80 - 160
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	60 - 140
		Cobalt Based			20 - 75
		Nickel Based			25 - 80
		Titanium Based			40 - 120
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	80 - 175
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			70 - 160



Solid Carbide Rapide End Mill

Recommended Feeds

HMR Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal: Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,014	0,008 0,013	0,009 0,013	0,009 0,012	0,008 0,011	0,009 0,014	0,009 0,013	0,009 0,013	-	-	0,009 0,014	0,006 0,010	0,006 0,010	0,009 0,013	0,006 0,010	0,006 0,010
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,015	0,012 0,019	0,008 0,014	0,008 0,014
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,014 0,022	0,015 0,024	0,015 0,022	0,013 0,020	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,016 0,027	0,011 0,020	0,011 0,019	0,015 0,026	0,010 0,019	0,010 0,018
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	0,012 0,023	0,012 0,022
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	0,016 0,033	0,016 0,030
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	0,020 0,043	0,020 0,039
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	0,024 0,053	0,024 0,049
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,042 0,084	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	0,032 0,076	0,032 0,068
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	0,040 0,100	0,040 0,089

Note: HTA = High Temperature Alloys

Rapide High Performance / High Speed End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,01	$5,00 \times f_z$
	0,03	$2,90 \times f_z$
	0,05	$2,25 \times f_z$
	0,08	$1,85 \times f_z$

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

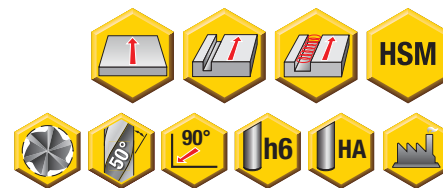


Solid Carbide
Rapide End Mill

Recommended Speeds

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HMR Series			Speed min. - max.		
			Coolant Recommendation		
Recommended ● Possible ◎			PVD Standard		
ISO	Materials	Rm and Hardness	●	◎	SP4035
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	80 - 360
		<950 N/mm ² <280 HBN	●	◎	70 - 320
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	70 - 320
		950-1200 N/mm ² 280-355 HBN	●	◎	50 - 280
		1200-1400 N/mm ² 355-415 HBN	●	◎	45 - 160
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	80 - 160
		Martensitic 400 series	●	◎	55 - 120
	PH Stainless	Refractory P.H.	●	◎	55 - 90
K	Cast Iron	Grey GG-Ft	●	◎	100 - 225
		Spheroidal-Ductile GGG-FGS	●	◎	70 - 155
		Malleable GTS - MN/MP	●	◎	65 - 130
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN	●	◎	
		Aluminium + Silicon > 16% Si 92 HBN	●	◎	
S	High Temperature Alloys	Iron Based	●	◎	50 - 110
		Cobalt Based	●	◎	15 - 60
		Nickel Based	●	◎	20 - 65
		Titanium Based	●	◎	30 - 100
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN	●	◎	60 - 140
		Chilled Cast Iron >1400 N/mm ² > 400 HBN	●	◎	50 - 130

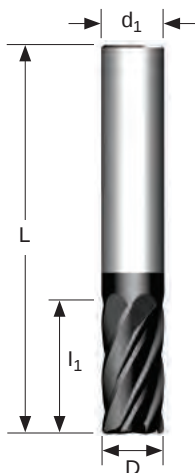


Materials Application

SP4060

P	M	K	N	S	H

PVD



6 - Flute End Mill

Solid Carbide
Rapide End Mill

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034369	HMN 060NN6	6,00	50,00	13,00	6,00	13,00	6	-	-	8,58
034370	HMN 080NN6	8,00	63,00	20,00	8,00	20,00	6	-	-	11,44
034371	HMN 100NN6	10,00	72,00	22,00	10,00	22,00	6	-	-	14,30
034372	HMN 120NN6	12,00	75,00	25,00	12,00	25,00	6	-	-	17,16
034373	HMN 160NN6	16,00	92,00	32,00	16,00	32,00	6	-	-	22,88
034374	HMN 200NN6	20,00	100,00	38,00	20,00	38,00	6	-	-	28,60

HMN - Radial a_e and Axial a_p depth of cut range

Product	Dimensions	
Grade	Shoulder Milling	
	a _e %	a _p %
SP4035	0,01 - 0,05 D	0,05 - 2 D



* For a_p max do not exceed 0,05 D (a_e)

For trochoidal application details refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.

Rapide High Performance / High Speed End Mills



Solid Carbide Rapide End Mill

Recommended Feeds

Rapide High Performance / High Speed End Mills

HMN Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	-	-	-	-	0,008 0,013	-	-	-	0,009 0,014	0,009 0,013	0,009 0,013	-	-	-	-	-	-	0,006 0,010	0,006 0,010
4,0	-	-	-	-	0,011 0,017	-	-	-	0,012 0,020	0,012 0,019	0,012 0,017	-	-	-	-	-	-	0,008 0,014	0,008 0,014
5,0	-	-	-	-	0,014 0,022	-	-	-	0,015 0,027	0,015 0,025	0,015 0,022	-	-	-	-	-	-	0,010 0,019	0,010 0,018
6,0	-	-	-	-	0,016 0,027	-	-	-	0,018 0,034	0,018 0,030	0,018 0,027	-	-	-	-	-	-	0,012 0,023	0,012 0,022
8,0	-	-	-	-	0,021 0,037	-	-	-	0,024 0,051	0,024 0,043	0,024 0,037	-	-	-	-	-	-	0,016 0,033	0,016 0,030
10,0	-	-	-	-	0,026 0,047	-	-	-	0,030 0,068	0,030 0,056	0,030 0,047	-	-	-	-	-	-	0,020 0,043	0,020 0,039
12,0	-	-	-	-	0,030 0,057	-	-	-	0,036 0,087	0,036 0,070	0,036 0,057	-	-	-	-	-	-	0,024 0,053	0,024 0,049
16,0	-	-	-	-	0,039 0,079	-	-	-	0,048 0,127	0,048 0,099	0,048 0,079	-	-	-	-	-	-	0,032 0,076	0,032 0,068
20,0	-	-	-	-	0,048 0,101	-	-	-	0,060 0,171	0,060 0,130	0,060 0,101	-	-	-	-	-	-	0,040 0,100	0,040 0,089

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,01 D	5,00 x f_z
	0,02 D	3,55 x f_z
	0,03 D	2,90 x f_z
	0,04 D	2,50 x f_z
	0,05 D	2,25 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Recommended Speeds

Solid Carbide Rapid End Mill

Rapide High Performance / High Speed End Mills

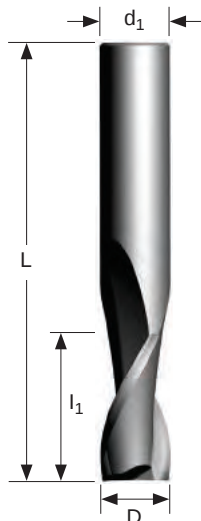
Speed v_c (m/min)					
HMN Series			Speed min. - max.		
Coolant Recommendation					
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			PVD Standard
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			
		950-1200 N/mm ² 280-355 HBN	●	◎	
		1200-1400 N/mm ² 355-415 HBN			55 - 200
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			120 - 280
		Spheroidal-Ductile GGG-FGS	●	◎	90 - 190
		Malleable GTS - MN/MP			80 - 160
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN		◎	80 - 175
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			70 - 160



Materials Application

SP4060

P	M	K	N	S	H



2 - Flute End Mill

Solid Carbide
Rapid End Mill

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034322	EA 020NTN2	2,00	38,00	6,00	3,00	6,00	2	2,86	3,90	2,86
034323	EA 025NTN2	2,50	38,00	8,00	3,00	8,00	2	3,58	4,88	3,58
034324	EA 030NN2	3,00	38,00	12,00	3,00	12,00	2	4,29	5,85	4,29
034325	EA 040NN2	4,00	50,00	14,00	4,00	14,00	2	5,72	7,80	5,72
034326	EA 050NN2	5,00	50,00	20,00	5,00	20,00	2	7,15	9,75	7,15
034327	EA 060NN2	6,00	63,00	20,00	6,00	20,00	2	8,58	11,70	8,58
034328	EA 080NN2	8,00	63,00	20,00	8,00	20,00	2	11,44	15,60	11,44
034329	EA 100NN2	10,00	70,00	25,00	10,00	25,00	2	14,30	19,50	14,30
034330	EA 120NN2	12,00	75,00	25,00	12,00	25,00	2	17,16	23,40	17,16
034331	EA 160NN2	16,00	88,00	30,00	16,00	30,00	2	22,88	31,20	22,88
034332	EA 200NN2	20,00	100,0	38,00	20,00	38,00	2	28,60	39,00	28,60

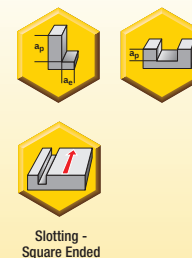
EA - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
SU0800	0,1 - 0,2 D	0,1 - 1,5 D	Mid - High	0,05 - 0,1 D	0,1 - 1,5 D	Low - Mid	0,05 - 0,5 D

* For a_p max do not exceed 0,05 D (a_e)

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.





Recommended Feeds

Solid Carbide Rapid End Mill

Rapide High Performance / High Speed End Mills

EA Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	-	-	-	-	-	-	-	-	-	-	-	0,017 0,031	0,017 0,027	-	-	-	-	-	-
4,0	-	-	-	-	-	-	-	-	-	-	-	0,022 0,043	0,022 0,037	-	-	-	-	-	-
5,0	-	-	-	-	-	-	-	-	-	-	-	0,027 0,057	0,027 0,049	-	-	-	-	-	-
6,0	-	-	-	-	-	-	-	-	-	-	-	0,032 0,071	0,032 0,061	-	-	-	-	-	-
8,0	-	-	-	-	-	-	-	-	-	-	-	0,042 0,102	0,042 0,087	-	-	-	-	-	-
10,0	-	-	-	-	-	-	-	-	-	-	-	0,051 0,135	0,051 0,114	-	-	-	-	-	-
12,0	-	-	-	-	-	-	-	-	-	-	-	0,060 0,169	0,060 0,142	-	-	-	-	-	-
16,0	-	-	-	-	-	-	-	-	-	-	-	0,078 0,242	0,078 0,202	-	-	-	-	-	-
20,0	-	-	-	-	-	-	-	-	-	-	-	0,095 0,320	0,095 0,266	-	-	-	-	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

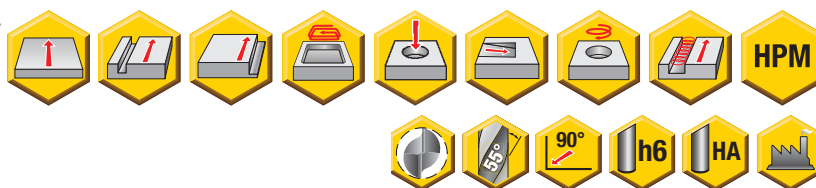


Solid Carbide
Rapide End Mill

Recommended Speeds

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
EA Series					
Coolant Recommendation					
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			Uncoated Micrograin
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			
		950-1200 N/mm ² 280-355 HBN			
		1200-1400 N/mm ² 355-415 HBN			
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			
		Spheroidal-Ductile GGG-FGS			
		Malleable GTS - MN/MP			
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN	●	◎	300 - 1400
		Aluminium + Silicon > 16% Si 92 HBN			90 - 250
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

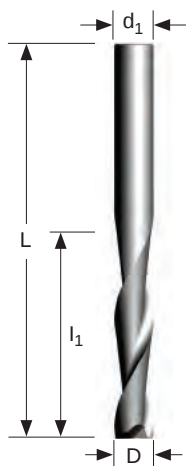


Materials Application

SP4060

P	M	K	N	S	H
			◆		

Uncoated



2 - Flute End Mill

Solid Carbide
Rapid End Mill

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min	
034381	HPA 030NN2	3,00	50,00	12,00	3,00	12,00	2	4,29	5,85	4,29	
034382	HPA 040NN2	4,00	50,00	14,00	4,00	14,00	2	5,72	7,80	5,72	
034383	HPA 050NN2	5,00	50,00	20,00	5,00	20,00	2	7,15	9,75	7,15	
034384	HPA 060NN2	6,00	63,00	20,00	6,00	20,00	2	8,58	11,70	8,58	
034385	HPA 080NN2	8,00	63,00	20,00	8,00	20,00	2	11,44	15,60	11,44	
034386	HPA 100NN2	10,00	70,00	25,00	10,00	25,00	2	14,30	19,50	14,30	
034387	HPA 120NN2	12,00	75,00	25,00	12,00	25,00	2	17,16	23,40	17,16	
034388	HPA 160NN2	16,00	88,00	32,00	16,00	32,00	2	22,88	31,20	22,88	
034389	HPA 200NN2	20,00	100,00	38,00	20,00	38,00	2	28,60	39,00	28,60	

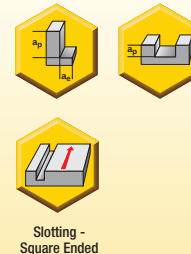
Rapid High Performance / High Speed End Mills

HPA - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting ap%
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
SU0800	0,2 - 0,5 D	0,1 - 2 D	Mid - High	0,05 - 0,2 D	0,1 - 2 D	Low - Mid	0,1 - 1 D

* For a_p max do not exceed 0,05 D (a_e)Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.

Slotting -
Square Ended



Solid Carbide
Rapide End Mill

Recommended Feeds

Rapide High Performance / High Speed End Mills

HPA Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	-	-	-	-	-	-	-	-	-	-	-	0,017 0,031	0,017 0,027	-	-	-	-	-	-
4,0	-	-	-	-	-	-	-	-	-	-	-	0,022 0,043	0,022 0,037	-	-	-	-	-	-
5,0	-	-	-	-	-	-	-	-	-	-	-	0,027 0,057	0,027 0,049	-	-	-	-	-	-
6,0	-	-	-	-	-	-	-	-	-	-	-	0,032 0,071	0,032 0,061	-	-	-	-	-	-
8,0	-	-	-	-	-	-	-	-	-	-	-	0,042 0,102	0,042 0,087	-	-	-	-	-	-
10,0	-	-	-	-	-	-	-	-	-	-	-	0,051 0,135	0,051 0,114	-	-	-	-	-	-
12,0	-	-	-	-	-	-	-	-	-	-	-	0,060 0,169	0,060 0,142	-	-	-	-	-	-
16,0	-	-	-	-	-	-	-	-	-	-	-	0,078 0,242	0,078 0,202	-	-	-	-	-	-
20,0	-	-	-	-	-	-	-	-	-	-	-	0,095 0,320	0,095 0,266	-	-	-	-	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z
	0,20 D	1,25 x f_z
	0,30 D	1,09 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

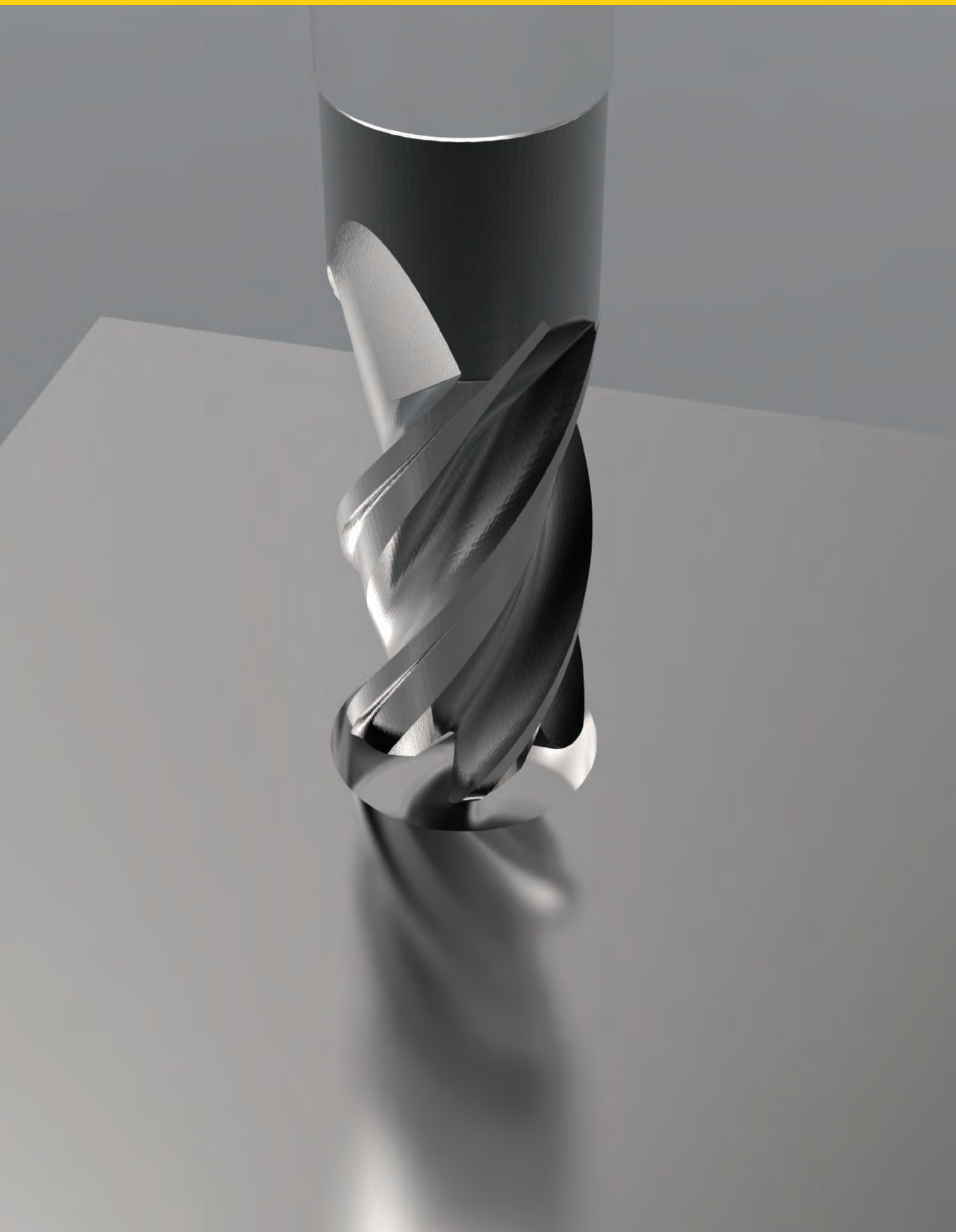


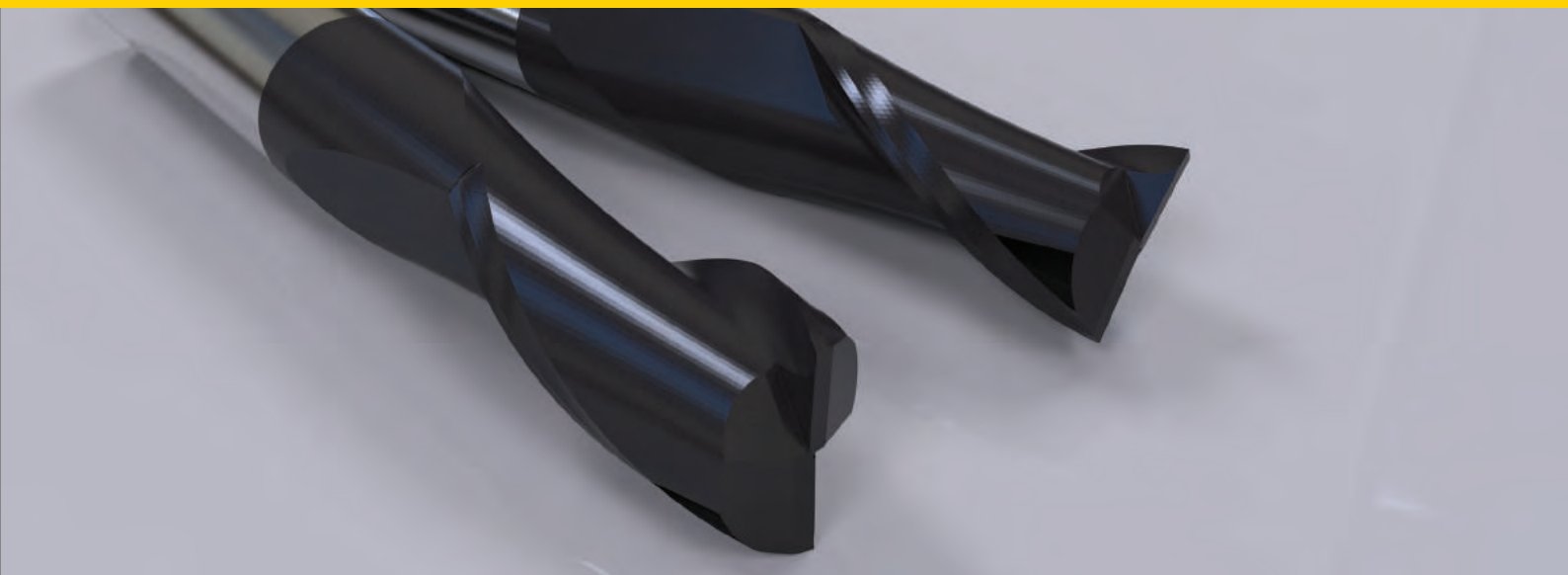
Recommended Speeds

Solid Carbide
Rapide End Mill

Rapide High Performance / High Speed End Mills

Speed v_c (m/min)					
HPA Series					
			Speed min. - max.		
Coolant Recommendation			 		Uncoated Micrograin
Recommended ● Possible ◎					SU0800
ISO	Materials	Rm and Hardness			
P	Unalloyed Steel	<600 N/mm ² <180 HBN			
		<950 N/mm ² <280 HBN			
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			
		950-1200 N/mm ² 280-355 HBN			
		1200-1400 N/mm ² 355-415 HBN			
M	Stainless Steel	Austenitic + Ferritic 300 series			
		Martensitic 400 series			
	PH Stainless	Refractory P.H.			
K	Cast Iron	Grey GG-Ft			
		Spheroidal-Ductile GGG-FGS			
		Malleable GTS - MN/MP			
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN	●	◎	300 - 1400
		Aluminium + Silicon > 16% Si 92 HBN			90 - 400
S	High Temperature Alloys	Iron Based			
		Cobalt Based			
		Nickel Based			
		Titanium Based			
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			





GENERAL PURPOSE MILLING

Designed to complement the Stellram Premium End mills, the general purpose End Mills offer solutions for a wide range of applications and materials.

Available in:

- a comprehensive range of diameters (including miniatures)
- 2, 3 and 4 flute geometries
- Square End, Square End with Radius, and Ball Nosed styles
- Standard and Extended length
- Uncoated and Coated Premium Carbide grades

General Purpose Milling

B48 - B86

General Purpose, Miniature

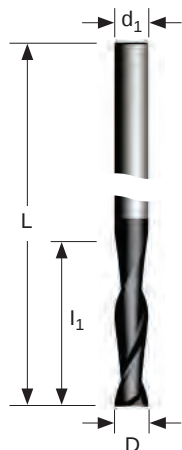
B72 - B86



Materials Application

SP4060					
P	M	K	N	S	H
					

PVD



2 - Flute End Mill

Solid Carbide

General Purpose - Eng Milling

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min	
034169	E 030NN2	3,00	38,00	12,00	3,00	12,00	2	4,29	5,85	4,29	
034170	E 040NN2	4,00	50,00	14,00	4,00	14,00	2	5,72	7,80	5,72	
034171	E 050NN2	5,00	50,00	16,00	5,00	16,00	2	7,15	9,75	7,15	
034172	E 060NN2	6,00	63,00	19,00	6,00	19,00	2	8,58	11,70	8,58	
034173	E 080NN2	8,00	63,00	19,00	8,00	19,00	2	11,44	15,60	11,44	
034174	E 100NN2	10,00	70,00	22,00	10,00	22,00	2	14,30	19,50	14,30	
034175	E 120NN2	12,00	75,00	25,00	12,00	25,00	2	17,16	23,40	17,16	
034176	E 160NN2	16,00	88,00	32,00	16,00	32,00	2	22,88	31,20	22,88	
034177	E 200NN2	20,00	100,00	38,00	20,00	38,00	2	28,60	39,00	28,60	

E_NN2 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting
	Roughing			Finishing			a _p %
	a _e %	a _p %	f _z	a _e %	a _p %	f _z	
SP4556	0,1 - 0,2 D	0,5 - 1,5 D	Mid - High	0,05 - 0,1D	0,5 - 1,5 D	Low - Mid	0,1 - 0,5 D

* When using a_p max, a_e should not exceed 0,1 D

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Slotting - Square Ended



Recommended Feeds

Solid Carbide
General Purpose - End Milling

E_NN2 Feeds f_z (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	-	-

Note: HTA = High Temperature Alloys

General Purpose End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z
	0,20 D	1,25 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Solid Carbide
General Purpose - Eng Milling

Recommended Speeds

General Purpose End Mills

Speed v_c (m/min)					
E_NN2 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

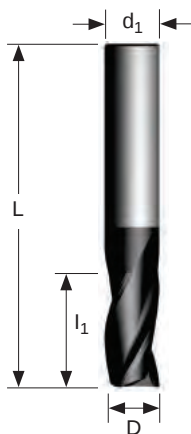


Materials Application

SP4060

P	M	K	N	S	H
◆	◆	◆	◆	◆	◆

PVD



3 - Flute End Mill

Solid Carbide
General Purpose - End Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034195	E 030NN3	3,00	38,00	12,00	3,00	12,00	3	4,29	5,85	4,29
034196	E 040NN3	4,00	50,00	14,00	4,00	14,00	3	5,72	7,80	5,72
034197	E 050NN3	5,00	50,00	16,00	5,00	16,00	3	7,15	9,75	7,15
034198	E 060NN3	6,00	63,00	19,00	6,00	19,00	3	8,58	11,70	8,58
034199	E 080NN3	8,00	63,00	19,00	8,00	19,00	3	11,44	15,60	11,44
034200	E 100NN3	10,00	70,00	22,00	10,00	22,00	3	14,30	19,50	14,30
034201	E 120NN3	12,00	75,00	25,00	12,00	25,00	3	17,16	23,40	17,16
034202	E 160NN3	16,00	88,00	32,00	16,00	32,00	3	22,88	31,20	22,88
034203	E 200NN3	20,00	100,00	38,00	20,00	38,00	3	28,60	39,00	28,60

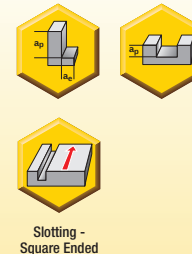
General Purpose End Mills

E_NN3 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions						
Grade	Shoulder Milling						Slotting
	Roughing			Finishing			
	ae%	ap%	fz	ae%	ap%	fz	
SP4556	0.1 - 0.5 D	0.5 - 2 D	Mid - High	0.05 - 0.1 D	0.5 - 2 D	Low - Mid	0.1 - 0.5 D

* When using a_p max, a_e should not exceed 0.1DNote: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.

Slotting -
Square Ended



Solid Carbide

General Purpose - Eng Milling

Recommended Feeds

General Purpose End Mills

E_NN3 Feeds f_z (mm/tooth) - Slotting / Pocketing

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z
	0,20 D	1,25 x f_z
	0,30 D	1,09 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.

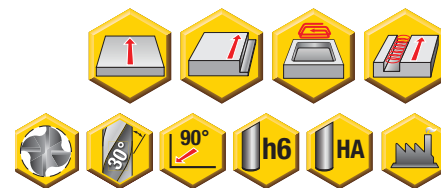


Recommended Speeds

Solid Carbide General Purpose - End Milling

Speed v_c (m/min)					
E_NN3 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

General Purpose End Mills

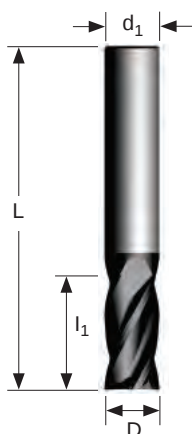


Materials Application

SP4060

P	M	K	N	S	H
					

PVD



4 - Flute End Mill

Solid Carbide

General Purpose - Eng Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034219	E 030NN4	3,00	38,00	12,00	3,00	12,00	4	-	-	4,29
034220	E 040NN4	4,00	50,00	14,00	4,00	14,00	4	-	-	5,72
034221	E 050NN4	5,00	50,00	16,00	5,00	16,00	4	-	-	7,15
034222	E 060NN4	6,00	63,00	19,00	6,00	19,00	4	-	-	8,58
034223	E 080NN4	8,00	63,00	19,00	8,00	19,00	4	-	-	11,44
034224	E 100NN4	10,00	70,00	22,00	10,00	22,00	4	-	-	14,30
034225	E 120NN4	12,00	75,00	25,00	12,00	25,00	4	-	-	17,16
034226	E 160NN4	16,00	88,00	32,00	16,00	32,00	4	-	-	22,88
034227	E 200NN4	20,00	100,00	38,00	20,00	38,00	4	-	-	28,60

E_NN4 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)					
Grade	Shoulder Milling					
	Roughing			Finishing		
	a _e %	a _p %	f _z	a _e %	a _p %	f _z
SP4556	0,1 - 0,5 D	0,5 - 2 D	Mid - High	0,05 - 0,1 D	0,5 - 2 D	Low - Mid



* When using a_p max, a_e should not exceed 0,1 D

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Recommended Feeds

Solid Carbide
General Purpose - End MillingE_NN4 Feeds f_z (mm/tooth) - Shoulder Milling (a_e max)

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	-	-

Note: HTA = High Temperature Alloys

General Purpose End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z
	0,20 D	1,25 x f_z
	0,30 D	1,09 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



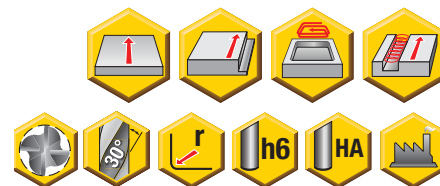
Solid Carbide

General Purpose - Eng Milling

Recommended Speeds

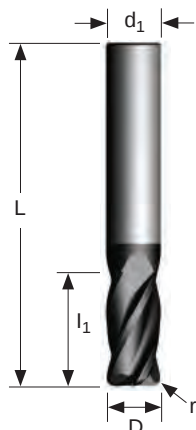
General Purpose End Mills

Speed v_c (m/min)					
E_NN4 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			



Materials Application

SP4060					
P	M	K	N	S	H



4 - Flute End Mill

Solid Carbide General Purpose - End Milling

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	I ₁	d ₁	r	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034228	ER 030NN4-E	3,00	38,00	12,00	3,00	0,50	12,00	4	-	-	4,29
034229	ER 040NN4-E	4,00	50,00	14,00	4,00	0,50	14,00	4	-	-	5,72
034230	ER 050NN4-E	5,00	50,00	16,00	5,00	0,50	16,00	4	-	-	7,15
034231	ER 060NN4-E	6,00	63,00	19,00	6,00	0,50	19,00	4	-	-	8,58
034232	ER 060NN4-G	6,00	63,00	19,00	6,00	1,00	19,00	4	-	-	8,58
034233	ER 080NN4-E	8,00	63,00	19,00	8,00	0,50	19,00	4	-	-	11,44
034234	ER 080NN4-G	8,00	63,00	19,00	8,00	1,00	19,00	4	-	-	11,44
034235	ER 100NN4-E	10,00	70,00	22,00	10,00	0,50	22,00	4	-	-	14,30
034236	ER 100NN4-G	10,00	70,00	22,00	10,00	1,00	22,00	4	-	-	14,30
034237	ER 100NN4-J	10,00	70,00	22,00	10,00	1,50	22,00	4	-	-	14,30
034238	ER 120NN4-E	12,00	75,00	25,00	12,00	0,50	25,00	4	-	-	17,16
034239	ER 120NN4-G	12,00	75,00	25,00	12,00	1,00	25,00	4	-	-	17,16
034240	ER 120NN4-J	12,00	75,00	25,00	12,00	1,50	25,00	4	-	-	17,16
034241	ER 120NN4-K	12,00	75,00	25,00	12,00	2,00	25,00	4	-	-	17,16
034242	ER 160NN4-G	16,00	92,00	32,00	16,00	1,00	32,00	4	-	-	22,88
034243	ER 160NN4-J	16,00	92,00	32,00	16,00	1,50	32,00	4	-	-	22,88
034244	ER 160NN4-K	16,00	92,00	32,00	16,00	2,00	32,00	4	-	-	22,88

General Purpose End Mills

E_NN4-(r) Radial a_e and Axial a_p depth of cut range

Product	Dimensions					
	Shoulder Milling					
	Roughing			Finishing		
Grade	a _e %	a _p %	f _z	a _e %	a _p %	f _z
SP4556	0,1 - 0,5 D	0,5 - 2 D	Mid - High	0,5 - 0,1 D	0,5 - 2 D	Low - Mid



* When using a_p max, a_e should not exceed 0,1D

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide

General Purpose - Eng Milling

Recommended Feeds

ER_NN4-(r) Feeds f_z (mm/tooth) - Shoulder Milling (a_e max)

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200N/mm ² 280-355 HBN	Alloyed Steel 1200-1400N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,05 D	2,30 x f_z
	0,10 D	1,65 x f_z
	0,15 D	1,40 x f_z
	0,20 D	1,25 x f_z
	0,30 D	1,09 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Recommended Speeds

Solid Carbide General Purpose - End Milling

Speed v_c (m/min)					
ER_NN4-with Radius Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN	●	◎	100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN	●	◎	90 - 140
M	Stainless Steel	1200-1400 N/mm ² 355-415 HBN	●	◎	80 - 120
		Austenitic + Ferritic 300 series	●	◎	85 - 120
	PH Stainless	Martensitic 400 series	●	◎	65 - 90
K	Cast Iron	Refractory P.H.	●	◎	50 - 80
		Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS	●	◎	60 - 120
N	Aluminium & Alloys	Malleable GTS - MN/MP	●	◎	50 - 100
		Aluminium & Alloys < 16% Si 116 HBN	●	◎	
S	High Temperature Alloys	Aluminium + Silicon > 16% Si 92 HBN	●	◎	
		Iron Based	●	◎	40 - 90
		Cobalt Based	●	◎	20 - 40
		Nickel Based	●	◎	25 - 45
H	Hard Materials	Titanium Based	●	◎	30 - 60
		Hard Steel >1400 N/mm ² >415 HBN	●	◎	
		Chilled Cast Iron >1400 N/mm ² > 400 HBN	●	◎	

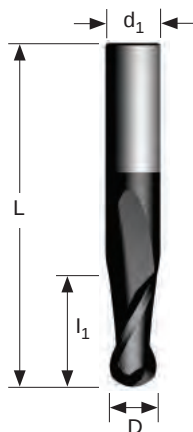
General Purpose End Mills



Materials Application

SP4060					
P	M	K	N	S	H
					

PVD



2 - Flute Ball Nose End Mill

Solid Carbide

General Purpose - Eng Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	L ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034276	B 030NN2	3,00	38,00	12,00	3,00	12,00	2	-	-	-
034277	B 040NN2	4,00	50,00	14,00	4,00	14,00	2	-	-	-
034278	B 050NN2	5,00	50,00	16,00	5,00	16,00	2	-	-	-
034279	B 060NN2	6,00	63,00	19,00	6,00	19,00	2	-	-	-
034280	B 080NN2	8,00	63,00	19,00	8,00	19,00	2	-	-	-
034281	B 100NN2	10,00	70,00	22,00	10,00	22,00	2	-	-	-
034282	B 120NN2	12,00	75,00	25,00	12,00	25,00	2	-	-	-
034283	B 160NN2	16,00	88,00	32,00	16,00	32,00	2	-	-	-
034284	B 200NN2	20,00	100,00	38,00	20,00	38,00	2	-	-	-

B_NN2 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)						
Grade	Shoulder Milling						Slotting
	Roughing			Finishing			ap%
	ae%	ap%	fz	ae%	ap%	fz	
SP4556	0.1 - 0.2 D	0.5 - 1.4 D	Mid - High	0.05 - 0.1 D	0.5 - 1.4 D	Low - Mid	0.1 - 0.4 D

* When using a_p max, a_e should not exceed 0,1 D

Note: For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.





Recommended Feeds

Solid Carbide General Purpose - End Milling

B_NN2 Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-
20,0	0,060 0,160	0,060 0,160	0,060 0,160	0,060 0,130	0,048 0,101	0,060 0,130	0,060 0,101	0,050 0,090	0,060 0,171	0,060 0,130	0,060 0,101	-	-	0,060 0,171	0,050 0,120	0,050 0,112	0,060 0,152	-	-

Note: HTA = High Temperature Alloys

General Purpose End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	Note: For copy milling & shoulder milling applications, refer to page B90.	



Solid Carbide

General Purpose - Eng Milling

Recommended Speeds

General Purpose End Mills

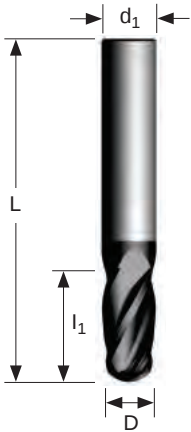
Speed v_c (m/min)					
B_NN2 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			



Materials Application

SP4060

P	M	K	N	S	H
◆	◆	◆	◆	◆	◆



4 - Flute Ball Nose End Mill

Solid Carbide
General Purpose - End Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l_1	d_1	a_p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034724	B 030NN4	3,00	38,00	12,00	3,00	12,00	4	-	-	-
034725	B 040NN4	4,00	50,00	14,00	4,00	14,00	4	-	-	-
034726	B 050NN4	5,00	50,00	16,00	5,00	16,00	4	-	-	-
034727	B 060NN4	6,00	63,00	19,00	6,00	19,00	4	-	-	-
034728	B 080NN4	8,00	63,00	19,00	8,00	19,00	4	-	-	-
034729	B 100NN4	10,00	70,00	22,00	10,00	22,00	4	-	-	-
034730	B 120NN4	12,00	75,00	25,00	12,00	25,00	4	-	-	-

General Purpose End Mills

B_NN4 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)					
Grade	Shoulder Milling					
	Roughing			Finishing		
	$a_e\%$	$a_p\%$	f_z	$a_e\%$	$a_p\%$	f_z
SP4556	0,1 - 0,5 D	0,5 - 1,9 D	Mid - High	0,05 - 0,1 D	0,5 - 1,9 D	Low - Mid



* When using a_p max, a_e should not exceed 0,1 D

Note: For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide

General Purpose - Eng Milling

Recommended Feeds

General Purpose End Mills

B_NN4 Feeds f_z (mm/tooth) - Slotting / Pocketing

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200N/mm ² 280-355 HBN	Alloyed Steel 1200-1400N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 118 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
3,0	0,009 0,014	0,009 0,014	0,009 0,014	0,009 0,013	0,009 0,012	0,009 0,013	0,009 0,013	0,007 0,011	0,009 0,014	0,009 0,013	0,009 0,012	-	-	0,009 0,014	0,007 0,011	0,007 0,010	0,009 0,014	-	-
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
5,0	0,015 0,027	0,015 0,027	0,015 0,027	0,015 0,025	0,013 0,022	0,015 0,024	0,015 0,022	0,013 0,019	0,015 0,027	0,015 0,025	0,015 0,022	-	-	0,015 0,027	0,011 0,020	0,011 0,019	0,015 0,026	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling



Feed Correction Parameters

 a_e

Correction Factor

Note: For copy milling & shoulder milling applications, refer to page B90.

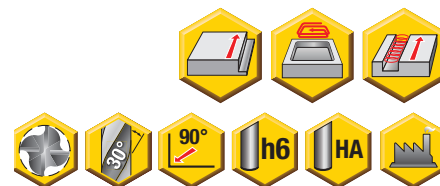


Recommended Speeds

Solid Carbide General Purpose - End Milling

Speed v_c (m/min)					
B_NN4 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

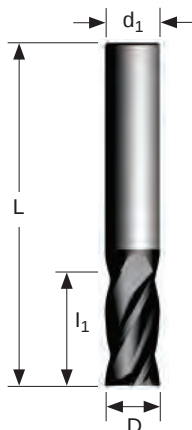
General Purpose End Mills



Materials Application

SP4060					
P	M	K	N	S	H
◆	◆	◆	◆	◆	◆

PVD



4 - Flute End Mill

Solid Carbide
General Purpose - Eng Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034317	E 060LL4	6,00	75,00	25,00	6,00	25,00	4	-	-	8,58
034318	E 080LL4	8,00	75,00	25,00	8,00	25,00	4	-	-	11,44
034319	E 100LL4	10,00	100,00	38,00	10,00	38,00	4	-	-	14,30
034320	E 120LL4	12,00	100,00	50,00	12,00	50,00	4	-	-	17,16
034321	E 160LL4	16,00	150,00	75,00	16,00	75,00	4	-	-	22,88

E_LL4 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)					
Grade	Shoulder Milling					
	Roughing			Finishing		
	a _e %	a _p %	f _z	a _e %	a _p %	f _z
SP4556	0,1 - 0,3 D	0,5 - 3 D	Mid - High	0,05 - 0,1 D	0,5 - 3 D	Low - Mid



* When using a_p max, a_e should not exceed 0,1 D

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Recommended Feeds

Solid Carbide
General Purpose - End Milling

E_LL4 Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-
16,0	0,048 0,119	0,048 0,119	0,048 0,119	0,048 0,099	0,039 0,079	0,048 0,099	0,048 0,079	0,040 0,070	0,048 0,127	0,048 0,099	0,048 0,079	-	-	0,048 0,127	0,039 0,090	0,039 0,084	0,048 0,115	-	-

Note: HTA = High Temperature Alloys

General Purpose End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	ae	Correction Factor
	0,05 D	2,30 x fz
	0,10 D	1,65 x fz
	0,15 D	1,40 x fz
	0,20 D	1,25 x fz
	0,30 D	1,09 x fz

For ae less than ae max, use correction factors stated above.
For ae max, use feeds stated above.



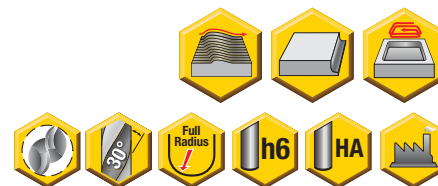
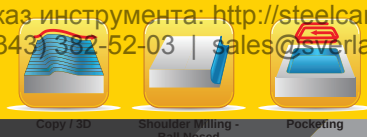
Solid Carbide

General Purpose - Eng Milling

Recommended Speeds

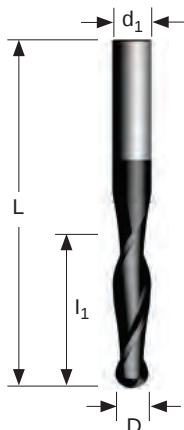
General Purpose End Mills

Speed v_c (m/min)					
E_LL4 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	75 - 110
		<950 N/mm ² <280 HBN			60 - 100
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	60 - 100
		950-1200 N/mm ² 280-355 HBN			55 - 85
		1200-1400 N/mm ² 355-415 HBN			50 - 70
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	50 - 70
		Martensitic 400 series			40 - 55
	PH Stainless	Refractory P.H.	●		30 - 45
K	Cast Iron	Grey GG-Ft	●	◎	55 - 90
		Spheroidal-Ductile GGG-FGS			35 - 70
		Malleable GTS - MN/MP			30 - 60
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	30 - 70
		Cobalt Based			15 - 35
		Nickel Based			20 - 35
		Titanium Based			25 - 50
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			



Materials Application

SP4060					
P	M	K	N	S	H



2 - Flute Ball Nose End Mill

Solid Carbide General Purpose - End Milling

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034738	B 040LL2	4,00	65,00	25,00	4,00	25,00	2	-	-	-
034739	B 060LL2	6,00	75,00	25,00	6,00	25,00	2	-	-	-
034740	B 060XLXL2	6,00	100,00	38,00	6,00	38,00	2	-	-	-
034741	B 080LL2	8,00	75,00	25,00	8,00	25,00	2	-	-	-
034742	B 080XLXL2	8,00	100,00	38,00	8,00	38,00	2	-	-	-
034743	B 100LL2	10,00	100,00	38,00	10,00	38,00	2	-	-	-
034744	B 100XLXL2	10,00	125,0	63,00	10,00	63,00	2	-	-	-
034745	B 120LL2	12,00	100,0	50,00	12,00	50,00	2	-	-	-
034746	B 120XLXL2	12,00	150,00	75,00	12,00	75,00	2	-	-	-

General Purpose End Mills

Radial a _e and Axial a _p depth of cut range						
Product	Dimensions (mm)					
Grade	Shoulder Milling					
	Roughing			Finishing		
	a _e %	a _p %	f _z	a _e %	a _p %	f _z
B_LL2						
SP4556	0,05 - 0,1 D	0,5 - 2,8 D	Mid - High	0,01 - 0,05 D	0,5 - 2,8 D	Low - Mid
B_XLXL2						
SP4556	0,05 - 0,1 D	1,0 - 3,5 D	Mid - High	0,01 - 0,05 D	1,0 - 3,5 D	Low - Mid



* When using a_p max, a_e should not exceed 0.1 D

Note: For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide

General Purpose - Eng Milling

Recommended Feeds

General Purpose End Mills

B_LL2 / B_XLXL2 Feeds f_z (mm/tooth) - Slotting / Pocketing

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200N/mm ² 280-355 HBN	Alloyed Steel 1200-1400N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
4,0	0,012 0,020	0,012 0,020	0,012 0,020	0,012 0,019	0,011 0,017	0,012 0,019	0,012 0,017	0,010 0,015	0,012 0,020	0,012 0,019	0,012 0,017	-	-	0,012 0,020	0,009 0,015	0,009 0,014	0,012 0,019	-	-
6,0	0,018 0,033	0,018 0,033	0,018 0,033	0,018 0,030	0,016 0,027	0,018 0,030	0,018 0,027	0,015 0,024	0,018 0,034	0,018 0,030	0,018 0,027	-	-	0,018 0,034	0,013 0,025	0,013 0,024	0,018 0,033	-	-
8,0	0,024 0,049	0,024 0,049	0,024 0,049	0,024 0,043	0,021 0,037	0,024 0,043	0,024 0,037	0,020 0,033	0,024 0,051	0,024 0,043	0,024 0,037	-	-	0,024 0,051	0,018 0,036	0,018 0,035	0,024 0,047	-	-
10,0	0,030 0,065	0,030 0,065	0,030 0,065	0,030 0,056	0,026 0,047	0,030 0,056	0,030 0,047	0,025 0,042	0,030 0,068	0,030 0,056	0,030 0,047	-	-	0,030 0,068	0,023 0,049	0,023 0,046	0,030 0,063	-	-
12,0	0,036 0,082	0,036 0,082	0,036 0,082	0,036 0,070	0,030 0,057	0,036 0,070	0,036 0,057	0,030 0,051	0,036 0,087	0,036 0,070	0,036 0,057	-	-	0,036 0,087	0,029 0,062	0,029 0,058	0,036 0,079	-	-

Note: HTA = High Temperature Alloys

Shoulder Milling / Profiling



Feed Correction Parameters

a_e Correction Factor

Note: For copy milling & shoulder milling applications, refer to page B90.

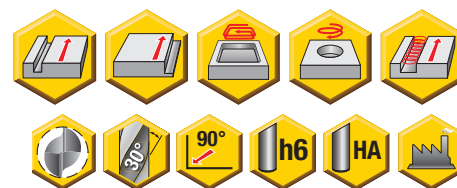


Recommended Speeds

Solid Carbide General Purpose - End Milling

Speed v_c (m/min)					
B_LL2 / B_XLXL2 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	75 - 110
		<950 N/mm ² <280 HBN			60 - 100
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	60 - 100
		950-1200 N/mm ² 280-355 HBN			55 - 85
		1200-1400 N/mm ² 355-415 HBN			50 - 70
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	50 - 70
		Martensitic 400 series			40 - 55
	PH Stainless	Refractory P.H.	●		30 - 45
K	Cast Iron	Grey GG-Ft	●	◎	55 - 90
		Spheroidal-Ductile GGG-FGS			35 - 70
		Malleable GTS - MN/MP			30 - 60
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	30 - 70
		Cobalt Based			15 - 35
		Nickel Based			20 - 35
		Titanium Based			25 - 50
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

General Purpose End Mills

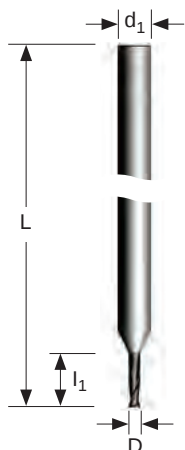


Materials Application

SP4060					
P	M	K	N	S	H



Miniature End Mills



2 - Flute End Mill

Solid Carbide
General Purpose - Miniature

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034158	E 004NTN2	0,40	38,00	1,20	3,00	1,20	2	0,57	0,78	0,57
034159	E 005NTN2	0,50	38,00	1,50	3,00	1,50	2	0,72	0,98	0,72
034160	E 006NTN2	0,60	38,00	1,80	3,00	1,80	2	0,86	1,17	0,86
034161	E 007NTN2	0,70	38,00	2,10	3,00	2,10	2	1,00	1,37	1,00
034162	E 008NTN2	0,80	38,00	2,40	3,00	2,40	2	1,14	1,56	1,14
034163	E 009NTN2	0,90	38,00	2,70	3,00	2,70	2	1,29	1,76	1,29
034164	E 010NTN2	1,00	38,00	3,00	3,00	3,00	2	1,43	1,95	1,43
034165	E 012NTN2	1,20	38,00	3,60	3,00	3,60	2	1,72	2,34	1,72
034166	E 015NTN2	1,50	38,00	5,00	3,00	5,00	2	2,15	2,93	2,15
034167	E 020NTN2	2,00	38,00	6,00	3,00	6,00	2	2,86	3,90	2,86
034168	E 025NTN2	2,50	38,00	7,00	3,00	7,00	2	3,58	4,88	3,58

E_NTN2 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)		
	Shoulder Milling		Slotting
	a _e %	a _p %	a _p %
SP4556	0,05 - 0,2 D	0,05 - 0,2 D	0,1 - 0,3 D

* When using a_p max, a_e should not exceed 0,05 D

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Slotting - Square Ended



Recommended Feeds

Solid Carbide General Purpose - Miniature

E_NTN2 Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS-MNMP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >40 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
0,4	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	-	-	0,004	0,004	0,004	0,004	-	-
0,5	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	-	-	0,005	0,005	0,005	0,005	-	-
0,6	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	-	-	0,005	0,005	0,005	0,005	-	-
0,7	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	-	-	0,006	0,006	0,006	0,006	-	-
0,8	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	-	-	0,007	0,007	0,007	0,007	-	-
0,9	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	-	-	0,008	0,008	0,008	0,008	-	-
1,0	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	-	-	0,009	0,009	0,009	0,009	-	-
1,2	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	-	-	0,011	0,011	0,011	0,011	-	-
1,5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2,0	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2,5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-

Note: HTA = High Temperature Alloys

Note: Due to the small diameter of the miniature end mill line, the feed rate has been reduced to a starting value only.

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,10 D	$1,65 \times f_z$
	0,20 D	$1,25 \times f_z$

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Solid Carbide
General Purpose - Miniature

Recommended Speeds

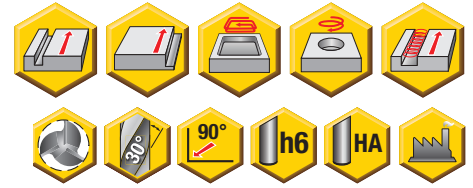


Miniature End Mills

Speed v_c (m/min)					
E_NTN2 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

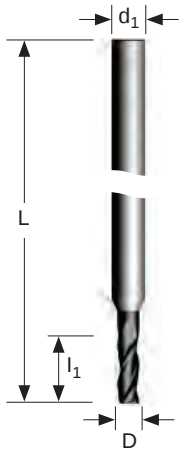
When calculating rotation speed (RPM), use v_c recommendations above.
If the RPM exceeds spindle capacity, use maximum spindle speed available.

When using rotation speeds above 25,000 RPM, ensure a balanced work holding assembly is utilised.



Materials Application

SP4060					
P	M	K	N	S	H



3 - Flute End Mill

Solid Carbide
General Purpose - Miniature

Metric Product		Dimensions (mm)									
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min	
034191	E 010NTN3	1,00	38,00	3,0	3,00	3,00	3	1,43	1,95	1,43	
034192	E 015NTN3	1,50	38,00	5,00	3,00	5,00	3	2,15	2,93	2,15	
034193	E 020NTN3	2,00	38,00	6,00	3,00	6,00	3	2,86	3,90	2,86	
034194	E 025NTN3	2,50	38,00	7,00	3,00	7,00	3	3,58	4,88	3,58	

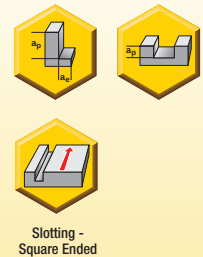
Miniature End Mills

E_NTN3 - Radial a _e and Axial a _p depth of cut range			
Product	Dimensions (mm)		
	Shoulder Milling		Slotting
	a _e %	a _p %	a _p %
SP4556	0,05 - 0,2 D	0,05 - 0,2 D	0,1 - 0,3 D

* When using a_p max, a_e should not exceed 0,05 D

Note: For ramping angle, helical a_p max. and trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.





Solid Carbide
General Purpose - Miniature

Recommended Feeds

E_NTN3 Feeds f_z (mm/tooth) - Slotting / Pocketing

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal- Ductile GGG-FGS	Cast Irons Malleable GTS -MNMP	Aluminum & Alloys <16% Si 118 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
1.0	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	-	-	0,009	0,009	0,009	0,009	-	-
1.5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2.0	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2.5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-

Note: HTA = High Temperature Alloys

Note: Due to the small diameter of the miniature end mill line, the feed rate has been reduced to a starting value only.

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,10 D	1,65 x f_z
	0,20 D	1,25 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Recommended Speeds

Solid Carbide General Purpose - Miniature

Speed v_c (m/min)					
E_NTN3 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

When calculating rotation speed (RPM), use v_c recommendations above.
If the RPM exceeds spindle capacity, use maximum spindle speed available.

When using rotation speeds above 25,000 RPM, ensure a balanced work holding assembly is utilised.



Materials Application

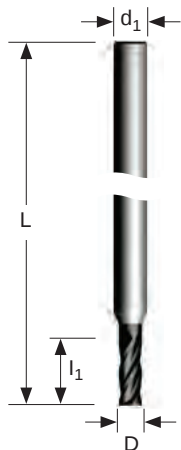
SP4060					
P	M	K	N	S	H



Solid Carbide
General Purpose - Miniature

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034216	E 010NTN4	1,00	38,00	3,00	3,00	3,00	4	-	-	1,43
034217	E 015NTN4	1,50	38,00	5,00	3,00	5,00	4	-	-	2,15
034218	E 020NTN4	2,00	38,00	6,00	3,00	6,00	4	-	-	2,86

Miniature End Mills



4 - Flute End Mill

E_NTN4 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)	
SP4556	Shoulder Milling	
	a _e %	a _p %
	0,05 - 0,2 D	0,05 - 0,2 D



* When using a_p max, a_e should not exceed 0,05 D

Note: For trochoidal application details, refer to pages B88 - B89.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Recommended Feeds

Solid Carbide General Purpose - Miniature

E_NT4 Feeds fz (mm/tooth) - Slotting / Pocketing																			
D	Unalloyed Steel <600 N/mm² <180 HBN	Unalloyed Steel 700-950N/mm² 200-280 HBN	Alloyed Steel <600 N/mm² <180 HBN	Alloyed Steel 950-1200N/mm² 280-355 HBN	Alloyed Steel 1200-1400N/mm² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MN/MP	Aluminium & Alloys <16% Si 116 HBN	Aluminium & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm² >415 HBN	Chilled Cast Iron >1400 N/mm² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
1.0	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	-	-	0,010	0,010	0,010	0,010	-	-
1.5	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-	-
2.0	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-	-
2.5	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-	-

Note: HTA = High Temperature Alloys

Note: Due to the small diameter of the miniature end mill line, the feed rate has been reduced to a starting value only.

Miniature End Mills

Shoulder Milling / Profiling	Feed Correction Parameters	
	a_e	Correction Factor
	0,10 D	1,65 x f_z
	0,20 D	1,25 x f_z

For a_e less than a_e max, use correction factors stated above.
For a_e max, use feeds stated above.



Solid Carbide
General Purpose - Miniature

Recommended Speeds



Miniature End Mills

Speed v_c (m/min)					
E_NTN4 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
M	Stainless Steel	1200-1400 N/mm ² 355-415 HBN	●	◎	80 - 120
		Austenitic + Ferritic 300 series			85 - 120
		Martensitic 400 series			65 - 90
K	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

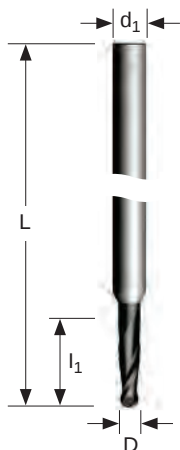
When calculating rotation speed (RPM), use v_c recommendations above.
If the RPM exceeds spindle capacity, use maximum spindle speed available.

When using rotation speeds above 25,000 RPM, ensure a balanced work holding assembly is utilised.



Materials Application

SP4060					
P	M	K	N	S	H



2 - Flute Ball Nose End Mill

Solid Carbide
General Purpose - Miniature

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034265	B 004NTN2	0,40	38,00	1,20	3,00	1,20	2	-	-	-
034266	B 005NTN2	0,50	38,00	1,50	3,00	1,50	2	-	-	-
034267	B 006NTN2	0,60	38,00	1,80	3,00	1,80	2	-	-	-
034268	B 007NTN2	0,70	38,00	2,10	3,00	2,10	2	-	-	-
034269	B 008NTN2	0,80	38,00	2,40	3,00	2,40	2	-	-	-
034270	B 009NTN2	0,90	38,00	2,70	3,00	2,70	2	-	-	-
034271	B 010NTN2	1,00	38,00	3,00	3,00	3,00	2	-	-	-
034272	B 012NTN2	1,20	38,00	3,60	3,00	3,60	2	-	-	-
034273	B 015NTN2	1,50	38,00	5,00	3,00	5,00	2	-	-	-
034274	B 020NTN2	2,00	38,00	6,00	3,00	6,00	2	-	-	-
034275	B 025NTN2	2,50	38,00	7,00	3,00	7,00	2	-	-	-

Miniature End Mills

B_NTN2 - Radial a _e and Axial a _p depth of cut range			
Product	Dimensions		
	Shoulder Milling		Slotting
	a _e %	a _p %	a _p %
SP4556	0,05 - 0,2D	0,05 - 0,2D	0,1 - 0,3 D



Slotting -
Ball Nosed

* When using a_p max, a_e should not exceed 0,05 D

Note: For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Solid Carbide

General Purpose - Miniature

Recommended Feeds

B_NTN2 Feeds f_z (mm/tooth) - Slotting / Pocketing

D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Silicon >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN	Chilled Cast Iron >1400 N/mm ² >400 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
0.4	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	-	-	0,004	0,004	0,004	0,004	-	-
0.5	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	-	-	0,005	0,005	0,005	0,005	-	-
0.6	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	0,005	-	-	0,005	0,005	0,005	0,005	-	-
0.7	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,006	-	-	0,006	0,006	0,006	0,006	-	-
0.8	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	0,007	-	-	0,007	0,007	0,007	0,007	-	-
0.9	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	0,008	-	-	0,008	0,008	0,008	0,008	-	-
1.0	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	0,009	-	-	0,009	0,009	0,009	0,009	-	-
1.2	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011	-	-	0,011	0,011	0,011	0,011	-	-
1.5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2.0	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-
2.5	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	0,014	-	-	0,014	0,014	0,014	0,014	-	-

Note: HTA = High Temperature Alloys

Note: Due to the small diameter of the miniature end mill line, the feed rate has been reduced to a starting value only.

Copy Milling / Profiling

Feed Correction Parameters

 a_e

Correction Factor



Note: For copy milling & shoulder milling applications, refer to page B90.



Recommended Speeds

Solid Carbide General Purpose - Miniature

Speed v_c (m/min)					
B_NTN2 Series			Speed min. - max.		
			Coolant Recommendation		PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HB N	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN			100 - 170
		950-1200 N/mm ² 280-355 HBN	●	◎	90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft			90 - 150
		Spheroidal-Ductile GGG-FGS	●	◎	60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based			40 - 90
		Cobalt Based			20 - 40
		Nickel Based	●	◎	25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

When calculating rotation speed (RPM), use v_c recommendations above.
If the RPM exceeds spindle capacity, use maximum spindle speed available.

When using rotation speeds above 25,000 RPM, ensure a balanced work holding assembly is utilised.

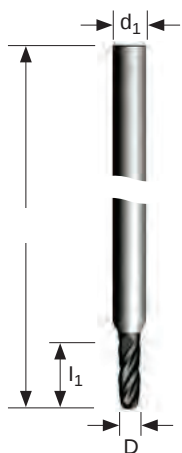


Materials Application

SP4060

P	M	K	N	S	H
					

PVD



4 - Flute Ball Nose End Mill

Solid Carbide

General Purpose - Miniature

Metric Product		Dimensions (mm)								
EDP	Item Description	D	L	l ₁	d ₁	a _p max*	No. of Teeth	Helical Hole min - max		Trochoidal min
034720	B 010NTN4	1,00	38,00	3,00	3,00	3,00	4	-	-	-
034721	B 015NTN4	1,50	38,00	5,00	3,00	5,00	4	-	-	-
034722	B 020NTN4	2,00	38,00	6,00	3,00	6,00	4	-	-	-
034723	B 025NTN4	2,50	38,00	7,00	3,00	7,00	4	-	-	-

B_NTN4 - Radial a_e and Axial a_p depth of cut range

Product	Dimensions (mm)	
	Shoulder Milling	
	a _e %	a _p %
	0,05 - 0,2 D	0,05 - 0,2 D

* When using a_p max, a_e should not exceed 0,05 D

Note: For copy milling & shoulder milling applications, refer to page B90.

See pages B93 - B102 for EDP - Description - Previous Part Number Cross Reference charts.



Recommended Feeds

Solid Carbide General Purpose - Miniature

B_NTN4 Feeds fz (mm/tooth) - Slotting / Pocketing																		
D	Unalloyed Steel <600 N/mm ² <180 HBN	Unalloyed Steel 700-950 N/mm ² 200-280 HBN	Alloyed Steel <600 N/mm ² <180 HBN	Alloyed Steel 950-1200 N/mm ² 280-355 HBN	Alloyed Steel 1200-1400 N/mm ² 355-415 HBN	Stainless Steel Austenitic + Ferritic 300 Series	Stainless Steel Martensitic 400 Series	Stainless Steel Refractory PH	Cast Irons Grey GG-FT	Cast Irons Spheroidal-Ductile GGG-FGS	Cast Irons Malleable GTS-MIMP	Aluminum & Alloys <16% Si 116 HBN	Aluminum & Alloys >16% Si 92 HBN	HTA Iron Based Alloys	HTA Cobalt Based Alloys	HTA Nickel Based Alloys	HTA Titanium Based Alloys	Hard Steel >1400 N/mm ² >415 HBN
Range	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
1.0	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	0,010	-	-	0,010	0,010	0,010	0,010	-
1.5	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-
2.0	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-
2.5	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	0,015	-	-	0,015	0,015	0,015	0,015	-

Note: HTA = High Temperature Alloys

Note: Due to the small diameter of the miniature end mill line, the feed rate has been reduced to a starting value only.



Copy Milling / Profiling		Feed Correction Parameters	
		ae	Correction Factor
		Note: For copy milling & shoulder milling applications, refer to page B90.	



Solid Carbide

General Purpose - Miniature

Recommended Speeds

Speed v _c (m/min)					
B_NTN4 Series					
			Speed min. - max.		
Coolant Recommendation					PVD Micrograin
Recommended ● Possible ◎					
ISO	Materials	Rm and Hardness			SP4556
P	Unalloyed Steel	<600 N/mm ² <180 HBN	●	◎	125 - 180
		<950 N/mm ² <280 HBN			100 - 170
	Alloyed Steel	700-950 N/mm ² 200-280 HBN	●	◎	100 - 170
		950-1200 N/mm ² 280-355 HBN			90 - 140
		1200-1400 N/mm ² 355-415 HBN			80 - 120
M	Stainless Steel	Austenitic + Ferritic 300 series	●	◎	85 - 120
		Martensitic 400 series			65 - 90
	PH Stainless	Refractory P.H.	●		50 - 80
K	Cast Iron	Grey GG-Ft	●	◎	90 - 150
		Spheroidal-Ductile GGG-FGS			60 - 120
		Malleable GTS - MN/MP			50 - 100
N	Aluminium & Alloys	Aluminium & Alloys < 16% Si 116 HBN			
		Aluminium + Silicon > 16% Si 92 HBN			
S	High Temperature Alloys	Iron Based	●	◎	40 - 90
		Cobalt Based			20 - 40
		Nickel Based			25 - 45
		Titanium Based			30 - 60
H	Hard Materials	Hard Steel >1400 N/mm ² >415 HBN			
		Chilled Cast Iron >1400 N/mm ² > 400 HBN			

When calculating rotation speed (RPM), use v_c recommendations above.
If the RPM exceeds spindle capacity, use maximum spindle speed available.

When using rotation speeds above 25,000 RPM, ensure a balanced work holding assembly is utilised.



RSM Technical Information

Product		Dimensions (mm)																		
Family Description	Diameter	Z	Profiling					Facing					Chip Thickness		Profiling (mm/z)				Facing (mm/z)	
			a _e min	a _e max	a _p min	a _p max	a _d max mm ²	a _e min	a _e max	a _p min	a _p max	a _d max mm ²	h _m min	h _m max	for a _e min f _z min	for a _e min f _z max	for a _e max f _z min	for a _e max f _z max	f _z min	f _z max
RSM100	10.00	6	0.17	0.67	10.30	13.00	6.87	Radius +0.50	7.5	0.20	Radius +0.50	1.25	0.02	0.05	0.078	0.195	0.040	0.100	0.020	0.057
RSM120	12.00	6	0.20	0.80	12.80	15.60	10.24		9			1.80			0.078	0.195	0.040	0.100		
RSM160	16.00	6	0.27	1.07	17.80	20.80	18.99		12			3.20			0.078	0.195	0.040	0.100		
RSM160	16.00	8	0.20	0.80	12.00	20.80	9.60		12			3.20			0.090	0.225	0.046	0.115		
RSM200	20.00	6	0.33	1.33	23.00	26.00	30.67		15			5.00			0.078	0.195	0.040	0.100		
RSM200	20.00	8	0.25	1.00	16.00	26.00	16.00		15			5.00			0.090	0.225	0.046	0.115		
RSM250	25.00	8	0.31	1.25	20.50	32.50	25.63		18.75			7.81			0.090	0.225	0.046	0.115		
RSM250	25.00	10	0.25	1.00	15.50	32.50	15.50		18.75			7.81			0.101	0.251	0.051	0.128		

In the application of RSM end mills, it is vital that $a_d \text{ max mm}^2$ is not exceeded, for this, adjust a_e & a_p accordingly.

Example:

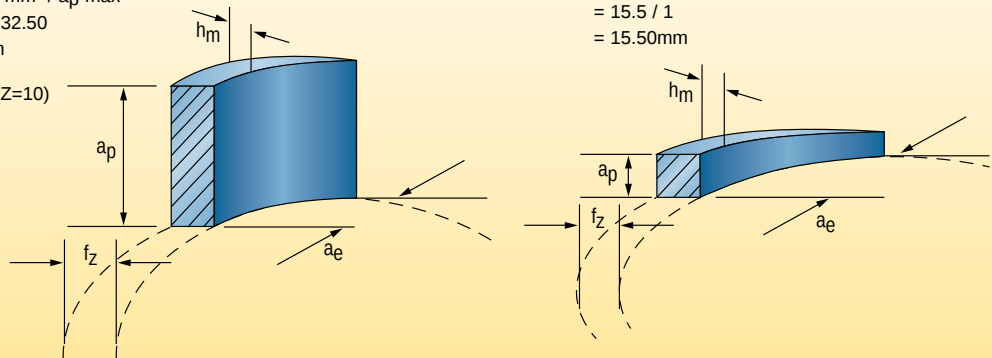
When using $a_p \text{ max}$, then $a_e = a_d \text{ max mm}^2 / a_p \text{ max}$
 $= 15.50 / 32.50$
 $= 0.47 \text{ mm}$

When using $a_e \text{ (max)}$, Then $a_p = a_d \text{ max mm}^2 / a_e \text{ max}$
 $= 15.5 / 1$
 $= 15.50 \text{ mm}$

Example based on values for RSM250 (Z=10)

Key:

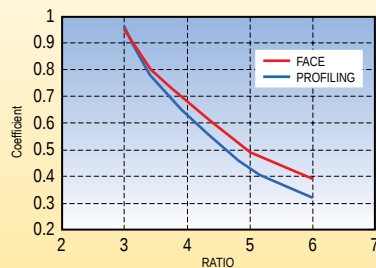
- a_e Radial depth of cut (mm)
- a_p Axial depth of cut (mm)
- a_d Cutting section (mm²)
- f_z Feed per tooth (mm/z)
- h_m Effective chip thickness (mm)



Cutting Section (a_d) and Speed (V_c) Correction Coefficients

When the length to diameter ($L_u:D$) exceeds 3:1 the cutting section (a_d) should be reduced as per the following graph.

How to correct the cutting section with the ratio: the reach / cutting diameter

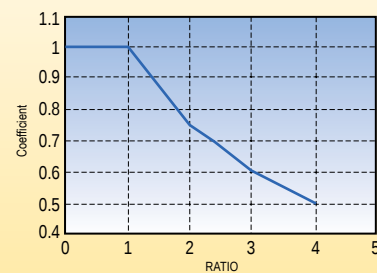


Example 1

Operation	Profile milling	a_d :	15.50mm ²
Cutter	RSM250LM10	Correction coefficient	0.64
L:D	4:1	Compensated a_d :	9.92mm ²

When the length to diameter ($L_u:D$) exceeds 3:1 the speed (V_c) should be reduced as per the following graph.

How to correct the speed with the ratio: the reach / cutting diameter



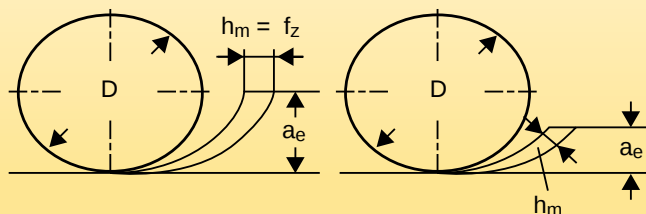
Example 2

Material	ATI 6-4™	Correction coefficient	0.50
L:D	4:1	Compensated V_c :	35 m/min
V_c	70 m/min		



Feed Correction

When using a_e , less than a_e (max), use calculation, in combination with the given feed rate to correct feed.



$$h_m = 2 \times f_z \times \sqrt{(a_e / D) \times (1 - (a_e / D))} \text{ mm}$$

$$f_z = \frac{h_m}{2 \times \sqrt{(a_e / D) \times (1 - (a_e / D))}} \text{ (mm/Z)}$$

a_e max values can be found on all family pages in the tables "Radial a_e and Axial a_p depth of cut range"

Linear Ramping

For linear ramping, use the feed correction factors in the table below, in conjunction with the specified feeds for each family.



Ramping Angle Capacity

Cutter family	Number of flutes	Effective center cut: Zu for ramping	Max Ramping angle (°)	Feed Correction Calculation			
				45°	30°	10°	5°
E_NN2	2	2	45	$0,6 \times f_z$	$0,7 \times f_z$	$0,85 \times f_z$	$0,9 \times f_z$
EA							
HPA							
E_NN3	3	1	45	$0,3 \times f_z$	$0,5 \times f_z$	$0,75 \times f_z$	$0,85 \times f_z$
ERC							
XE	4	2	10	-	-	$0,5 \times f_z$	$0,75 \times f_z$
XER							

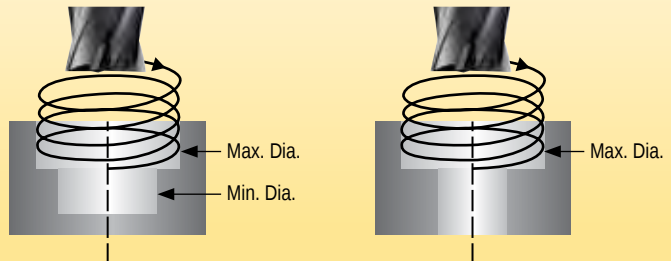


Helical Interpolation

Min. Hole Diameter from solid =
1,43 x Dia. cutter

Max. Hole Diameter from solid =
1,95 x (Dia. cutter - radius)

Max. Enlargement Diameter =
Hole size + ((Dia. cutter - radius) x 2)



Helical Ramping Angle Calculation:

The ramping angle is dependent on size of hole,
and the material being machined.

Example: XER 100NN4-C, machining a hole
18,53mm on Titanium Alloy.

Max depth of cut = 0,07 X 10,00
= 0,7mm

$$\text{Ramping angle} = \tan^{-1} \left(\frac{0,70}{18,53 \times \pi} \right)$$

$$= \tan^{-1} (0,012)$$

$$= 0,70^\circ$$

Maximum Depth of Cut Calculation

Material		ap (doc), max		
	Unalloyed Steel / Alloyed Steel	0,05	0,1	x Dia.
	Stainless Steel	0,05	0,08	x Dia.
	Cast Iron	0,08	0,10	x Dia.
	Aluminum	0,20		x Dia.
	Inconel	0,03		x Dia.
	Titanium	0,07		x Dia.

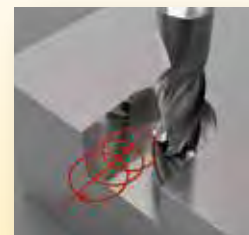
Drilling



Feed Correction

Number of Flutes	Drilling
2	0,5 x fz
3	0,1 x fz
4	N/A

Trochoidal Milling

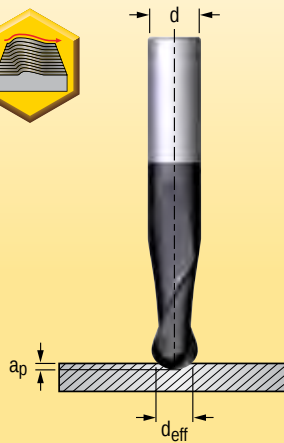


Capacity

End Mill Diameter (D)	Slot Width
	Min
1,00 - 6,00	1,43 D
8,00 - 12,00	1,43 D
16,00 - 20,00	1,43 D

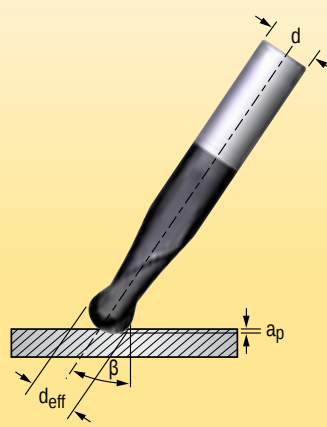


Copy / 3D Milling



$$\beta = 0 \quad d_{\text{eff}} = 2 \times \sqrt{R^2 - (R - a_p)^2}$$

$$R = D / 2 \text{ (mm)}$$

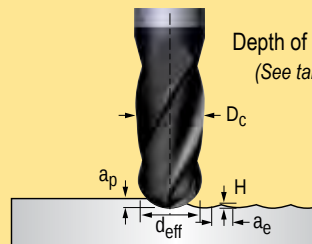


$$h_m = f_z \times \sqrt{((R^2 - (R - a_e)^2)) / R} \times \sqrt{((R^2 - (R - a_p)^2)) / R}$$

$$f_z = \frac{h_m}{\sqrt{((R^2 - (R - a_e)^2)) / R} \times \sqrt{((R^2 - (R - a_p)^2)) / R}} \text{ (mm/Z)}$$

$$\beta < 0 \quad d_{\text{eff}} \text{ (mm)} = D \times \sin \left[\beta \pm \arccos \left(\frac{d - 2 \times a_p}{d} \right) \right]$$

Depth of profile / Diameter pitch correlation



$$\text{Depth of Profile (H)} = \frac{D_c}{2} - \sqrt{\left(\frac{D_c}{2}\right)^2 - a_e^2}$$

(See table below)

Application Parameters / Depth of Profile (H) (mm)

diameter a _e	20,00	16,00	12,00	10,00	8,00	6,00	5,00	4,00	3,00
10,00	10,00								
8,00	4,00	8,00							
6,00	2,00	2,71	6,00						
5,00	1,34	1,76	2,68	5,00					
4,00	0,83	1,07	1,53	2,00	4,00				
3,00	0,46	0,58	0,80	1,00	1,35	3,00			
2,50	0,32	0,40	0,55	0,67	0,88	1,34	2,50		
2,00	0,20	0,25	0,34	0,42	0,54	0,76	1,00	2,00	
1,50	0,11	0,14	0,19	0,23	0,29	0,40	0,50	0,68	1,50
0,75	0,03	0,04	0,05	0,06	0,07	0,10	0,12	0,15	0,20

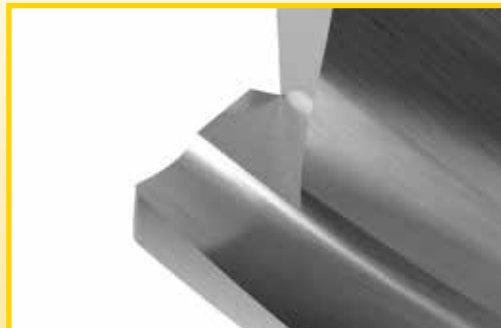
Read across top row and down first column for chosen parameters to find resultant Depth of profile (H)



SU4000

Coating Type: Uncoated Submicron

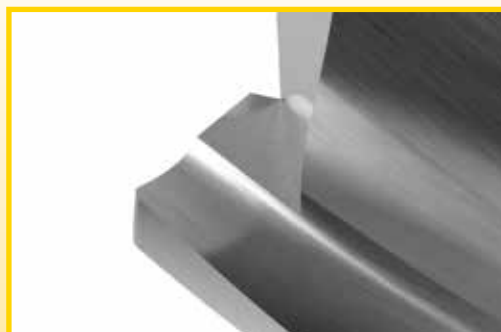
Our toughest and most wear resistant submicron substrate. Developed for machining Titanium and Titanium Alloys, whilst overcoming the problems associated with such materials.

**Technical**

SU0800

Coating Type: Uncoated Submicron

A tough and wear resistant Submicron Grade, developed for Aluminium and Aluminium Alloys.



SP4556

Coating Type: PVD, TiAlN

A versatile PVD TiAlN coated micrograin substrate suitable for a variety of applications. Primary use in Unalloyed Steels, Alloyed Steels, Stainless Steel and Cast Irons.

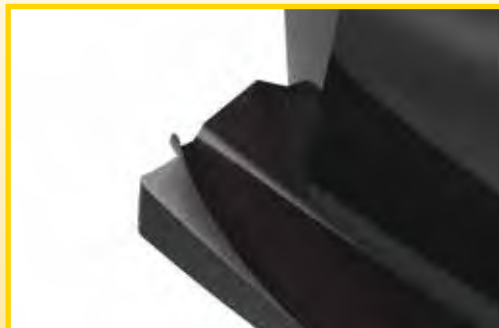




SP4035

Coating Type: PVD, TiAlN

A TiAlN PVD coated grade with a micrograin substrate offering high temperature stability and a low coefficient of friction, allowing the possibility of higher speeds and feeds, as well as dry machining. Primarily used in Steels, Stainless Steels, High Temperature Alloys, Cast Irons and Hard Materials.



SP4060

Coating Type: Advanced Nano PVD, TiAlN

Our toughest and most wear resistant submicron substrate, combined with an advanced nano composite TiAlN PVD coating, allowing tools to be used at elevated surface speeds. Primarily used in High Temperature Alloys and Stainless Steels. Also suitable for Alloyed Steels.





Part numbers for General Purpose milling & Rapide® milling ranges have now been allocated new EDP Numbers and descriptions, to fit in line with existing Stellram products and nomenclature.

Please use the following tables to cross reference the new EDP Numbers / Descriptions with the previous part numbers.

Part Number & Descriptions

PVD E						PVD E					
Definition	EDP	Description	Grade	Previous Part No	Page No.	Definition	EDP	Description	Grade	Previous Part No	Page No.
	034158	E 004NTN2		G11201570E			034191	E 010NTN3		G11303940TE	
	034159	E 005NTN2		G11201960E			034192	E 015NTN3		G11305910TE	B75
	034160	E 006NTN2		G11202360E			034193	E 020NTN3		G11307870TE	
	034161	E 007NTN2		G11202750E			034194	E 025NTN3		G11309840TE	
	034162	E 008NTN2		G11203150E			034195	E 030NN3		G11311810TE	
	034163	E 009NTN2		G11203540E	B72		034196	E 040NN3		G11315750TE	
	034164	E 010NTN2		G11203940TE			034197	E 050NN3	SP4556	G11319680TE	
	034165	E 012NTN2		G11204720E			034198	E 060NN3		G11323620TE	
	034166	E 015NTN2		G11205910TE			034199	E 080NN3		G11331500TE	B51
	034167	E 020NTN2	SP4556	G11207870TE			034200	E 100NN3		G11339370TE	
	034168	E 025NTN2		G11209840TE			034201	E 120NN3		G11347240TE	
	034169	E 030NN2		G11211810TE			034202	E 160NN3		G11362990TE	
	034170	E 040NN2		G11215750TE			034203	E 200NN3		G11378740TE	
	034171	E 050NN2		G11219680TE							
	034172	E 060NN2		G11223620TE							
	034173	E 080NN2		G11231500TE	B48						
	034174	E 100NN2		G11239370TE							
	034175	E 120NN2		G11247240TE							
	034176	E 160NN2		G11262990TE							
	034177	E 200NN2		G11278740TE							
											

Technical



Part Number & Descriptions

Technical

PVD E						PVD ER					
Definition	EDP	Description	Grade	Previous Part No	Page No.	Definition	EDP	Description	Grade	Previous Part No	Page No.
	034216	E 010NTN4	SP4556	G11403940TE	B78		034228	ER 030NN4-E	SP4556	G11411810E050	
	034217	E 015NTN4		G11405910TE			034229	ER 040NN4-E		G11415750E050	
	034218	E 020NTN4		G11407870TE			034230	ER 050NN4-E		G11419680E050	
	034219	E 030NN4		G11411810TE			034231	ER 060NN4-E		G11423620E050	
	034220	E 040NN4		G11415750TE	B54		034232	ER 060NN4-G		G11423620E100	B57
	034221	E 050NN4		G11419680TE			034233	ER 080NN4-E		G11431500E050	
	034222	E 060NN4		G11423620TE			034234	ER 080NN4-G		G11431500E100	
	034223	E 080NN4		G11431500TE			034235	ER 100NN4-E		G11439370E050	
	034224	E 100NN4		G11439370TE			034236	ER 100NN4-G		G11439370E100	
	034225	E 120NN4		G11447240TE			034237	ER 100NN4-J		G11439370E150	
	034226	E 160NN4		G11462990TE			034238	ER 120NN4-E		G11447240E050	
	034227	E 200NN4		G11478740TE			034239	ER 120NN4-G		G11447240E100	
							034240	ER 120NN4-J		G11447240E150	
							034241	ER 120NN4-K		G11447240E200	
							034242	ER 160NN4-G		G11462990E100	
							034243	ER 160NN4-J		G11462990E150	
							034244	ER 160NN4-K		G11462990E200	



Part Number & Descriptions

PVD E					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034317	E 060LL4		G14823620E	
	034318	E 080LL4		G14831500E	
	034319	E 100LL4	SP4556	G14839370E	B66
	034320	E 120LL4		G14847240E	
	034321	E 160LL4		G14862990E	
					
					
					
					
					

Technical



Part Number & Descriptions

Technical

PVD B						PVD B					
Definition	EDP	Description	Grade	Previous Part No	Page No.	Definition	EDP	Description	Grade	Previous Part No	Page No.
	034265	B 004NTN2		G12201570E			034720	B 010NTN4		G12403940E	
	034266	B 005NTN2		G12201960E			034721	B 015NTN4		G12405910E	B84
	034267	B 006NTN2		G12202360E			034722	B 020NTN4		G12407870E	
	034268	B 007NTN2		G12202750E			034723	B 025NTN4		G12409840E	
	034269	B 008NTN2		G12203150E			034724	B 030NN4		G12411810E	
	034270	B 009NTN2		G12203540E	B81		034725	B 040NN4	SP4556	G12415750E	
	034271	B 010NTN2		G12203940E			034726	B 050NN4		G12419680E	
	034272	B 012NTN2		G12204720E			034727	B 060NN4		G12423620E	B63
	034273	B 015NTN2		G12205910E			034728	B 080NN4		G12431500E	
	034274	B 020NTN2	SP4556	G12207870E			034729	B 100NN4		G12439370E	
	034275	B 025NTN2		G12209840E			034730	B 120NN4		G12447240E	
	034276	B 030NN2		G12211810E							
	034277	B 040NN2		G12215750E							
	034278	B 050NN2		G12219680E							
	034279	B 060NN2		G12223620E							
	034280	B 080NN2		G12231500E	B60						
	034281	B 100NN2		G12239370E							
	034282	B 120NN2		G12247240E							
	034283	B 160NN2		G12262990E							
	034284	B 200NN2		G12278740E							



Part Number & Descriptions

 PVD B					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034738	B 040LL2		G12615750E	
	034739	B 060LL2		G12623620E	
	034740	B 060XLXL2		G12623620E-XL	
	034741	B 080LL2		G12631500E	
	034742	B 080XLXL2	SP4556	G12631500E-XL	B69
	034743	B 100LL2		G12639370E	
	034744	B 100XLXL2		G12639370E-XL	
	034745	B 120LL2		G12647240E	
	034746	B 120XLXL2		G12647240E-XL	
					
					
					
					





Part Number & Descriptions

Technical

PVD ERC					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034343	ERC 030NTN3		G16311810M6	
	034344	ERC 040NTN3		G16315750M6	
	034345	ERC 050NTN3		G16319680M6	
	034346	ERC 060NN3		G16323620M6	
	034347	ERC 080NN3	SP4035	G16331500	B20
	034348	ERC 100NN3		G16339370	
	034349	ERC 120NN3		G16347240	
	034839	ERC 160NN3		G16362990	
	034351	ERC 200NN3		G16378740	

PVD HE					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034352	HE 020NTN4		G16407870	
	034353	HE 030NTN4		G16411810	
	034354	HE 040NTN4		G16415750	
	034355	HE 050NTN4		G16419680	
	034356	HE 060NN4	SP4035	G16423620	B23
	034357	HE 080NN4		G16431500	
	034358	HE 100NN4		G16439370	
	034359	HE 120NN4		G16447240	
	034360	HE 160NN4		G16462990	



Part Number & Descriptions

PVD HER					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034361	HER 060NN4-E	SP4035	G16823620-05	B26
	034362	HER 060NN4-G		G16823620-10	
	034363	HER 080NN4-E		G16831500-05	
	034364	HER 080NN4-G		G16831500-10	
	034365	HER 100NN4-E		G16839370-05	
	034366	HER 100NN4-G		G16839370-10	
	034367	HER 120NN4-E		G16847240-05	
	034368	HER 120NN4-G		G16847240-10	
					
					
					
					





Part Number & Descriptions

Technical

PVD HB					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034375	HB 030TL2	SP4035	G17211810LF	B29
	034376	HB 040TL2		G17215750LF	
	034377	HB 060LL2		G17223620LF	
	034378	HB 080LL2		G17231500LF	
	034379	HB 100LL2		G17239370LF	
	034380	HB 120LL2		G17247240LF	

PVD HMR					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034333	HMR 030NTN6-C	SP4035	G16011810-025	B32
	034334	HMR 040NTN6-C		G16015750-025	
	034335	HMR 050NTN6-C		G16019680-025	
	034336	HMR 060NN6-C		G16023620-025	
	034645	HMR 060NN6-E		G16023620-050	
	034337	HMR 080NN6-C	SP4035	G16031500-025	B32
	034646	HMR 080NN6-E		G16031500-050	
	034338	HMR 100NN6-C		G16039370-025	
	034339	HMR 100NN6-E		G16039370-050	
	034340	HMR 120NN6-C		G16047240-025	
	034647	HMR 120NN6-E		G16047240-050	
	034341	HMR 160NN6-C		G16062990-025	
	034648	HMR 160NN6-E		G16062990-050	
	034342	HMR 200NN6-C		G16078740-025	



Part Number & Descriptions

PVD HMN					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034369	HMN 060NN6	SP4035	G16923620	B37
	034370	HMN 080NN6		G16931500	
	034371	HMN 100NN6		G16939370	
	034372	HMN 120NN6		G16947240	
	034373	HMN 160NN6		G16962990	
	034374	HMN 200NN6		G16978740	
50° 90° h6 HA Factory					





Part Number & Descriptions

Technical

Uncoated EA					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034322	EA 020NTN2		G15207870	
	034323	EA 025NTN2		G15209840	
	034324	EA 030NN2		G15211810	
	034325	EA 040NN2		G15215750	
	034326	EA 050NN2		G15219680	
	034327	EA 060NN2	SU0800	G15223620	B40
	034328	EA 080NN2		G15231500	
	034329	EA 100NN2		G15239370	
	034330	EA 120NN2		G15247240	
	034331	EA 160NN2		G15262990	
	034332	EA 200NN2		G15278740	

Uncoated HPA					
Definition	EDP	Description	Grade	Previous Part No	Page No.
	034381	HPA 030NN2		G19211810	
	034382	HPA 040NN2		G19215750	
	034383	HPA 050NN2		G19219680	
	034384	HPA 060NN2		G19223620	
	034385	HPA 080NN2	SU0800	G19231500	B43
	034386	HPA 100NN2		G19239370	
	034387	HPA 120NN2		G19247240	
	034388	HPA 160NN2		G19262990	
	034389	HPA 200NN2		G19278740	