TOTEM®

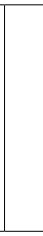
High Performance Cutting Tools

SOLID CARBIDE END MILLS

END MILL SELECTION GUIDE

											
		For 55-70 HRc (HP)				For 45-70 HRc (HP)					
Description		Ball nose 2 flute	Torus 4 flute	Multi flute finisher	Multi flute finisher with corner radius	Ball nose 2 flute	Ball nose 4 flute	Torus 2 flute	Torus 4 flute	Multi flute finisher	Multi flute finisher with corner radius
Page No.		2.015	2.021	2.027	2.028	2.031	2.032	2.034	2.036	2.039	2.040
Length		Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Stub/Reg	Stub/Reg
Dia Range Std		0.1-12.0	0.1-12.0	3.0-20.0	3.0-20.0	1.0-16.0	6.0-16.0	1.5-16.0	3.0-16.0	3.0-20.0	3.0-20.0
Dia Range Spl											
Length of Cut (ap Max)		0.2D	0.75D	2D	2D	2D	2D	2D	2D	2D	2D
No of Flutes		2	4	6-16	6-16	2	4	2	4	6-8	6-8
Helix		30^0	30^0	45^0	45^0	30^0	30^0	30^0	30^0	45^0	45^0
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End				√						√	
Ball Nose		√				√	√				
Corner Radius			√		√			√	√		v
Corner Chamfer											
Center Cutting		√	√	√	√	√	√	√	√	√	√
Chip Breaker											
Neck Type		√	√	√	√	√	√	√	v	√	√
Steel	P0										
	P1										
	P2										
	P3										
	P4										
	P5					•	•	•	•	•	•
	P6					•	•	•	•	•	•
Stainless Steel	M1										
	M2										
	M3										
Cast Iron	K1										
	K2										
	K3										
Non-Ferrous	N1										
	N2										
	N3										
	N4										
	N5										
	N6										
	N7										
Special Alloys	S1										
	S2										
	S3										
	S4										
Hardened Steel	H1					•	•	•	•	•	•
	H2					•	•	•	•	•	•
	H3	•	•	•	•	•	•	•	•	•	•
	H4	•	•	•	•	•	•	•	•	•	•
Periphery Milling											
Slotting											
Ramping											
Profiling											

END MILL SELECTION GUIDE

												
		High feed (HP)	Micro End Mill (HP)						Diamond Tipped (HP)		Graphite Milling (HP)	
Description		Torus cutter for high feed machining	2 Flute micro end mill	4 Flute micro end mill	2 Flute micro end mill with corner radius	4 Flute micro end mill with corner radius	2 Flute micro ball nose	2 flute ball nose for exotic material	End mill with corner radius	Ball nose end mill	Rougher	3 Flute end mill
Page No.		2.045	2.047	2.053	2.057	2.063	2.067	2.076	2.079	2.081	2.088	2.090
Length		Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std		2.0-12.0	0.1-3.0	0.2-3.0	0.1-3.0	0.2-3.0	0.1-3.0	0.4-12.0	3-12.0	3-12.0	4.0-16.0	2.0-12.0
Dia Range Spl												
Length of Cut (ap Max)		0.05D	0.6D	0.6D	0.6D	0.6D	0.6D	1.5D	0.65D	0.65D	2.5D	2D
No of Flutes		4	2	4	2	4	2	2	2	2	2	3
Helix			30^0	30^0	30^0	30^0	30^0	30^0	0^0	0^0	25^0	40^0
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	Diamond Tipped	Diamond Tipped	Diamond Coating	Diamond Coating
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End			√	√								√
Ball Nose							√	√		√		
Corner Radius		√			√	√			√			
Corner Chamfer											√	
Center Cutting		√	√	√	√	√	√	√	√	√	√	√
Chip Breaker												
Neck Type		√	√	√	√	√	√	√	√	√	√	√
Steel	P0											
	P1											
	P2											
	P3	•										
	P4	•										
	P5		•	•	•	•	•	•				
	P6		•	•	•	•	•	•				
Stainless Steel	M1		•	•	•	•	•	•				
	M2		•	•	•	•	•	•				
	M3		•	•	•	•	•	•				
Cast Iron	K1		•	•	•	•	•	•				
	K2							•				
	K3											
Non-Ferrous	N1								•	•		
	N2								•	•		
	N3								•	•		
	N4								•	•		
	N5								•	•	•	•
	N6								•	•	•	•
	N7								•	•	•	•
Special Alloys	S1		•	•	•	•	•	•				
	S2		•	•	•	•	•	•				
	S3		•	•	•	•	•	•				
	S4		•	•	•	•	•	•				
Hardened Steel	H1	•	•	•	•	•	•	•				
	H2		•	•	•	•	•					
	H3		•	•	•	•	•					
	H4		•	•	•	•	•					
Periphery Milling												
Slotting												
Ramping												
Profiling												

END MILL SELECTION GUIDE

										
		Graphite Milling (HP)				**For 45 - 62 HRc Proton Plus (HP)**				
Description		End mill with corner radius	Ball nose	Micro end mill with corner radius	Micro ball nose	4 Flute end mill regular length	4 Flute end mill long length	4 Flute end mill long reach length	4 Flute end mill Regular Length	4 Flute end mill long Length
Page No.		2.091	2.095	2.099	2.101	2.104	2.105	2.106	2.107	2.108
Length		Reg	Reg	Reg	Reg	Reg	Long Length	Long Reach	Reg	Long
Dia Range Std		2.0-12.0	2.0-12.0	0.3-1.5	0.3-1.5	3.0-16.0	3.0-16.0	6.0-12.0	3.0-25.0	6.0-25.0
Dia Range Spl						1.0-25.4	1.0-20.0	1.0-20.0	1.0-25.0	1.0-25.0
Length of Cut (ap Max)		2D	2D	2D	1D	0.1D	0.1D	0.1D	0.1D	0.1D
No of Flutes		2-3-4	2-3-4	2	2	4	4	4	4-5	4-6
Helix		40^0	40^0	40^0	40^0	30^0	30^0	30^0	50^0	50^0
Coating		Diamond Coating	Diamond Coating	Diamond Coating	Diamond Coating	Proton Plus	Proton Plus	Proton Plus	Proton Plus	Proton Plus
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End						√	√	√	√	√
Ball Nose			√		√					
Corner Radius		√		√		√	√	√		
Corner Chamfer										
Center Cutting		√	√	√	√	√	√	√	√	√
Chip Breaker										
Neck Type		√	√	√	√					
Steel	P0									
	P1									
	P2									
	P3									
	P4									
	P5					•	•	•	•	•
	P6					•	•	•	•	•
Stainless Steel	M1									
	M2									
	M3									
Cast Iron	K1									
	K2									
	K3									
Non-Ferrous	N1									
	N2									
	N3									
	N4									
	N5	•	•	•	•					
	N6	•	•	•	•					
	N7	•	•	•	•					
Special Alloys	S1									
	S2									
	S3									
	S4									
Hardened Steel	H1					•	•	•	•	•
	H2					•	•	•	•	•
	H3					•	•	•	•	•
	H4					•	•	•	•	•
Periphery Milling						√	√	√	√	√
Slotting										
Ramping						√	√	√	√	√
Profiling						√	√	√	√	√

END MILL SELECTION GUIDE

									
		For 45 - 62 HRc Proton Plus (HP)				For 32- 45 HRc High Speed Machining (HP)			
Description		4 Flute end mill regular Length	Ball nose 2 flute regular length	Ball nose 2 flute long length	Ball nose 2 flute long reach length	4 Flute end mill regular length	2 Flute end mill regular length	Ball nose 4 flute regular length	Ball nose 2 flute regular length
Page No.		2.109	2.110	2.111	2.112	2.115	2.116	2.117	2.118
Length		Reg	Reg	Long Length	Long Reach	Reg	Reg	Reg	Reg
Dia Range Std		3.0-20.0	1.0-12.0	1.0-12.0	6.0-12.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Dia Range Spl		1.0-25.0	1.0-20.0	1.0-20.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Length of Cut (ap Max)		0.1D	0.02D	0.02D	0.02D	1D	0.5D	1D	0.5D
No of Flutes		4	2	2	2	4	2	4	2
Helix		50^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating		Proton Plus	Proton Plus	Proton Plus	Proton Plus	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round
Square End		√				√	√		
Ball Nose			√	√	√			√	√
Corner Radius		√				Custom Solution	Custom Solution		
Corner Chamfer									
Center Cutting		√	√	√	√	√	√	√	√
Chip Breaker									
Neck Type									
Steel	P0								
	P1								
	P2								
	P3					•	•	•	•
	P4					•	•	•	•
	P5	•	•	•	•				
	P6	•	•	•	•				
Stainless Steel	M1					•	•	•	•
	M2								
	M3								
Cast Iron	K1								
	K2								
	K3								
Non-Ferrous	N1								
	N2								
	N3								
	N4								
	N5								
	N6								
	N7								
Special Alloys	S1								
	S2								
	S3								
	S4								
Hardened Steel	H1	•	•	•	•				
	H2	•	•	•	•				
	H3	•	•	•	•				
	H4	•	•	•	•				
Periphery Milling		√	√	√	√	√	√	√	√
Slotting						√	√	√	√
Ramping		√	√	√	√	√	√	√	√
Profiling		√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

										
		For SS,Ti & High Temperature Alloys (HP)				Trochoidal milling (HP)			Finisher	Economic (HP)
Description		4 Flute Variable Helix End mill F177TR/ NF177 TR	Ball Nose 4 flute variable helix F179 TR	Ball Nose 4 flute variable helix F179 TRL	5 Flute end mill F178 TR (Gold & Black)	7 Flute end mill for tro-choidal milling F180TR/ NF180TR/F180TRL	5 Flute end mill for trochoidal milling 5VR	6 Flute end mill for trochoidal milling 6VR	Swift	Nano
Page No.		2.124	2.127	2.128	2.130	2.132	2.135	2.136	2.138	2.140
Length		Reg	Reg	Long	Reg	Long	Reg	Reg	Reg	Stub
Dia Range Std		6.0-20.0	6.0-20.0	6.0-20.0	6.0-16.0	10.0-16.0	6.0-16.0	6.0-20.0	3.0-20.0	4.0-20.0
Dia Range Spl		1.5-25.4	3.0-25.4	3.0-25.4	1.5-25.4	8.0-20.0	4.0-20.0	4.0-20.0	3.0-25.0	3.0-25.0
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		4	4	4	5	7	5	6	3	4
Helix		35^0/ 38^0	35^0/ 38^0	35^0/ 38^0	35^0/ 38^0	38^0	Vari	45^0	60^0	35^0 / 38^0
Coating		Cr Base	Cr Base	Cr Base	Cr Base	Cr Base	Cr Base	Cr Base	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End		√			√			√	√	
Ball Nose			√	√						
Corner Radius		√			√	√	√		Custom Solution	Custom Solution
Corner Chamfer		√							Custom Solution	√
Center Cutting		√	√	√	√	√	√	√	√	√
Chip Breaker										Custom Solution
Neck Type		√			Custom Solution	√			Custom Solution	Custom Solution
Steel	P0									
	P1	•	•	•	•	•	•	•	•	•
	P2	•	•	•	•	•	•	•	•	•
	P3	•	•	•	•	•	•	•	•	•
	P4	•	•	•	•	•	•	•	•	•
	P5	•	•	•	•	•	•	•		
	P6	•	•	•	•	•	•	•		
Stainless Steel	M1	•	•	•	•	•	•	•	•	•
	M2	•	•	•	•	•	•	•	•	•
	M3	•	•	•	•	•	•	•	•	
Cast Iron	K1	•	•	•	•		•	•	•	•
	K2	•	•	•	•		•	•	•	•
	K3	•	•	•	•		•	•	•	•
Non-Ferrous	N1									
	N2									
	N3									
	N4									
	N5									
	N6									
	N7									
Special Alloys	S1	•	•	•	•	•	•	•	•	
	S2	•	•	•	•	•	•	•	•	
	S3	•	•	•	•	•	•	•	•	
	S4	•	•	•	•	•	•	•	•	
Hardened Steel	H1	•	•	•	•	•	•	•	•	
	H2					•				
	H3									
	H4									
Periphery Milling		√	√	√	√	√	√	√	√	√
Slotting		√	√	√	√		√		√	√
Ramping		√	√	√	√		√		√	√
Profiling		√	√	√	√		√		√	√

END MILL SELECTION GUIDE

									
		Razor cut - for roughing & Aluminium (HP)							
Description		CBC	CBCH / NCBCH	3FWFXL	3FWFCR	3FWF	3F	2FWF	1F
Page No.		2.144	2.145	2.146	2.147	2.148	2.148	2.149	2.150
Length		Reg	Reg	Long reach	Reg	Reg	Reg	Reg	Reg
Dia Range Std		6.0-25.0	6.0-25.0	6.0-20.0	6.0-16.0	3.0-20.0	3.0-20.0	1.5-20.0	3.0-10.0
Dia Range Spl		4.0-25.0	4.0-25.0	4.0-25.0	4.0-20.0	3.0-20.0	3.0-20.0	1.5-20.0	3.0-10.0
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		3	3	3	3	3	3	2	1
Helix		30°	40°	38°	38°	38°	45°	45°	30°
Coating		Bright	Bright	Bright	Bright	Bright	Bright	Bright	Bright
Shank		Round	Round	Round	Round	Round	Round	Round	Round
Square End						√	√	√	√
Ball Nose									
Corner Radius		Custom Solution	√	√	√	Custom Solution	Custom Solution	Custom Solution	Custom Solution
Corner Chamfer		√	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution
Center Cutting		√	√	√	√	√	√	√	√
Chip Breaker		√	√						
Neck Type									
Steel	P0								
	P1								
	P2								
	P3								
	P4								
	P5								
	P6								
Stainless Steel	M1								
	M2								
	M3								
Cast Iron	K1								
	K2								
	K3								
Non-Ferrous	N1	•	•	•	•	•	•	•	•
	N2	•	•	•	•	•	•	•	•
	N3		•						
	N4		•						
	N5		•						
	N6								
	N7								
Special Alloys	S1								
	S2								
	S3								
	S4								
Hardened Steel	H1								
	H2								
	H3								
	H4								
Periphery Milling		√	√	√	√	√	√	√	√
Slotting		√	√	√	√	√	√	√	√
Ramping		√	√	√	√	√	√	√	√
Profiling		√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

											
		Chip breaker rougher (HP)						For General Purpose Application on Variety of Materials (GP)			
Description		F192CBS Sinusoidal Chip breaker	F192CB Sinusoidal Chip breaker	F192CBL Sinusoidal Chip breaker	F193CB Chip breaker with flat pitch	NF193 CB / NF193CBL Chip breaker with flat pitch	F194CB Chip breaker with flat pitch	4 Flute end mill Regular length F111 GP	4 Flute end mill Stub length F163 GP	4 Flute end mill long length F122 GP	4 Flute end mill extra long F187 GP
Page No.		2.155	2.156	2.157	2.158	2.159	2.160	2.166	2.167	2.168	2.169
Length		Stub	Reg	Long	Reg	Long	Reg	Reg	Stub	Long Length	Extra Long
Dia Range Std		8.0-20.0	4.0-20.0	6.0-12.0	6.0-25.0	6.0-25.0	6.0-25.0	1.0-25.0	1.0-20.0	3.0-25.0	3.0-20.0
Dia Range Spl		6.0-25.4	4.0-25.4	6.0-25.4	6.0-25.0	6.0-25.0	6.0-25.0	0.3-32.0	0.3-32.0	3.0-25.0	3.0-20.0
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		3-4	3-4	3-4	4-6	4-6	4-6	4	4	4	4
Helix		20^0	20^0	20^0	45^0	45^0	45^0	30^0	30^0	30^0	30^0
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End		√	√	√				√	√	√	√
Ball Nose											
Corner Radius		Custom Solution	Custom Solution	Custom Solution	√	√		Custom Solution	Custom Solution	Custom Solution	Custom Solution
Corner Chamfer		Custom Solution	Custom Solution	Custom Solution			√	Custom Solution	Custom Solution	Custom Solution	Custom Solution
Center Cutting		√	√	√	√	√	√	√	√	√	√
Chip Breaker		√	√	√	√	√	√				
Neck Type		Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution
Steel	P0	•						•	•	•	•
	P1	•	•	•				•	•	•	•
	P2	•	•	•				•	•	•	•
	P3	•	•	•	•	•	•	•	•	•	•
	P4	•	•	•	•	•	•	•	•	•	•
	P5	•	•	•	•	•	•				
	P6	•	•	•	•	•	•				
Stainless Steel	M1	•	•	•	•	•	•	•	•	•	•
	M2	•	•	•	•	•	•	•	•	•	•
	M3	•	•	•	•	•	•	•	•	•	•
Cast Iron	K1	•	•	•	•	•	•	•	•	•	•
	K2	•	•	•	•	•	•	•	•	•	•
	K3	•	•	•	•	•	•	•	•	•	•
Non-Ferrous	N1							•	•	•	•
	N2							•	•	•	•
	N3							•	•	•	•
	N4										
	N5										
	N6										
	N7										
Special Alloys	S1	•	•	•	•	•	•	•	•	•	•
	S2	•			•	•	•	•	•	•	•
	S3	•	•	•	•	•	•	•	•	•	•
	S4	•			•	•	•	•	•	•	•
Hardened Steel	H1	•	•	•	•	•	•	•	•	•	•
	H2	•			•	•	•	•	•	•	•
	H3				•	•	•	•	•	•	•
	H4										
Periphery Milling		√	√	√	√	√	√	√	√	√	√
Slotting		√	√	√	√	√	√	√	√	√	√
Ramping		√	√		√	√	√	√	√	√	√
Profiling		√	√		√	√	√	√	√	√	√

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END MILL SELECTION GUIDE

										
		For General Purpose Application on Variety of Materials (GP)								
Description		4 flute end mill long reach F181 GP	3 Flute end mill regular length F116 GP	2 Flute end mill stub length F164 GP	2 Flute end mill regular length F121 GP	2 Flute end mill long length F123 GP	2 Flute end mill long reach F183 GP	Ball Nose 4 flute Stub Length F165 GP	Ball Nose 4 flute Regular Length F140 GP	Ball Nose 4 flute long reach F184 GP
Page No.		2.170	2.171	2.172	2.173	2.174	2.175	2.176	2.177	2.178
Length		Long Reach	Reg	Stub	Reg	Long Length	Long Reach	Stub	Reg	Long Reach
Dia Range Std		3.0-20.0	1.0-25.0	1.0-20.0	1.0-25.0	3.0-20.0	3.0-20.0	1.0-20.0	1.0-25.0	3.0-20.0
Dia Range Spl		3.0-20.0	1.0-32.0	0.5-20.0	1.0-32.0	3.0-25.4	3.0-20.0	1.0-20.0	1.0-25.4	3.0-20.0
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		4	3	2	2	2	2	4	4	4
Helix		30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End		√	√	√	√	√	√			
Ball Nose								√	√	√
Corner Radius		Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution			
Corner Chamfer		Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution			
Center Cutting		√	√	√	√	√	√	√	√	√
Chip Breaker										
Neck Type		Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution	Custom Solution			Custom Solution
Steel	P0	•	•	•	•	•	•	•	•	•
	P1	•	•	•	•	•	•	•	•	•
	P2	•	•	•	•	•	•	•	•	•
	P3	•	•	•	•	•	•	•	•	•
	P4	•	•	•	•	•	•	•	•	•
	P5									
	P6									
Stainless Steel	M1	•	•	•	•	•	•	•	•	•
	M2	•	•	•	•	•	•	•	•	•
	M3	•	•	•	•	•	•	•	•	•
Cast Iron	K1	•	•	•	•	•	•	•	•	•
	K2	•	•	•	•	•	•	•	•	•
	K3	•	•	•	•	•	•	•	•	•
Non-Ferrous	N1	•	•	•	•	•	•	•	•	•
	N2	•	•	•	•	•	•	•	•	•
	N3	•	•	•	•	•	•	•	•	•
	N4									
	N5									
	N6									
	N7									
Special Alloys	S1	•	•	•	•	•	•	•	•	•
	S2	•	•	•	•	•	•	•	•	•
	S3	•	•	•	•	•	•	•	•	•
	S4	•	•	•	•	•	•	•	•	•
Hardened Steel	H1	•	•	•	•	•	•	•	•	•
	H2	•	•	•	•	•	•	•	•	•
	H3	•	•	•	•	•	•	•	•	•
	H4									
Periphery Milling		√	√	√	√	√	√	√	√	√
Slotting		√	√	√	√	√	√	√	√	√
Ramping		√	√	√	√	√	√	√	√	√
Profiling		√	√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

									
		For General Purpose Application on Variety of Materials (GP)							
Description		Ball Nose 2 flute regular length F150 GP	Ball Nose 2 flute stub length F166 GP	Ball Nose 2 flute long reach F186 GP	4 flute end mill long length F125GP	2 flute end mill long length F126GP	4 flute extra long end mill F188GP	Chip breaker regular length F114 CB GP	Chp breaker long length F132 CB GP
Page No.		2.179	2.180	2.181	2.182	2.183	2.184	2.187	2.188
Length		Reg	Stub	Long Reach	Long Length	Long Length	Extra Long	Reg	Long Length
Dia Range Std		1.0-25.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-25.0	3.0-20.0	4.0-20.0	6.0-16.0
Dia Range Spl		1.0-25.4	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-25.4	3.0-25.4
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		2	2	2	4	2	4	4	4
Helix		30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round	Round
Square End								√	√
Ball Nose		√	√	√	√	√	√		
Corner Radius									
Corner Chamfer									
Center Cutting		√	√	√	√	√	√	√	√
Chip Breaker								√	√
Neck Type				Custom Solution	Custom Solution	Custom Solution	Custom Solution		
Steel	P0	•	•	•	•	•	•	•	•
	P1	•	•	•	•	•	•	•	•
	P2	•	•	•	•	•	•	•	•
	P3	•	•	•	•	•	•	•	•
	P4	•	•	•	•	•	•	•	•
	P5							•	•
	P6							•	•
Stainless Steel	M1	•	•	•	•	•	•	•	•
	M2	•	•	•	•	•	•	•	•
	M3	•	•	•	•	•	•	•	•
Cast Iron	K1	•	•	•	•	•	•	•	•
	K2	•	•	•	•	•	•	•	•
	K3	•	•	•	•	•	•	•	•
Non-Ferrous	N1	•	•	•	•	•	•		
	N2	•	•	•	•	•	•		
	N3	•	•	•	•	•	•		
	N4								
	N5								
	N6								
	N7								
Special Alloys	S1	•	•	•	•	•	•	•	•
	S2	•	•	•	•	•	•	•	•
	S3	•	•	•	•	•	•	•	•
	S4	•	•	•	•	•	•	•	•
Hardened Steel	H1	•	•	•	•	•	•	•	•
	H2	•	•	•	•	•	•	•	•
	H3	•	•	•	•	•	•	•	•
	H4								
Periphery Milling		√	√	√	√	√	√	√	√
Slotting		√	√	√	√	√	√	√	√
Ramping		√	√	√	√	√	√	√	√
Profiling		√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

								
		For General Purpose Application on Variety of Materials (GP)						
Description		2 Flute end mill regular length F121 XL	4 Flute end mill regular length F111 XL	Ball nose 2 flute regular length F150 XL	Ball nose 4 flute Regular Length F140 XL	2 flute end mill long length F123 XL	4 flute end mill long length F122 XL	4 flute ball nose long length F125 XL
Page No.		2.190	2.191	2.192	2.193	2.194	2.195	2.196
Length		Reg	Reg	Reg	Reg	Long Length	Long Length	Long Length
Dia Range Std		1.0-20.0	1.0-20.0	1.0-20.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Dia Range Spl								
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		2	4	2	4	2	4	4
Helix		30°	30°	30°	30°	30°	30°	30°
Coating		TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank		Round	Round	Round	Round	Round	Round	Round
Square End		√	√			√	√	
Ball Nose				√	√			√
Corner Radius								
Corner Chamfer								
Center Cutting		√	√	√	√	√	√	√
Chip Breaker								
Neck Type								
Steel	P0	•	•	•	•	•	•	•
	P1	•	•	•	•	•	•	•
	P2	•	•	•	•	•	•	•
	P3	•	•	•	•	•	•	•
	P4	•	•	•	•	•	•	•
	P5	•	•	•	•	•	•	•
	P6	•	•	•	•	•	•	•
Stainless Steel	M1	•	•	•	•	•	•	•
	M2	•	•	•	•	•	•	•
	M3	•	•	•	•	•	•	•
Cast Iron	K1	•	•	•	•	•	•	•
	K2	•	•	•	•	•	•	•
	K3	•	•	•	•	•	•	•
Non-Ferrous	N1	•	•	•	•	•	•	•
	N2	•	•	•	•	•	•	•
	N3	•	•	•	•	•	•	•
	N4	•	•	•	•	•	•	•
	N5	•	•	•	•	•	•	•
	N6	•	•	•	•	•	•	•
	N7							
Special Alloys	S1	•	•	•	•	•	•	•
	S2	•	•	•	•	•	•	•
	S3	•	•	•	•	•	•	•
	S4	•	•	•	•	•	•	•
Hardened Steel	H1	•	•	•	•	•	•	•
	H2	•	•	•	•	•	•	•
	H3	•	•	•	•	•	•	•
	H4	•	•	•	•	•	•	•
Periphery Milling		√	√	√	√	√	√	√
Slotting		√	√	√	√	√	√	√
Ramping		√	√	√	√	√	√	√
Profiling		√	√	√	√	√	√	√

USE YOUR ENDMILLS SELECTOR

Select length of tool **D**

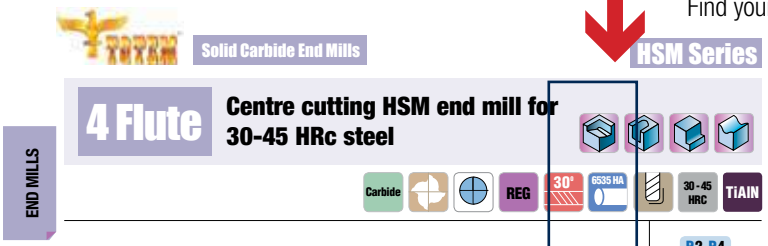
A — Select HP/GP (High Performance / General Performance)

C — Select corner style

B — Select your work piece material from this table

	For 45 - 58 HRc Proton Plus						For 30- 45 HRc High Speed Machining			
Description	4 flute end mill regular length	4 flute end mill long length	4 flute end mill long reach length	ball nose 2 flute regular length	ball nose 2 flute long length	ball nose 2 flute long reach length	4 flute end mill regular length	2 flute end mill regular length	Ball Nose 4 flute regular length	Ball Nose 2 flute regular length
Page No.	107	109	111	112	113	114	116	117	118	119
Length	Reg	Long Length	Long Reach	Reg	Long Length	Long Reach	Reg	Reg	Reg	Reg
Dia Range Std	3.0-16.0	3.0-16.0	6.0-12.0	1.0-12.0	1.0-12.0	6.0-12.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Dia Range Spl	2.0-25.4	2.0-20.0	2.0-20.0	1.0-20.0	1.0-20.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Length of Cut (Ap Max)	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD
No of Flutes	4	4	4	2	2	2	4	2	4	2
Helix	30°	30°	30°	30°	30°	30°	30°	30°	30°	30°
Coating	Proton Plus	Proton Plus	Proton Plus	Proton Plus	Proton Plus	Proton Plus	TiAlN	TiAlN	TiAlN	TiAlN
Shank										
Square End	√	√	√				√	√		
Ball Nose				√	√	√			√	√
Corner Radius	√	√	√				Custom Solution	Custom Solution		
Corner Chamfer										
Center Cutting	√	√	√	√	√	√	√	√	√	√
Chip Breaker										
Neck Type										
P0										
P1										
P2							•	•	•	•
P3							•	•	•	•
P4							•	•	•	•
P5										
P6										
M1										
M2										
M3										
K1										
K2										
K3										
N1										
N2										
N3										
N4										
N5										
N6										
N7										
S1										
S2										
S3										
S4										
H1	•	•	•	•	•	•				
H2	•	•	•	•	•	•				
H3	•	•	•	•	•	•				
H4										
Periphery Milling	√	√	√	√	√	√	√	√	√	√
Slotting							√	√	√	√
Ramping	√	√	√	√	√	√	√	√	√	√
Profiling	√	√	√	√	√	√	√	√	√	√

E — Find your tool on the page



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0501200	12	38	3
4	FBK0501974	14	51	4
5	FBK0501326	20	51	5
6	FBK0501366	20	64	6
8	FBK0501975	20	64	8
10	FBK0500846	25	70	10
12	FBK0500942	25	76	12
14	FBK0501017	30	89	14
16	FBK0501048	30	89	16
20	FBK0501125	38	102	20

F — Select tool diameter

*Custom Solution possible Refer page 2.171

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HIGH PERFORMANCE END MILLS

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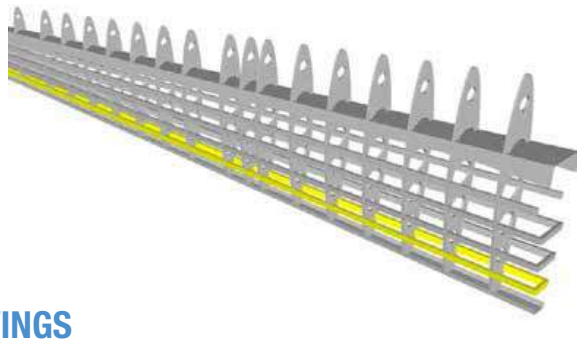
ENGINE COMPONENTS
POWER PLANT

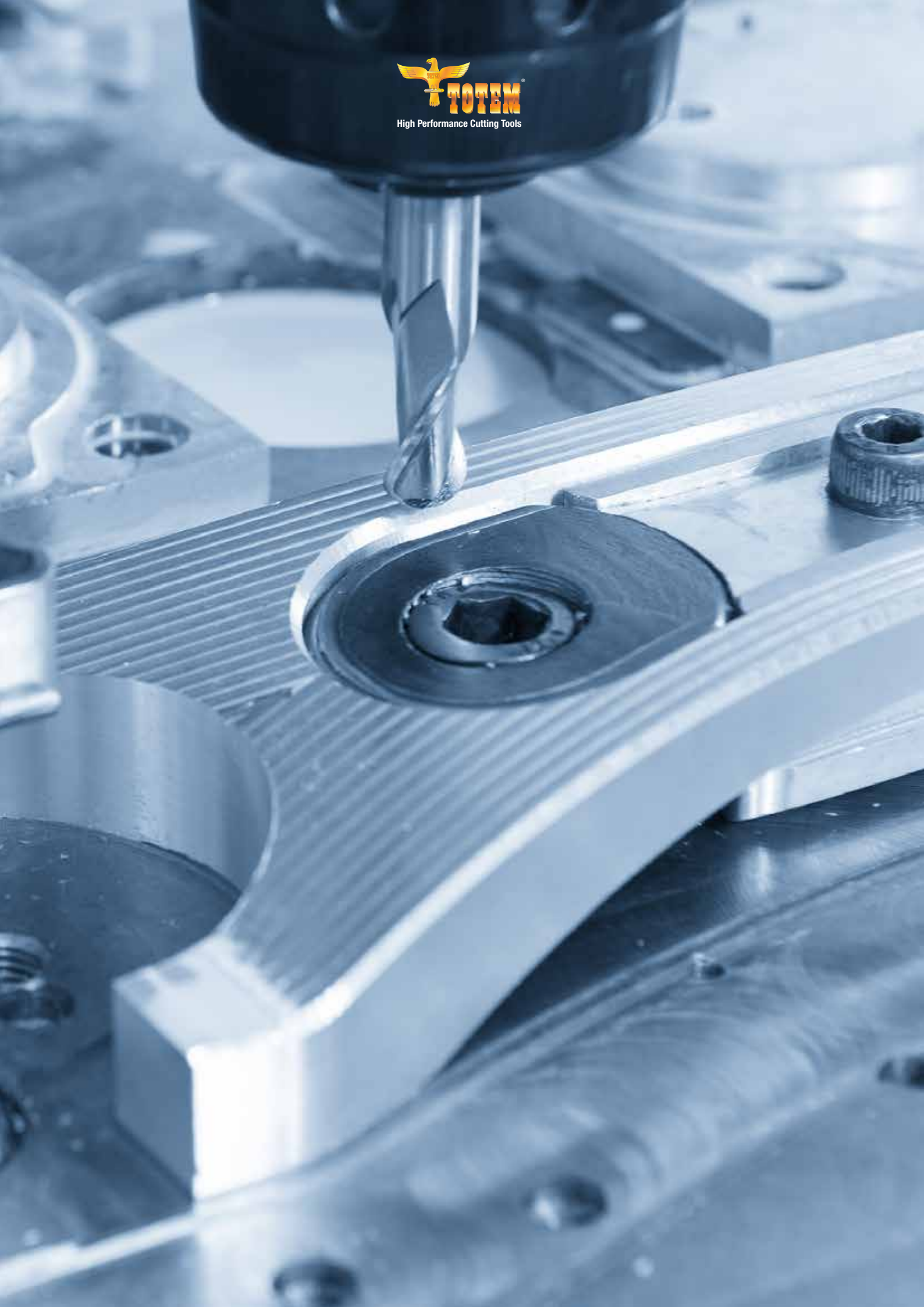
FUSELAGE

LANDING GEAR



WINGS

EMPENNAGE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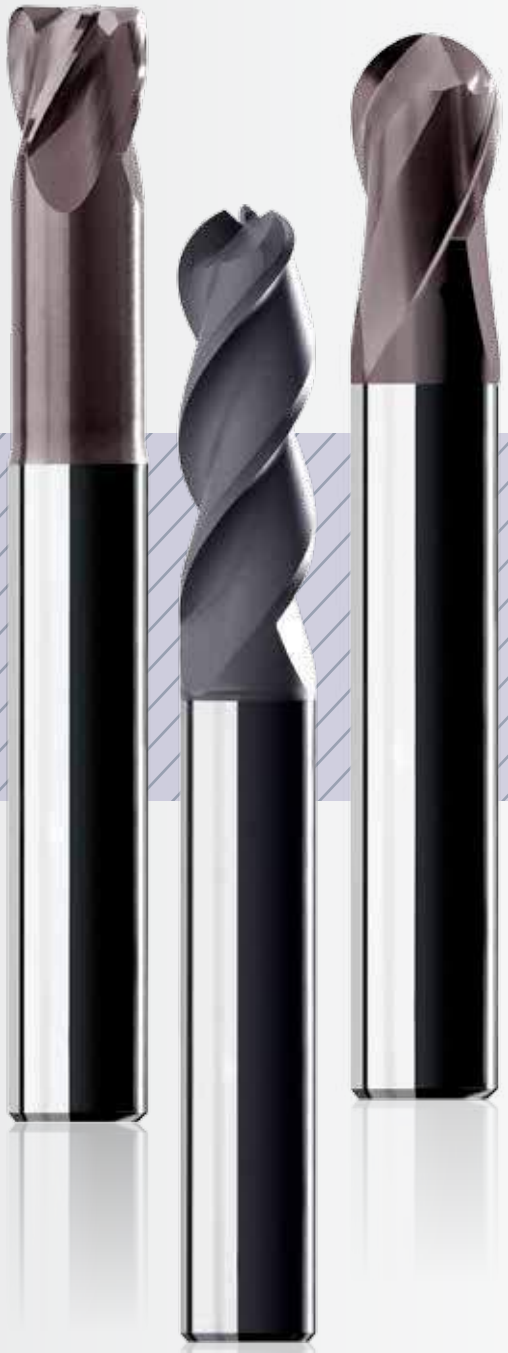


TOOLING SOLUTIONS FOR DIE, MOULD & PATTERN INDUSTRY

TOTEM®

High Performance Cutting Tools

TOOLING SOLUTIONS

FOR

DIE & MOULD INDUSTRY

	ISO Material Group	Application Hardness Range	Catalogue Series	Surface Coating	Standard Range	Size Range	No of Flute	Custom Solution	Trochoidal Milling Capability
	P2-P4	32 -45 HRC	HSM	TiAlN Base	Flat Endmill	3 mm to 20 mm	2 Flute / 4 Flute	Possible	Yes
					Ball nose Endmill	3 mm to 20 mm	2 Flute / 4 Flute	Possible	Yes
					Rib Milling Cutter	0.8 mm to 3 mm	2 flute	Possible	Yes
	P6 H1-H3	45-58 HRC	Proton Plus Series	Proton Plus	Flat Endmill	1 mm to 25 mm	2 /4/5/6 Flute	Possible	Yes
					Ball nose Endmill	1 mm to 12 mm	2 Flute	Possible	Yes
	P3-P4 H1-H4	45-70 HRC	Proton HD	TiAlN Base	Ball nose Endmill	1.0 mm to 16 mm	2 Flute / 4 Flute	Possible	Yes
					Torus Style	3mm to 16 mm	2 Flute / 4 Flute	Possible	Yes
					Multi flute finisher	3.0 mm to 20 mm	6-8 Flute	Possible	Yes
					Multi flute finisher with CR	3.0 mm to 20 mm	6-8 Flute	Possible	Yes
	H1-H4 P2-P6	45-70 HRC	Proton HD	TiAlN Base	Micro Flat Endmill	0.1 mm to 3 mm	2 Flute	Possible	Yes
					Micro Flat Endmill	0.2 mm to 3 mm	4 Flute	Possible	Yes
					Micro Ball nose Endmill	0.1 mm to 3 mm	2 Flute	Possible	Yes
					Micro - Flat & Ball with CR	0.1 mm to 3 mm	2 Flute / 4 Flute	Possible	Yes
	H3/H4	55-70 HRC	Proton HD	TiAlN Base	Ball nose 2 flute	0.1 mm to 12 mm	2 Flute	Possible	Yes
					Torus Style	0.1 mm to 12 mm	4 Flute	Possible	Yes
					Multi flute finisher	3.0 mm to 20 mm	6-16 Flute	Possible	Yes
					Multi flute finisher with CR	3.0 mm to 20 mm	6-16 Flute	Possible	Yes

SUCCESS STORIES

Customer	Mould Maker	
Component	Mould	
Material	1.2379 62 HRc	
Code	FBK0503571	
Description	EM 10.0 (FHPM 6 100 078 10 40) PHD	
	Competitor	Forbes
Ø	10 mm	10 mm
Z	6 Flutes	6 Flutes
Vc	100 m/min	100 m/min
n	3180 rpm	3180 rpm
F	0.05 mm/rev	0.6 mm/rev
Vf	954 mm/min	11448 mm/min
ap	20mm	20mm
ae	0.1 mm	0.1 mm
Coolant	Cold Air	Cold Air
Productivity	10 times Higher	

Customer	Mould Maker	
Component	Mould	
Material	1.2379 62 HRc	
Code	FBK0503535	
Description	BEM 6.0 (FHPK 2 060 064 06 L070) PHD	
	Competitor	Forbes
Ø	6 mm	6 mm
Z	2 Flutes	2 Flutes
Vc	160 m/min	160 m/min
n	8400 rpm	8400 rpm
F	0.157 mm/rev	0.157 mm/rev
Vf	2630 mm/min	2630 mm/min
ap	0.3 mm	0.3 mm
ae	1.2 mm	1.2 mm
Coolant	Min Lubrication	Min Lubrication
Q	0.95 mm3/min	0.95 mm3/min
Tool Life	30 mins	2 Hours
Productivity	4 times Higher	

Customer	Mould Maker	
Component	Mould	
Material	1.21662 60 HRc	
Code	FBK0503554	
Description	EM 8.0 (FHPT 4 08B 078 08 40 L160) PHD	
	Competitor	Forbes
Ø	8 mm	8 mm
Z	4 Flutes	4 Flutes
Vc	25 m/min	200 m/min
n	995 rpm	7958 rpm
F	0.038 mm/rev	0.079 mm/rev
Vf	150 mm/min	2500 mm/min
ap	3 mm	3 mm
ae	0.25 mm	0.1 mm
Coolant	Cold Air	Cold Air
Q	0.11 mm3/min	0.75 mm3/min
Productivity	6 times Higher	

Customer	Mould Maker	
Component	Mould	
Material	Elmax Hardened 62 HRc	
Code	FBK0505796	
Description	EM 1.5 (FHPT 4 015 064 06 40 L015) PHD	
	Competitor	Forbes
Ø	1.5 mm	1.5 mm
Z	4 Flutes	4 Flutes
Vc	85 m/min	85 m/min
n	18000 rpm	18000 rpm
F	0.0115 mm/rev	0.02 mm/rev
Vf	828 mm/min	1440 mm/min
ap	0.65 mm	0.65 mm
ae	0.04 mm	0.04 mm
Coolant	Min Lubrication	Min Lubrication
Q	21.52 mm3/min	37.44 mm3/min
Productivity	42% Higher MRR	

End mills for hardened steels from 55-70 HRc

Advantages

- No EDM is required (milling is much faster).
- Polishing can be minimized.
- One single clamping, so it is easier to achieve accurate results.

Several strategies are possible

HPM (High Perfomance Machining)	HSM (High Speed Machining)
High cutting speed (Vc)	High cutting speed (Vc)
Large cutting depth (ap)	Small cutting depth (ap)
Small cutting width (ae)	Small cutting width (ae)
Medium feed per tooth (fz)/ table feed (Vf)	High feed per tooth (fz) / table feed (Vf)

FG code: FBK0504466

Workpiece material: 1.2379
Hardness: 62HRc

	Competitor	Totem
Vc	100 m/min	100 m/min
n	3180 rpm	3180 rpm
fz	0.05 mm/t	0.60 mm/t
Z	6	6
Vf	1.000 mm/min	11.500 mm/min
ap	20 mm	20 mm
ae	0.1 mm	0.1 mm

Depending on the workpiece different strategies can be chosen.
Chip removal and coolant in such applications are crucial.

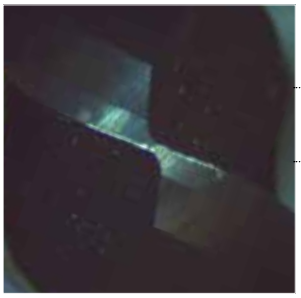
Program

- Centre cutting high performance ball nose 2 Flute for 55-70 HRc
- Centre cutting high performance torus 4 Flute for 55-70 HRc
- Centre cutting high performance multi flute finisher for 55-70 HRc
- Centre cutting high performance multi flute finisher with corner radius for 55-70 HRc

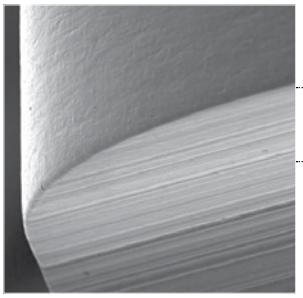
Coating Details

- Multi layer coating
- Nano structure
- Extreme hardness
- Longer tool life

Optimized center



Wear



Edge preparation

For multi flute finisher with corner radius the tolerance on the corner radius is ±0.005mm.

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2 Flute

Centre cutting high performance ball nose 2 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5

IMAGE 1

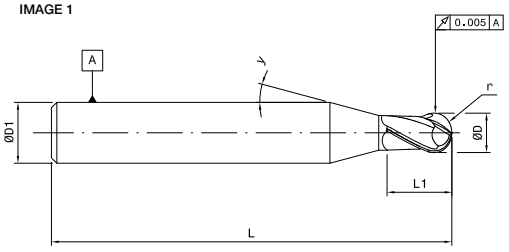
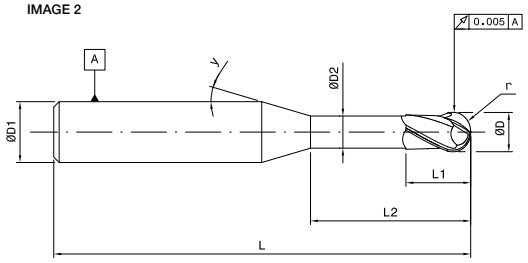


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.15	-	-	51.00	4.00	0.05	2	15	1	0.684	0.706	0.755	0.812	FBK0506053
0.10	0.15	0.09	2.00	51.00	4.00	0.05	2	15	2	2.357	2.437	2.616	2.825	FBK0506054
0.20	0.30	-	-	51.00	4.00	0.10	2	15	1	0.786	0.810	0.863	0.925	FBK0506055
0.20	0.30	0.19	2.00	51.00	4.00	0.10	2	15	2	2.355	2.434	2.609	2.812	FBK0506056
0.20	0.30	0.19	4.00	51.00	4.00	0.10	2	15	2	4.423	4.573	4.909	5.299	FBK0506057
0.20	0.30	0.19	6.00	51.00	4.00	0.10	2	15	2	6.490	6.713	7.208	7.785	FBK0506058
0.40	0.50	-	-	51.00	4.00	0.20	2	15	1	1.299	1.337	1.423	1.522	FBK0506059
0.40	0.50	0.38	2.00	51.00	4.00	0.20	2	15	2	2.371	2.447	2.615	2.811	FBK0506060
0.40	0.50	0.38	4.00	51.00	4.00	0.20	2	15	2	4.439	4.586	4.915	5.298	FBK0506061
0.40	0.50	0.38	6.00	51.00	4.00	0.20	2	15	2	6.506	6.726	7.215	7.784	FBK0506062
0.40	0.50	0.38	8.00	51.00	4.00	0.20	2	15	2	8.573	8.865	9.515	10.27	FBK0506063
0.50	0.70	-	-	51.00	4.00	0.25	2	15	1	1.504	1.548	1.645	1.758	FBK0506064
0.50	0.70	0.46	2.00	51.00	4.00	0.25	2	15	2	2.408	2.483	2.651	2.846	FBK0506065
0.50	0.70	0.46	4.00	51.00	4.00	0.25	2	15	2	4.476	4.623	4.951	5.332	FBK0506066
0.50	0.70	0.46	6.00	51.00	4.00	0.25	2	15	2	6.543	6.762	7.250	7.818	FBK0506067
0.50	0.70	0.46	8.00	51.00	4.00	0.25	2	15	2	8.610	8.902	9.550	10.304	FBK0506068
0.60	0.80	-	-	51.00	4.00	0.30	2	15	1	2.259	2.327	2.479	2.656	FBK0506069
0.60	0.80	0.56	2.00	51.00	4.00	0.30	2	15	2	2.543	2.621	2.795	2.997	FBK0506070
0.80	1.00	-	-	51.00	4.00	0.40	2	15	1	2.462	2.534	2.694	2.880	FBK0506071
1.00	1.20	-	-	51.00	4.00	0.50	2	15	1	2.665	2.741	2.909	3.104	FBK0506072
1.00	1.20	0.96	2.20	51.00	4.00	0.50	2	15	2	2.743	2.821	2.995	3.197	FBK0506073
1.00	1.20	0.96	4.00	51.00	4.00	0.50	2	15	2	4.603	4.746	5.064	5.435	FBK0506074
1.00	1.20	0.96	6.00	51.00	4.00	0.50	2	15	2	6.671	6.886	7.364	7.921	FBK0506075
1.00	1.20	0.96	8.00	51.00	4.00	0.50	2	15	2	8.738	9.025	9.664	10.407	FBK0506076

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.020

2 Flute

Centre cutting high performance ball nose 2 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

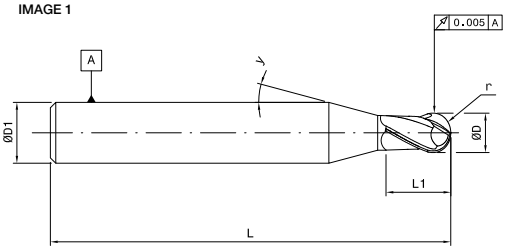
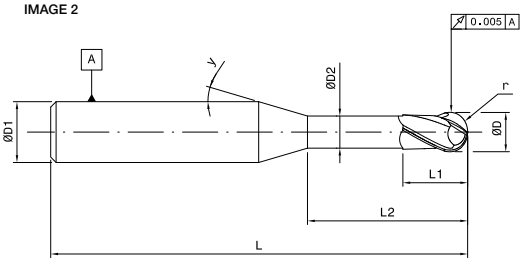


IMAGE 2



H2-H3

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.20	0.96	10.00	51.00	4.00	0.50	2	15	2	10.805	11.164	11.964	12.894	FBK0506077
1.50	1.80	-	-	51.00	4.00	0.75	2	15	1	4.066	4.182	4.439	4.738	FBK0506078
1.50	1.80	1.45	3.30	51.00	4.00	0.75	2	15	2	4.163	4.282	4.546	4.854	FBK0506079
1.50	1.80	1.45	4.00	51.00	4.00	0.75	2	15	2	4.886	5.030	5.351	5.725	FBK0506080
1.50	1.80	1.45	6.00	51.00	4.00	0.75	2	15	2	6.954	7.170	7.651	8.211	FBK0506081
1.50	1.80	1.45	8.00	51.00	4.00	0.75	2	15	2	9.021	9.309	9.951	10.697	FBK0506082
1.50	1.80	1.45	10.00	51.00	4.00	0.75	2	15	2	11.088	11.448	12.25	13.183	FBK0506083
2.00	2.50	-	-	51.00	4.00	1.00	2	15	1	4.781	4.913	5.206	5.548	FBK0506084
2.00	2.50	1.90	4.00	51.00	4.00	1.00	2	15	2	4.974	5.113	5.421	5.78	FBK0506085
2.00	2.50	1.90	6.00	51.00	4.00	1.00	2	15	2	7.042	7.252	7.721	8.266	FBK0506086
2.00	2.50	1.90	8.00	51.00	4.00	1.00	2	15	2	9.109	9.392	10.02	10.752	FBK0506087
2.00	2.50	1.90	10.00	51.00	4.00	1.00	2	15	2	11.176	11.531	12.32	13.239	FBK0506088
2.50	3.00	-	-	51.00	4.00	1.25	2	15	1	5.290	5.431	5.744	6.109	FBK0506089
2.50	3.00	2.40	4.50	51.00	4.00	1.25	2	15	2	5.483	5.630	5.959	6.341	FBK0506090
2.50	3.00	2.40	6.00	51.00	4.00	1.25	2	15	2	7.033	7.235	7.683	8.205	FBK0506091
2.50	3.00	2.40	8.00	51.00	4.00	1.25	2	15	2	9.101	9.374	9.983	10.692	FBK0506092
2.50	3.00	2.40	10.00	51.00	4.00	1.25	2	15	2	11.168	11.513	12.283	13.178	FBK0506093
3.00	3.50	-	-	51.00	4.00	1.50	2	15	1	5.798	5.948	6.281	6.669	FBK0506094
3.00	3.50	2.90	5.00	51.00	4.00	1.50	2	15	2	5.991	6.148	6.496	6.901	FBK0506095
3.00	3.50	2.90	6.00	51.00	4.00	1.50	2	15	2	7.025	7.217	7.646	8.144	FBK0506096
3.00	3.50	2.90	7.00	51.00	4.00	1.50	2	15	2	8.058	8.287	8.796	9.388	FBK0506097
3.00	3.50	2.90	8.00	51.00	4.00	1.50	2	15	2	9.092	9.357	9.946	10.631	FBK0506098
3.00	3.50	2.90	10.00	51.00	4.00	1.50	2	15	2	11.159	11.496	12.245	∞	FBK0506099

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.020

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2 Flute

Centre cutting high performance ball nose 2 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

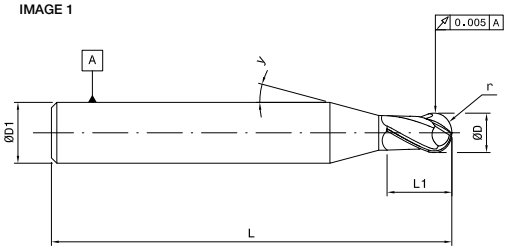
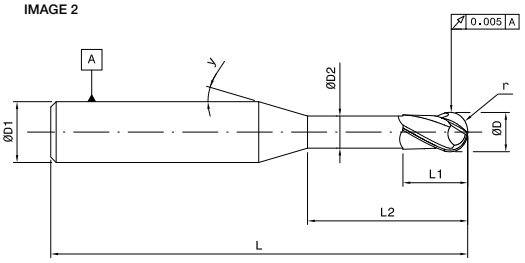


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.15	-	-	64.00	6.00	0.05	2	15	1	0.684	0.706	0.755	0.812	FBK0505685
0.10	0.15	0.09	2.00	64.00	6.00	0.05	2	15	2	2.357	2.437	2.616	2.825	FBK0505686
0.20	0.30	-	-	64.00	6.00	0.10	2	15	1	0.786	0.810	0.863	0.925	FBK0505687
0.20	0.30	0.19	2.00	64.00	6.00	0.10	2	15	2	2.355	2.434	2.609	2.812	FBK0505688
0.20	0.30	0.19	4.00	64.00	6.00	0.10	2	15	2	4.423	4.573	4.909	5.299	FBK0505689
0.20	0.30	0.19	6.00	64.00	6.00	0.10	2	15	2	6.490	6.713	7.208	7.785	FBK0505690
0.40	0.50	-	-	64.00	6.00	0.20	2	15	1	1.299	1.337	1.423	1.522	FBK0505691
0.40	0.50	0.38	2.00	64.00	6.00	0.20	2	15	2	2.371	2.447	2.615	2.811	FBK0505692
0.40	0.50	0.38	4.00	64.00	6.00	0.20	2	15	2	4.439	4.586	4.915	5.298	FBK0505693
0.40	0.50	0.38	6.00	64.00	6.00	0.20	2	15	2	6.506	6.726	7.215	7.784	FBK0505694
0.40	0.50	0.38	8.00	64.00	6.00	0.20	2	15	2	8.573	8.865	9.515	10.27	FBK0505695
0.50	0.70	-	-	64.00	6.00	0.25	2	15	1	1.504	1.548	1.645	1.758	FBK0504418
0.50	0.70	0.46	2.00	64.00	6.00	0.25	2	15	2	2.408	2.483	2.651	2.846	FBK0505696
0.50	0.70	0.46	4.00	64.00	6.00	0.25	2	15	2	4.476	4.623	4.951	5.332	FBK0505697
0.50	0.70	0.46	6.00	64.00	6.00	0.25	2	15	2	6.543	6.762	7.250	7.818	FBK0505698
0.50	0.70	0.46	8.00	64.00	6.00	0.25	2	15	2	8.610	8.902	9.550	10.304	FBK0505699
0.60	0.80	-	-	64.00	6.00	0.30	2	15	1	2.259	2.327	2.479	2.656	FBK0504419
0.60	0.80	0.56	2.00	64.00	6.00	0.30	2	15	2	2.543	2.621	2.795	2.997	FBK0504420
0.80	1.00	-	-	64.00	6.00	0.40	2	15	1	2.462	2.534	2.694	2.880	FBK0504421
1.00	1.20	-	-	64.00	6.00	0.50	2	15	1	2.665	2.741	2.909	3.104	FBK0504422
1.00	1.20	0.96	2.20	64.00	6.00	0.50	2	15	2	2.743	2.821	2.995	3.197	FBK0505700
1.00	1.20	0.96	4.00	64.00	6.00	0.50	2	15	2	4.603	4.746	5.064	5.435	FBK0504424
1.00	1.20	0.96	6.00	64.00	6.00	0.50	2	15	2	6.671	6.886	7.364	7.921	FBK0505701
1.00	1.20	0.96	8.00	64.00	6.00	0.50	2	15	2	8.738	9.025	9.664	10.407	FBK0505702

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.020

2 Flute

Centre cutting high performance ball nose 2 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

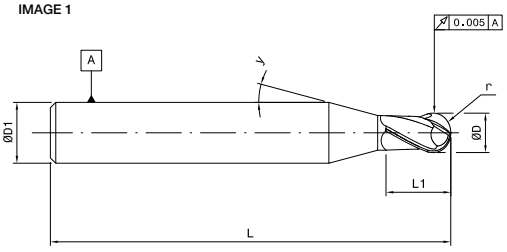
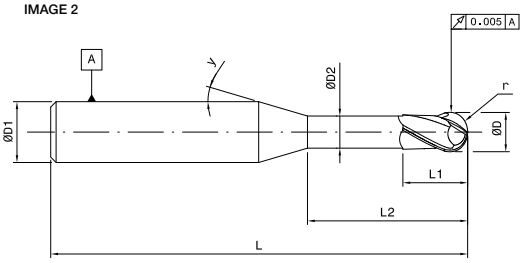


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.20	0.96	10.00	64.00	6.00	0.50	2	15	2	10.805	11.164	11.964	12.894	FBK0505703
1.50	1.80	-	-	64.00	6.00	0.75	2	15	1	4.066	4.182	4.439	4.738	FBK0504425
1.50	1.80	1.45	3.30	64.00	6.00	0.75	2	15	2	4.163	4.282	4.546	4.854	FBK0505704
1.50	1.80	1.45	4.00	64.00	6.00	0.75	2	15	2	4.886	5.030	5.351	5.725	FBK0505705
1.50	1.80	1.45	6.00	64.00	6.00	0.75	2	15	2	6.954	7.170	7.651	8.211	FBK0505706
1.50	1.80	1.45	8.00	64.00	6.00	0.75	2	15	2	9.021	9.309	9.951	10.697	FBK0505707
1.50	1.80	1.45	10.00	64.00	6.00	0.75	2	15	2	11.088	11.448	12.25	13.183	FBK0505708
2.00	2.50	-	-	64.00	6.00	1.00	2	15	1	4.781	4.913	5.206	5.548	FBK0504426
2.00	2.50	1.90	4.00	64.00	6.00	1.00	2	15	2	4.974	5.113	5.421	5.780	FBK0504427
2.00	2.50	1.90	6.00	64.00	6.00	1.00	2	15	2	7.042	7.252	7.721	8.266	FBK0505709
2.00	2.50	1.90	8.00	64.00	6.00	1.00	2	15	2	9.109	9.392	10.02	10.752	FBK0505710
2.00	2.50	1.90	10.00	64.00	6.00	1.00	2	15	2	11.176	11.531	12.32	13.239	FBK0505711
2.50	3.00	-	-	64.00	6.00	1.25	2	15	1	5.290	5.431	5.744	6.109	FBK0504428
2.50	3.00	2.40	4.50	64.00	6.00	1.25	2	15	2	5.483	5.630	5.959	6.341	FBK0505712
2.50	3.00	2.40	6.00	64.00	6.00	1.25	2	15	2	7.033	7.235	7.683	8.205	FBK0505713
2.50	3.00	2.40	8.00	64.00	6.00	1.25	2	15	2	9.101	9.374	9.983	10.692	FBK0505714
2.50	3.00	2.40	10.00	64.00	6.00	1.25	2	15	2	11.168	11.513	12.283	13.178	FBK0505715
3.00	3.50	-	-	64.00	6.00	1.50	2	15	1	5.798	5.948	6.281	6.669	FBK0504429
3.00	3.50	2.90	5.00	64.00	6.00	1.50	2	15	2	5.991	6.148	6.496	6.901	FBK0505716
3.00	3.50	2.90	6.00	64.00	6.00	1.50	2	15	2	7.025	7.217	7.646	8.144	FBK0505717
3.00	3.50	2.90	7.00	64.00	6.00	1.50	2	15	2	8.058	8.287	8.796	9.388	FBK0504430
3.00	3.50	2.90	8.00	64.00	6.00	1.50	2	15	2	9.092	9.357	9.946	10.631	FBK0505718
3.00	3.50	2.90	10.00	64.00	6.00	1.50	2	15	2	11.159	11.496	12.245	13.117	FBK0505719
4.00	4.50	-	-	64.00	6.00	2.00	2	15	1	6.815	6.983	7.356	7.791	FBK0504431

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.020

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2 Flute

Centre cutting high performance ball nose 2 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4

IMAGE 3

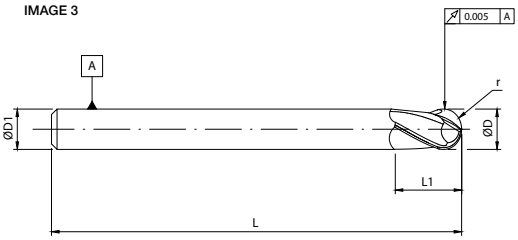
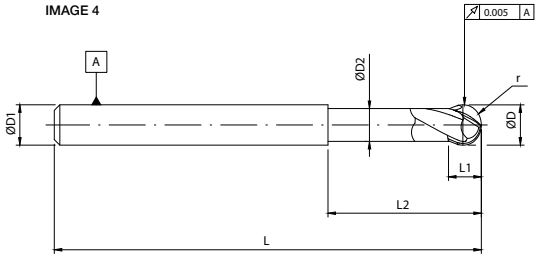


IMAGE 4



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
4.00	4.50	3.80	8.00	64.00	6.00	2.00	2	15	2	9.268	9.521	10.085	10.741	FBK0504432
5.00	6.00	-	-	64.00	6.00	2.50	2	15	2	8.349	8.553	9.006	9.534	FBK0504433
5.00	6.00	4.70	10.00	64.00	6.00	2.50	2	15	2	11.512	11.826	12.525	∞	FBK0504434
6.00	7.00	-	-	64.00	6.00	3.00	2	-	1	∞	∞	∞	∞	FBK0503535
6.00	7.00	5.70	12.00	64.00	6.00	3.00	2	-	2	∞	∞	∞	∞	FBK0504435
6.00	7.00	5.70	25.00	64.00	6.00	3.00	2	-	2	∞	∞	∞	∞	FBK0504436
8.00	9.00	-	-	64.00	8.00	4.00	2	-	1	∞	∞	∞	∞	FBK0504437
8.00	9.00	7.60	16.00	64.00	8.00	4.00	2	-	2	∞	∞	∞	∞	FBK0504438
8.00	9.00	7.60	25.00	64.00	8.00	4.00	2	-	2	∞	∞	∞	∞	FBK0503536
10.00	12.00	-	-	78.00	10.00	5.00	2	-	1	∞	∞	∞	∞	FBK0504439
10.00	12.00	9.60	20.00	78.00	10.00	5.00	2	-	2	∞	∞	∞	∞	FBK0503537
12.00	15.00	-	-	78.00	12.00	6.00	2	-	1	∞	∞	∞	∞	FBK0504440

Tolerance chart

Diameter range	Shank	Cutting diameter	Cutting diameter	Cutting diameter	Cutting diameter
	ØD1-h5	ØD-e8	ØD-f7	ØD-g7	ØFHC
D ≤ 3	0	-0.014	-0.006	-0.002	0
	-0.004	-0.028	-0.016	-0.012	-0.025
3 < D ≤ 6	0	-0.020	-0.010	-0.004	0
	-0.005	-0.038	-0.022	-0.016	-0.030
6 < D ≤ 10	0	-0.025	-0.013	-0.005	0
	-0.006	-0.047	-0.028	-0.02	-0.036
10 < D ≤ 18	0	-0.032	-0.016	-0.006	0
	-0.008	-0.059	-0.034	-0.024	-0.043
18 < D ≤ 30	0	-0.040	-0.020	-0.006	0
	-0.009	-0.073	-0.041	-0.024	-0.052

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0
Remark ∞ means no collusion in projection length area

Application data on page no 2.020

Cutting parameters

Centre cutting high performance 2 flute for ball nose 50-70 HRc - 0.1 mm to 2.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling	Cutting Speed (Vc) m/min: Profiling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																	
								Diameter in mm																	
								mm	0.1		0.2		0.4		0.5		0.6		0.8		1.0		1.5		2.0	
			ap 0.2D ae/D 3%	ap 0.2D ae/D 3%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	3	150	180	MQL/ COLD AIR	150	220	fz	0.002	0.007	0.004	0.010	0.006	0.013	0.007	0.015	0.009	0.018	0.009	0.018	0.015	0.025	0.020	0.035	0.030	0.050
		4	200	220	MQL/ COLD AIR	200	250	fz	0.002	0.007	0.004	0.010	0.006	0.013	0.007	0.015	0.009	0.018	0.009	0.018	0.015	0.025	0.020	0.035	0.030	0.050

Centre cutting high performance 2 flute for ball nose 50-70 HRc - 2.5 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling	Cutting Speed (Vc) m/min: Profiling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																	
								Diameter in mm																	
								mm	2.5		3.0		4.0		5.0		6.0		8.0		10.0		12.0			
			ap 0.2D ae/D 3%	ap 0.2D ae/D 3%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max		
Hardened Steel	H	3	150	180	MQL/ COLD AIR	150	220	fz	0.035	0.055	0.040	0.060	0.050	0.080	0.060	0.110	0.065	0.125	0.080	0.130	0.085	0.135	0.100	0.140		
		4	200	220	MQL/ COLD AIR	200	250	fz	0.035	0.055	0.040	0.060	0.050	0.080	0.060	0.110	0.065	0.125	0.080	0.130	0.085	0.135	0.100	0.140		

FBK0503535

Workpiece material: 1.2379

Hardness: 62 HRc

	Competitor	Totem
Ø	6mm	6mm
z	2 flutes	2 flutes
vc	160 m/min	160 m/min
n	8400 rpm	8400 rpm
fz	0.157 mm/t	0.157 mm/t
vf	2630 mm/min	2630 mm/min
ap	0.3 mm	0.3 mm
ae	1.2 mm	1.2 mm
Coolant	min. lubrication	min. lubrication

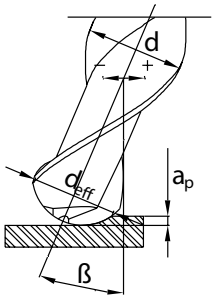
Q	0.95 mm^3/min	0.95 mm^3/min
Tool Life	30 mins	2 Hrs

Advantages

- Consistency
- Higher Tool Life

Tips:

- Use a rigid milling machine and clamping method
- Try to minimize entering and exiting the workpiece
- Use minimum lubrication or oil-mist-spray



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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4 Flute

Centre cutting high performance torus 4 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4

IMAGE 1

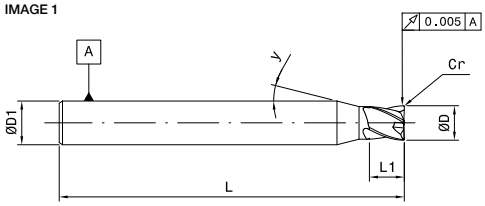
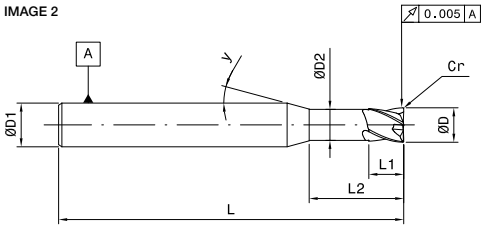


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.20	-	-	51.00	4.00	0.01	4	15	1	0.685	0.709	0.761	0.822	FBK0505720
0.20	0.20	0.18	0.40	51.00	4.00	0.01	4	15	2	0.724	0.749	0.804	0.869	FBK0505721
0.40	0.40		-	51.00	4.00	0.01	4	15	1	1.202	1.244	1.336	1.444	FBK0505722
0.40	0.40	0.38	0.90	51.00	4.00	0.01	4	15	2	1.241	1.284	1.379	1.490	FBK0505723
0.40	0.40	0.38	1.60	51.00	4.00	0.01	4	15	2	1.964	2.032	2.184	2.360	FBK0505724
0.50	0.50	-	-	51.00	4.00	0.03	4	15	1	1.305	1.349	1.448	1.563	FBK0505725
0.50	0.50	0.48	1.00	51.00	4.00	0.03	4	15	2	1.343	1.389	1.491	1.610	FBK0505726
0.50	0.50	0.48	2.00	51.00	4.00	0.03	4	15	2	2.377	2.459	2.641	2.853	FBK0505727
0.60	0.60	-	-	51.00	4.00	0.05	4	15	1	2.060	2.130	2.286	2.468	FBK0505728
0.60	0.60	0.56	1.60	51.00	4.00	0.05	4	15	2	2.138	2.210	2.372	2.561	FBK0505729
0.60	0.60	0.56	2.40	51.00	4.00	0.05	4	15	2	2.965	3.066	3.292	3.555	FBK0505730
0.80	0.80		-	51.00	4.00	0.05	4	15	1	2.267	2.344	2.516	2.716	FBK0505731
0.80	0.80	0.76	1.80	51.00	4.00	0.05	4	15	2	2.344	2.424	2.602	2.809	FBK0505732
0.80	0.80	0.76	3.20	51.00	4.00	0.05	4	15	2	3.791	3.922	4.212	4.550	FBK0505733
1.00	1.00	-	-	51.00	4.00	0.05	4	15	1	2.474	2.558	2.746	2.965	FBK0505734
1.00	1.00	0.96	2.00	51.00	4.00	0.05	4	15	2	2.551	2.638	2.832	3.058	FBK0505735
1.00	1.00	0.96	4.00	51.00	4.00	0.05	4	15	2	4.618	4.778	5.132	5.544	FBK0505736
1.00	1.00	0.96	6.00	51.00	4.00	0.05	4	15	2	6.686	6.917	7.432	8.030	FBK0505737
1.00	1.00		-	51.00	4.00	0.10	4	15	1	2.472	2.555	2.739	2.953	FBK0505738
1.00	1.00	0.96	2.00	51.00	4.00	0.10	4	15	2	2.549	2.635	2.825	3.046	FBK0505739
1.00	1.00	0.96	4.00	51.00	4.00	0.10	4	15	2	4.617	4.774	5.124	5.532	FBK0505740
1.00	1.00	0.96	6.00	51.00	4.00	0.10	4	15	2	6.684	6.913	7.424	8.018	FBK0505741
1.50	1.50	-	-	51.00	4.00	0.10	4	15	1	3.778	3.906	4.191	4.523	FBK0505742
1.50	1.50	1.45	3.00	51.00	4.00	0.10	4	15	2	3.874	4.006	4.299	4.639	FBK0505743
1.50	1.50	1.45	6.00	51.00	4.00	0.10	4	15	2	6.975	7.215	7.748	8.369	FBK0505744
1.50	1.50	1.45	9.00	51.00	4.00	0.10	4	15	2	10.076	10.424	11.198	12.098	FBK0505745
1.50	1.50	-	-	51.00	4.00	0.20	4	15	1	3.775	3.899	4.177	4.499	FBK0505746

Application data on page no 2.026

4 Flute

Centre cutting high performance torus 4 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

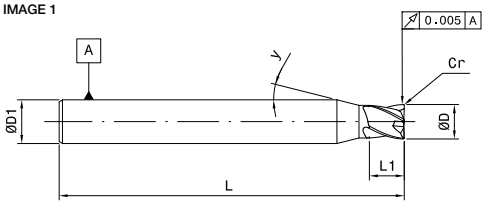
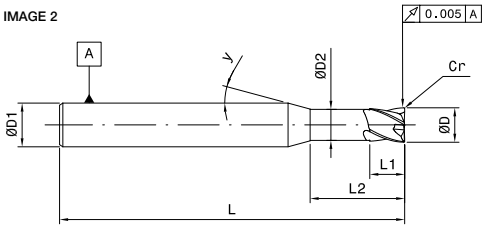


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	1.50	1.45	3.00	51.00	4.00	0.20	4	15	2	3.871	3.999	4.284	4.615	FBK0505747
1.50	1.50	1.45	6.00	51.00	4.00	0.20	4	15	2	6.972	7.208	7.733	8.345	FBK0505748
1.50	1.50	1.45	9.00	51.00	4.00	0.20	4	15	2	10.073	10.417	11.183	12.074	FBK0505749
2.00	2.00	-	-	51.00	4.00	0.10	4	15	1	4.295	4.441	4.766	5.145	FBK0505750
2.00	2.00	1.90	4.00	51.00	4.00	0.10	4	15	2	5.005	5.175	5.556	5.999	FBK0505751
2.00	2.00	1.90	8.00	51.00	4.00	0.10	4	15	2	9.139	9.454	10.155	10.971	FBK0505752
2.00	2.00	1.90	12.00	51.00	4.00	0.10	4	15	2	13.274	13.733	14.755	15.944	FBK0505753
2.00	2.00	-	-	51.00	4.00	0.30	4	15	1	4.288	4.427	4.736	5.096	FBK0505754
2.00	2.00	1.90	4.00	51.00	4.00	0.30	4	15	2	4.998	5.162	5.526	5.95	FBK0505755
2.00	2.00	1.90	8.00	51.00	4.00	0.30	4	15	2	9.133	9.440	10.125	10.923	FBK0505756
2.00	2.00	1.90	12.00	51.00	4.00	0.30	4	15	2	13.267	13.719	14.725	15.895	FBK0505757
2.50	2.50	-	-	51.00	4.00	0.10	4	15	1	4.812	4.976	5.341	5.767	FBK0505758
2.50	2.50	2.40	5.00	51.00	4.00	0.10	4	15	2	6.038	6.245	6.706	7.242	FBK0505759
2.50	2.50	2.40	10.00	51.00	4.00	0.10	4	15	2	11.207	11.594	12.455	13.457	FBK0505760
2.50	2.50	2.40	15.00	51.00	4.00	0.10	4	15	2	16.375	16.942	18.204	∞	FBK0505761
2.50	2.50	-	-	51.00	4.00	0.30	4	15	1	4.805	4.962	5.311	5.718	FBK0505762
2.50	2.50	2.40	5.00	51.00	4.00	0.30	4	15	2	6.032	6.231	6.676	7.193	FBK0505763
2.50	2.50	2.40	10.00	51.00	4.00	0.30	4	15	2	11.200	11.580	12.425	13.409	FBK0505764
2.50	2.50	2.40	15.00	51.00	4.00	0.30	4	15	2	16.368	16.928	18.174	∞	FBK0505765
3.00	3.00	-	-	51.00	4.00	0.20	4	15	1	5.325	5.504	5.901	6.364	FBK0505766
3.00	3.00	-	6.00	51.00	4.00	0.20	4	15	1	7.069	7.308	7.841	8.461	FBK0505767
3.00	3.00	-	12.00	51.00	4.00	0.20	4	15	1	13.271	13.726	14.74	∞	FBK0505768
3.00	3.00	-	18.00	51.00	4.00	0.20	4	15	1	19.473	20.144	∞	∞	FBK0505769
3.00	3.00	-	-	51.00	4.00	0.20	4	15	1	5.325	5.504	5.901	6.364	FBK0505770
3.00	3.00	-	6.00	51.00	4.00	0.50	4	15	1	7.058	7.287	7.796	8.388	FBK0505771
3.00	3.00	-	12.00	51.00	4.00	0.50	4	15	1	13.26	13.705	14.695	∞	FBK0505772
3.00	3.00	-	18.00	51.00	4.00	0.50	4	15	1	19.462	20.123	∞	∞	FBK0505773

Remark ∞ means no collusion in projection length area

Application data on page no 2.026

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4 Flute

Centre cutting high performance torus 4 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

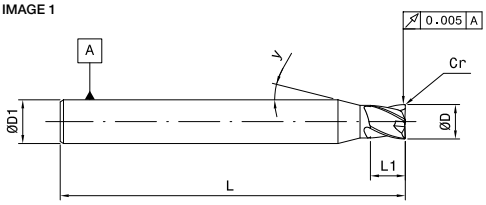
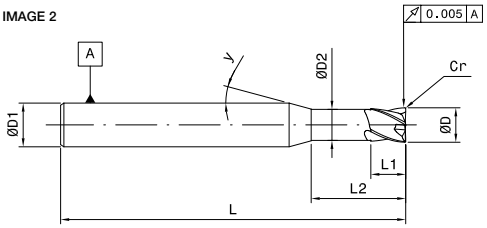


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.20	-	-	64.00	6.00	0.01	4	15	1	0.685	0.709	0.761	0.822	FBK0505774
0.20	0.20	0.18	0.40	64.00	6.00	0.01	4	15	2	0.724	0.749	0.804	0.869	FBK0505775
0.40	0.40	-	-	64.00	6.00	0.01	4	15	1	1.202	1.244	1.336	1.444	FBK0505776
0.40	0.40	0.38	0.90	64.00	6.00	0.01	4	15	2	1.241	1.284	1.379	1.490	FBK0505777
0.40	0.40	0.38	1.60	64.00	6.00	0.01	4	15	2	1.964	2.032	2.184	2.360	FBK0505778
0.50	0.50	-	-	64.00	6.00	0.03	4	15	1	1.305	1.349	1.448	1.563	FBK0505779
0.50	0.50	0.48	1.00	64.00	6.00	0.03	4	15	2	1.343	1.389	1.491	1.610	FBK0505780
0.50	0.50	0.48	2.00	64.00	6.00	0.03	4	15	2	2.377	2.459	2.641	2.853	FBK0505781
0.60	0.60	-	-	64.00	6.00	0.05	4	15	1	2.060	2.130	2.286	2.468	FBK0505782
0.60	0.60	0.56	1.60	64.00	6.00	0.05	4	15	2	2.138	2.210	2.372	2.561	FBK0505783
0.60	0.60	0.56	2.40	64.00	6.00	0.05	4	15	2	2.965	3.066	3.292	3.555	FBK0505784
0.80	0.80	-	-	64.00	6.00	0.05	4	15	1	2.267	2.344	2.516	2.716	FBK0505785
0.80	0.80	0.76	1.80	64.00	6.00	0.05	4	15	2	2.344	2.424	2.602	2.809	FBK0505786
0.80	0.80	0.76	3.20	64.00	6.00	0.05	4	15	2	3.791	3.922	4.212	4.550	FBK0505787
1.00	1.00	-	-	64.00	6.00	0.05	4	15	1	2.474	2.558	2.746	2.965	FBK0505788
1.00	1.00	0.96	2.00	64.00	6.00	0.05	4	15	2	2.551	2.638	2.832	3.058	FBK0505789
1.00	1.00	0.96	4.00	64.00	6.00	0.05	4	15	2	4.618	4.778	5.132	5.544	FBK0505790
1.00	1.00	0.96	6.00	64.00	6.00	0.05	4	15	2	6.686	6.917	7.432	8.030	FBK0505791
1.00	1.00	-	-	64.00	6.00	0.10	4	15	1	2.472	2.555	2.739	2.953	FBK0505792
1.00	1.00	0.96	2.00	64.00	6.00	0.10	4	15	2	2.549	2.635	2.825	3.046	FBK0505793
1.00	1.00	0.96	4.00	64.00	6.00	0.10	4	15	2	4.617	4.774	5.124	5.532	FBK0505794
1.00	1.00	0.96	6.00	64.00	6.00	0.10	4	15	2	6.684	6.913	7.424	8.018	FBK0505795
1.50	1.50	-	-	64.00	6.00	0.10	4	15	1	3.778	3.906	4.191	4.523	FBK0505796
1.50	1.50	1.45	3.00	64.00	6.00	0.10	4	15	2	3.874	4.006	4.299	4.639	FBK0505797
1.50	1.50	1.45	6.00	64.00	6.00	0.10	4	15	2	6.975	7.215	7.748	8.369	FBK0505798
1.50	1.50	1.45	9.00	64.00	6.00	0.10	4	15	2	10.076	10.424	11.198	12.098	FBK0505799
1.50	1.50	-	-	64.00	6.00	0.20	4	15	1	3.775	3.899	4.177	4.499	FBK0505800
1.50	1.50	1.45	3.00	64.00	6.00	0.20	4	15	2	3.871	3.999	4.284	4.615	FBK0505801

Application data on page no 2.026

4 Flute

Centre cutting high performance torus 4 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

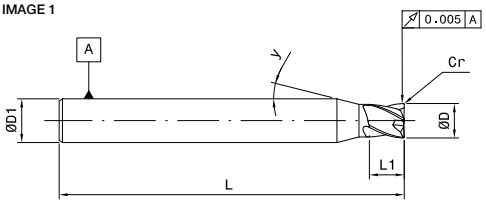
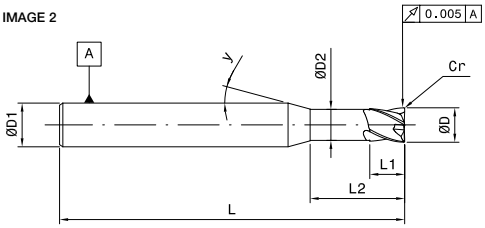


IMAGE 2



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	1.50	1.45	6.00	64.00	6.00	0.20	4	15	2	6.972	7.208	7.733	8.345	FBK0505802
1.50	1.50	1.45	9.00	64.00	6.00	0.20	4	15	2	10.073	10.417	11.183	12.074	FBK0505803
2.00	2.00	-	-	64.00	6.00	0.10	4	15	1	4.295	4.441	4.766	5.145	FBK0505804
2.00	2.00	1.90	4.00	64.00	6.00	0.10	4	15	2	5.005	5.175	5.556	5.999	FBK0504441
2.00	2.00	1.90	8.00	64.00	6.00	0.10	4	15	2	9.139	9.454	10.155	10.971	FBK0504442
2.00	2.00	1.90	12.00	64.00	6.00	0.10	4	15	2	13.274	13.733	14.755	15.944	FBK0504443
2.00	2.00	-	-	64.00	6.00	0.30	4	15	1	4.288	4.427	4.736	5.096	FBK0505805
2.00	2.00	1.90	4.00	64.00	6.00	0.30	4	15	2	4.998	5.162	5.526	5.950	FBK0504444
2.00	2.00	1.90	8.00	64.00	6.00	0.30	4	15	2	9.133	9.440	10.125	10.923	FBK0504445
2.00	2.00	1.90	12.00	64.00	6.00	0.30	4	15	2	13.267	13.719	14.725	15.895	FBK0504446
2.50	2.50	-	-	64.00	6.00	0.10	4	15	1	4.812	4.976	5.341	5.767	FBK0505806
2.50	2.50	2.40	5.00	64.00	6.00	0.10	4	15	2	6.038	6.245	6.706	7.242	FBK0505807
2.50	2.50	2.40	10.00	64.00	6.00	0.10	4	15	2	11.207	11.594	12.455	13.457	FBK0505808
2.50	2.50	2.40	15.00	64.00	6.00	0.10	4	15	2	16.375	16.942	18.204	19.673	FBK0505809
2.50	2.50	-	-	64.00	6.00	0.30	4	15	1	4.805	4.962	5.311	5.718	FBK0505810
2.50	2.50	2.40	5.00	64.00	6.00	0.30	4	15	2	6.032	6.231	6.676	7.193	FBK0505811
2.50	2.50	2.40	10.00	64.00	6.00	0.30	4	15	2	11.200	11.580	12.425	13.409	FBK0505812
2.50	2.50	2.40	15.00	64.00	6.00	0.30	4	15	2	16.368	16.928	18.174	19.625	FBK0505813
3.00	3.00	-	-	64.00	6.00	0.20	4	15	1	5.325	5.504	5.901	6.364	FBK0505814
3.00	3.00	2.90	6.00	64.00	6.00	0.20	4	15	2	7.069	7.308	7.841	8.461	FBK0504447
3.00	3.00	2.90	12.00	64.00	6.00	0.20	4	15	2	13.271	13.726	14.74	15.919	FBK0504448
3.00	3.00	2.90	18.00	64.00	6.00	0.20	4	15	2	19.473	20.144	21.639	23.378	FBK0504449
3.00	3.00	-	-	64.00	6.00	0.50	4	15	1	5.325	5.504	5.901	6.364	FBK0505815
3.00	3.00	2.90	6.00	64.00	6.00	0.50	4	15	2	7.058	7.287	7.796	8.388	FBK0504450
3.00	3.00	2.90	12.00	64.00	6.00	0.50	4	15	2	13.26	13.705	14.695	15.846	FBK0504451
3.00	3.00	2.90	18.00	64.00	6.00	0.50	4	15	2	19.462	20.123	21.594	23.305	FBK0504452
4.00	4.00	3.80	8.00	64.00	6.00	0.20	4	15	2	9.329	9.647	10.355	11.179	FBK0503544

Application data on page no 2.026

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4 Flute

Centre cutting high performance torus 4 flute for 55-70 HRc

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

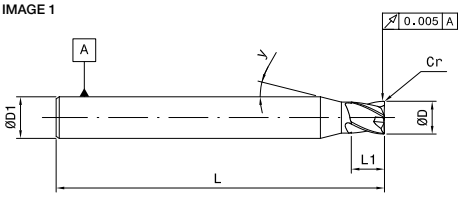


IMAGE 2

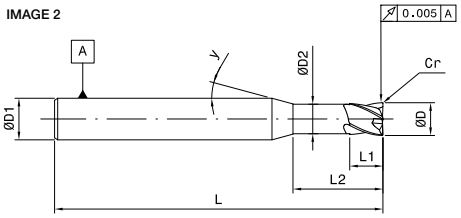
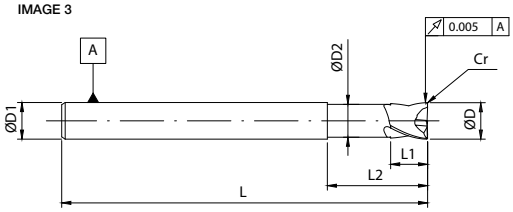


IMAGE 3



H3-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
4.00	4.00	3.80	16.00	64.00	6.00	0.20	4	15	2	17.598	18.204	19.554	∞	FBK0503545
4.00	4.00	3.80	24.00	64.00	6.00	0.20	4	15	2	25.867	26.762	28.753	∞	FBK0503546
4.00	4.00	3.80	8.00	64.00	6.00	0.50	4	15	2	9.319	9.626	10.31	11.106	FBK0503547
4.00	4.00	3.80	16.00	64.00	6.00	0.50	4	15	2	17.588	18.183	19.509	∞	FBK0503548
4.00	4.00	3.80	24.00	64.00	6.00	0.50	4	15	2	25.857	26.741	28.708	∞	FBK0503549
6.00	6.00	5.70	12.00	64.00	6.00	0.50	4	-	3	-	-	-	-	FBK0503550
6.00	6.00	5.70	24.00	64.00	6.00	0.50	4	-	3	-	-	-	-	FBK0503551
6.00	6.00	5.70	12.00	64.00	6.00	1.00	4	-	3	-	-	-	-	FBK0503538
6.00	6.00	5.70	24.00	64.00	6.00	1.00	4	-	3	-	-	-	-	FBK0503539
8.00	8.00	7.60	16.00	78.00	8.00	0.50	4	-	3	-	-	-	-	FBK0503554
8.00	8.00	7.60	32.00	78.00	8.00	0.50	4	-	3	-	-	-	-	FBK0503555
8.00	8.00	7.60	16.00	78.00	8.00	1.00	4	-	3	-	-	-	-	FBK0503556
8.00	8.00	7.60	32.00	78.00	8.00	1.00	4	-	3	-	-	-	-	FBK0503540
10.00	10.00	9.60	20.00	100.00	10.00	0.50	4	-	3	-	-	-	-	FBK0503558
10.00	10.00	9.60	40.00	100.00	10.00	0.50	4	-	3	-	-	-	-	FBK0503559
10.00	10.00	9.60	20.00	100.00	10.00	1.00	4	-	3	-	-	-	-	FBK0503560
10.00	10.00	9.60	40.00	100.00	10.00	1.00	4	-	3	-	-	-	-	FBK0503561
12.00	12.00	11.60	24.00	100.00	12.00	0.50	4	-	3	-	-	-	-	FBK0503562
12.00	12.00	11.60	48.00	100.00	12.00	0.50	4	-	3	-	-	-	-	FBK0503563
12.00	12.00	11.60	24.00	100.00	12.00	1.00	4	-	3	-	-	-	-	FBK0503564
12.00	12.00	11.60	48.00	100.00	12.00	1.00	4	-	3	-	-	-	-	FBK0503565

Remark ∞ means no collusion in projection length area

Application data on page no 2.026

Cutting parameters

Centre cutting high performance 4 flute for 55-70 HRc - 0.1 mm to 2.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																	
			Shoulder Milling	Profiling				Diameter in mm																	
								mm	0.1		0.2		0.4		0.5		0.6		0.8		1.0		1.5		2.0	
			ap 0.75D ae/D 2.5%	ap 0.75D ae/D 2.5%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	3	150	180	MQL/ COLD AIR	150	220	fz	0.002	0.007	0.004	0.010	0.006	0.013	0.007	0.015	0.009	0.018	0.009	0.018	0.015	0.025	0.020	0.035	0.030	0.050
		4	200	220	MQL/ COLD AIR	200	250	fz	0.002	0.007	0.004	0.010	0.006	0.013	0.007	0.015	0.009	0.018	0.009	0.018	0.015	0.025	0.020	0.035	0.030	0.050

Centre cutting high performance 4 flute for 55-70 HRc - 2.5 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																	
			Shoulder Milling	Profiling				Diameter in mm																	
								mm	2.5		3.0		4.0		5.0		6.0		8.0		10		12			
			ap 0.75D ae/D 2.5%	ap 0.75D ae/D 2.5%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max		
Hardened Steel	H	3	150	180	MQL/ COLD AIR	150	220	fz	0.035	0.055	0.040	0.060	0.050	0.080	0.060	0.110	0.065	0.125	0.080	0.130	0.085	0.135	0.100	0.140		
		4	200	220	MQL/ COLD AIR	200	250	fz	0.035	0.055	0.040	0.060	0.050	0.080	0.060	0.110	0.065	0.125	0.080	0.130	0.085	0.135	0.100	0.140		

Advantages

- Consistency of cutting speeds.
- Optimized performance.
- High productivity
- Ideal chipflow geometry
- Optimized for hardened steels

FBK0503554

Workpiece material: 1.2162
Hardness: 60 HRc

	Competitor	Totem
Ø	8mm	8mm
z	4 flutes	4 flutes
vc	25 m/min	200 m/min
n	995 rpm	7958 rpm
fz	0.038 mm/t	0.079 mm/t
vf	150 mm/min	2500 mm/min
ap	3 mm	3 mm
ae	0.25 mm	0.1 mm
Coolant	air	air

Q	0.11 mm^3/min	0.75 mm^3/min

Finishing application
6 times faster than competitor

FBK0505796

Workpiece material: Elmax hardened
Hardness: 62 HRc

	Competitor	Totem
Ø	1.5 mm	1.5 mm
z	4 teeth	2 teeth
vc	85 m/min	85 m/min
n	18000 rpm	18000 rpm
fz	0.02 mm/t	0.023 mm/t
vf	1440 mm/min	828 mm/min
ap	0.65 mm	0.65 mm
ae	0.04 mm	0.04 mm
Coolant	MMS	MMS

Q	21.52 mm^3/min	37.44 mm^3/min

Finishing application
42% Higher MRR

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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Multi Flute

Centre cutting high performance multi flute finisher for 55-70 HRc

HPM HSM | 6-16 | 45° | f7 | 6535 HA | h5 | TiAlN

Regular

Extra Teeth

H3-H4

IMAGE 1

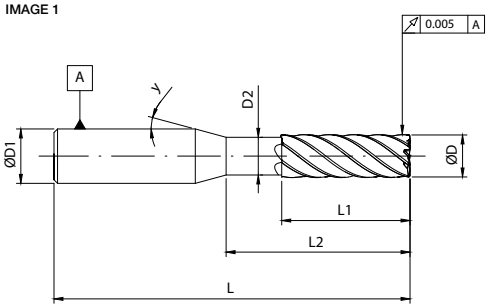
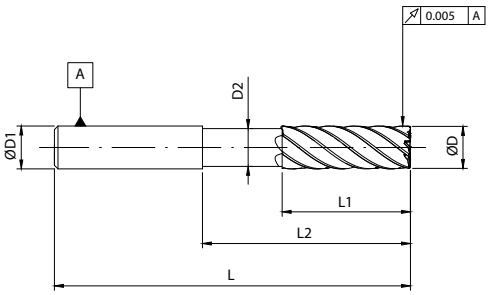


IMAGE 2



Regular

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
3.00	8.00	2.90	15.00	64.00	6.00	-	6	15	1	FBK0503566
4.00	10.00	3.80	16.00	64.00	6.00	-	6	15	1	FBK0503567
5.00	12.00	4.70	18.00	64.00	6.00	-	6	15	1	FBK0503568
6.00	14.00	5.60	20.00	64.00	6.00	-	6	-	2	FBK0503569
8.00	18.00	7.60	25.00	78.00	8.00	-	6	-	2	FBK0503570
10.00	22.00	9.40	30.00	78.00	10.00	-	6	-	2	FBK0503571
12.00	26.00	11.40	35.00	89.00	12.00	-	6	-	2	FBK0503572
16.00	34.00	15.40	40.00	89.00	16.00	-	6	-	2	FBK0504453
20.00	42.00	19.40	48.00	102.00	20.00	-	8	-	2	FBK0504454

Also available with extra teeth for higher productivity

Extra Teeth

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
8.00	18.00	7.60	25.00	78.00	8.00	-	8	-	2	FBK0504455
10.00	22.00	9.40	30.00	78.00	10.00	-	10	-	2	FBK0504456
12.00	26.00	11.40	35.00	89.00	12.00	-	12	-	2	FBK0504457
16.00	34.00	15.40	40.00	89.00	16.00	-	16	-	2	FBK0504458

Remark ∞ means no collusion in projection length area

Application data on page no 2.029

Multi Flute

Centre cutting high performance multi flute finisher with corner radius for 55-70 HRc

HPM HSM | 6-16 | 45° | f7 | 6535 HA | h5 | TiAlN

Regular

Extra Teeth

IMAGE 1

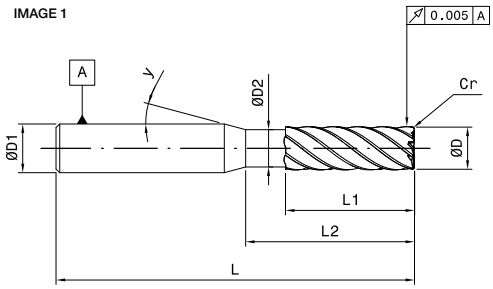
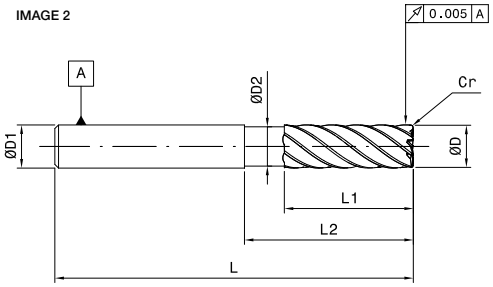


IMAGE 2



H3-H4

Regular

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
3.00	8.00	2.90	15.00	64.00	6.00	0.30	6	15	1	FBK0504459
4.00	10.00	3.80	16.00	64.00	6.00	0.30	6	15	1	FBK0504460
5.00	12.00	4.70	18.00	64.00	6.00	0.30	6	15	1	FBK0504461
5.00	12.00	4.70	18.00	64.00	6.00	0.50	6	15	1	FBK0504462
6.00	14.00	5.60	20.00	64.00	6.00	0.50	6	-	2	FBK0504463
6.00	14.00	5.60	20.00	64.00	6.00	1.00	6	-	2	FBK0504464
8.00	18.00	7.40	25.00	70.00	8.00	0.50	6	-	2	FBK0504465
8.00	18.00	7.40	25.00	70.00	8.00	1.00	6	-	2	FBK0503542
10.00	22.00	9.40	30.00	78.00	10.00	0.50	6	-	2	FBK0504466
10.00	22.00	9.40	30.00	78.00	10.00	1.00	6	-	2	FBK0503543
10.00	22.00	9.40	30.00	78.00	10.00	1.50	6	-	2	FBK0504467
12.00	26.00	11.40	35.00	78.00	12.00	0.50	6	-	2	FBK0503573
12.00	26.00	11.40	35.00	78.00	12.00	1.00	6	-	2	FBK0504468
12.00	26.00	11.40	35.00	78.00	12.00	2.00	6	-	2	FBK0504469
16.00	34.00	15.40	40.00	89.00	16.00	1.00	6	-	2	FBK0504470
16.00	34.00	15.40	40.00	89.00	16.00	2.00	6	-	2	FBK0504471
20.00	42.00	19.40	48.00	102.00	20.00	1.00	8	-	2	FBK0504472
20.00	42.00	19.40	48.00	102.00	20.00	2.00	8	-	2	FBK0504473

Also available with extra teeth for higher productivity

Extra Teeth

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
8.00	18.00	7.60	25.00	78.00	8.00	0.50	8	-	2	FBK0504474
10.00	22.00	9.40	30.00	78.00	10.00	0.50	10	-	2	FBK0504475
12.00	26.00	11.40	35.00	89.00	12.00	0.50	12	-	2	FBK0504476
16.00	34.00	15.40	40.00	89.00	16.00	0.50	16	-	2	FBK0504477

Remark ∞ means no collusion in projection length area

Application data on page no 2.029

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Cutting parameters

- Centre cutting high performance multi flute finisher for 55-70 HRc - 3.0 mm to 8.0 mm
- Centre cutting high performance multi flute finisher with corner radius for 55-70 HRc - 3.0 mm to 8.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling			Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
									Diameter in mm											
									mm	3.0		4.0		5.0		6.0		8.0		
			ap 2D ae/D 1.5%	ap 1.5D ae/D 2%	ap 1D ae/D 2%		min	max	Range	min	max	min	max	min	max	min	max	min	max	
Hardened Steel	H	3	66	77	110	MQL/ COLD AIR	110	170	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	60.000	0.080	
		4	48	56	80	MQL/ COLD AIR	80	140	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	60.000	0.080	

- Centre cutting high performance multi flute finisher for 55-70 HRc - 10.0 mm to 20.0 mm
- Centre cutting high performance multi flute finisher with corner radius for 55-70 HRc - 10.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling			Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)										
									Diameter in mm										
									mm	10		12		16		20			
			ap 2D ae/D 1.5%	ap 1.5D ae/D 2%	ap 1D ae/D 2%		min	max	Range	min	max	min	max	min	max	min	max		
Hardened Steel	H	3	66	77	110	MQL/ COLD AIR	110	170	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
		4	48	56	80	MQL/ COLD AIR	80	140	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Multi flute finisher

Multi flute finisher with extra teeth

Multi flute finisher with corner radius

Multi flute finisher with corner radius and extra teeth

End mills for hardened steels 45-70 HRc

An optimized combination between geometry, coating and tolerances result in an excellent surface finish and extended toollife.

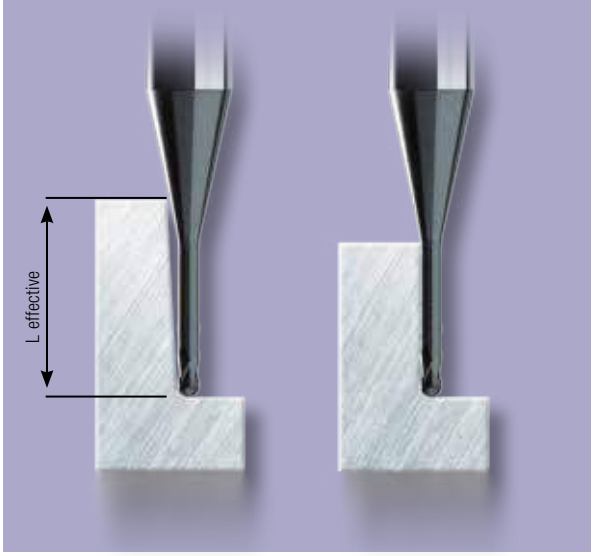
Program

- Centre cutting high performance ball nose 2 flute for 45-70 HRc
- Centre cutting high performance ball nose 4 flute for 45-70 HRc
- Centre cutting high performance torus 2 flute for 45-70 HRc
- Centre cutting high performance torus 4 flute for 45-70 HRc
- Centre cutting high performance multi flute finisher for 45-70 HRc
- Centre cutting high performance multi flute finisher with corner radius for 45-70 HRc
- Centre cutting high performance torus cutter for high feed machining
- Centre cutting high performance 2 flute micro end mill
- Centre cutting high performance 4 flute micro end mill
- Centre cutting high performance 2 flute micro end mill with corner radius
- Centre cutting high performance 4 flute micro end mill with corner radius
- Centre cutting high performance 2 flute micro ball nose

Ballnose geometries

- Special designed center
- Smooth surface finish
- Optimized coating for tool life improvement

Effective length compared with incline angle-
Increases the effective length



FBK0503554

Workpiece material: 1.2162
Hardness: 60 HRc

	Competitor	Totem
Ø	8mm	8mm
z	4 flutes	4 flutes
vc	25 m/min	200 m/min
n	995 rpm	7958 rpm
fz	0.038 mm/t	0.079 mm/t
vf	150 mm/min	2500 mm/min
ap	3 mm	3 mm
ae	0.25 mm	0.1 mm
Coolant	air	air

Q	0.11 mm^3/min	0.75 mm^3/min

Higher productivity

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2 Flute

Centre cutting high performance ball nose 2 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P5-P6

H1-H4

IMAGE 1

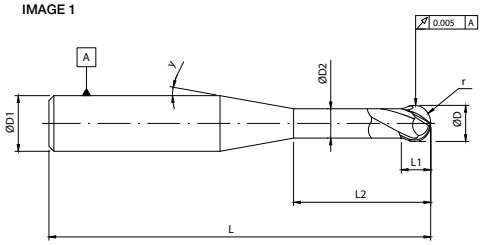
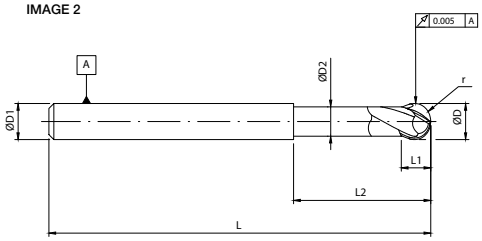


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
1.00	2.00	0.90	4.00	64.00	6.00	0.50	2	7	1	FBK0504478
1.00	2.00	0.90	4.00	78.00	6.00	0.50	2	4	1	FBK0504479
1.50	2.00	1.40	4.00	64.00	6.00	0.80	2	6	1	FBK0504480
1.50	2.00	1.40	4.00	78.00	6.00	0.80	2	4	1	FBK0504481
2.00	3.00	1.90	5.00	64.00	6.00	1.00	2	6	1	FBK0504482
2.00	3.00	1.90	8.00	64.00	6.00	1.00	2	9	1	FBK0505816
2.00	3.00	1.90	8.00	78.00	6.00	1.00	2	4	1	FBK0505817
2.00	3.00	1.90	15.00	78.00	6.00	1.00	2	5	1	FBK0504483
3.00	4.00	2.90	7.00	64.00	6.00	1.50	2	5	1	FBK0504484
3.00	4.00	2.90	15.00	78.00	6.00	1.50	2	4	1	FBK0504485
3.00	4.00	2.90	7.00	100.00	6.00	1.50	2	2	1	FBK0504486
4.00	5.00	3.80	8.00	64.00	6.00	2.00	2	4	1	FBK0504487
4.00	5.00	3.80	15.00	78.00	6.00	2.00	2	3	1	FBK0504488
4.00	5.00	3.80	8.00	100.00	6.00	2.00	2	1	1	FBK0504489
5.00	5.00	4.70	10.00	64.00	6.00	2.50	2	2	1	FBK0504490
5.00	5.00	4.70	20.00	78.00	6.00	2.50	2	2	1	FBK0504491
6.00	6.00	5.60	25.00	64.00	6.00	3.00	2	-	2	FBK0504492
6.00	6.00	5.60	35.00	78.00	6.00	3.00	2	-	2	FBK0504493
6.00	6.00	5.60	25.00	100.00	8.00	3.00	2	2	1	FBK0504494
8.00	8.00	7.40	25.00	64.00	8.00	4.00	2	-	2	FBK0504495
8.00	8.00	7.40	35.00	78.00	8.00	4.00	2	-	2	FBK0504496
8.00	8.00	7.40	50.00	100.00	8.00	4.00	2	-	2	FBK0504497
8.00	8.00	7.40	30.00	120.00	10.00	4.00	2	2	1	FBK0504498
10.00	10.00	9.40	35.00	78.00	10.00	5.00	2	-	2	FBK0504499
10.00	10.00	9.40	55.00	100.00	10.00	5.00	2	-	2	FBK0504500
10.00	10.00	9.40	30.00	120.00	12.00	5.00	2	2	1	FBK0504501
12.00	12.00	11.40	35.00	78.00	12.00	6.00	2	-	2	FBK0504502
12.00	12.00	11.40	55.00	100.00	12.00	6.00	2	-	2	FBK0504503
12.00	12.00	11.40	40.00	120.00	16.00	6.00	2	5	1	FBK0504504
16.00	20.00	15.40	50.00	100.00	16.00	8.00	2	-	2	FBK0504505
16.00	20.00	15.40	100.00	150.00	16.00	8.00	2	-	2	FBK0504506

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.033

4 Flute

Centre cutting high performance ball nose 4 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

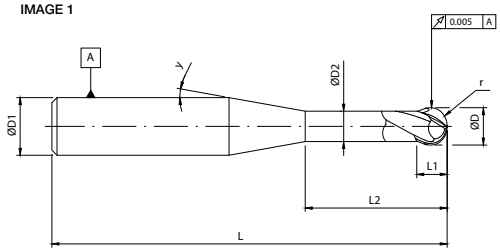
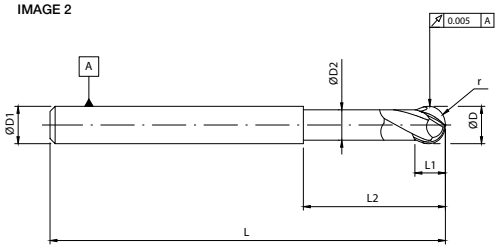


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
6.00	6.00	5.60	25.00	64.00	6.00	3.00	4	-	2	FBK0504511
6.00	6.00	5.60	35.00	78.00	6.00	3.00	4	-	2	FBK0504512
6.00	6.00	5.60	25.00	100.00	8.00	3.00	4	2	1	FBK0504513
8.00	8.00	7.40	25.00	64.00	8.00	4.00	4	-	2	FBK0504514
8.00	8.00	7.40	35.00	78.00	8.00	4.00	4	-	2	FBK0504515
8.00	8.00	7.40	50.00	100.00	8.00	4.00	4	-	2	FBK0504516
8.00	8.00	7.40	30.00	120.00	10.00	4.00	4	2	1	FBK0504517
10.00	10.00	9.40	35.00	78.00	10.00	5.00	4	-	2	FBK0504518
10.00	10.00	9.40	55.00	100.00	10.00	5.00	4	-	2	FBK0504519
10.00	10.00	9.40	30.00	120.00	12.00	5.00	4	2	1	FBK0504520
12.00	12.00	11.40	35.00	78.00	12.00	6.00	4	-	2	FBK0504521
12.00	12.00	11.40	55.00	100.00	12.00	6.00	4	-	2	FBK0504522
12.00	12.00	11.40	40.00	120.00	16.00	6.00	4	5	1	FBK0504523
16.00	20.00	15.40	50.00	100.00	16.00	8.00	4	-	2	FBK0504524
16.00	20.00	15.40	100.00	150.00	16.00	8.00	4	-	2	FBK0504525

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.033

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Cutting parameters

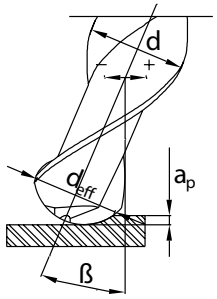
- Centre cutting high performance ball nose 2 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm
- Centre cutting high performance ball nose 4 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling Rough Milling	Cutting Speed (Vc) m/min: Profile Milling Finish Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
									Diameter in mm										
						mm			1.0		1.5		2.0		3.0		4.0		5.0	
			ap 1D ae/D 30%	ap 1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	150	180	Emulsion	150	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		6	120	150		120	200	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
			ap 0.5D ae/D 5%	ap 0.5D ae/D 2%		Cutting Speed (Vc) m/min		mm	1.0		1.5		2.0		3.0		4.0		5.0	
						min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	1	120	150	MQL/ Cold Air	120	180	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		2	150	180		150	200	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		3	200	220		200	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		4	200	220		200	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050

- Centre cutting high performance ball nose 2 flute for 45-70 HRc (Roughing+ Finishing) - 6.0 mm to 16.0 mm
- Centre cutting high performance ball nose 4 flute for 45-70 HRc (Roughing+ Finishing) - 6.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling Rough Milling	Cutting Speed (Vc) m/min: Profile Milling Finish Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
									Diameter in mm										
						mm			6.0		8.0		10.0		12.0		16.0		
			ap 1D ae/D 30%	ap 1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	
Steel	P	5	150	180	Emulsion	150	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	
		6	120	150		120	200	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	
			ap 0.5D ae/D 5%	ap 0.5D ae/D 2%		Cutting Speed (Vc) m/min		mm	6.0		8.0		10.0		12.0		16.0		
						min	max	Range	min	max	min	max	min	max	min	max	min	max	
Hardened Steel	H	1	120	150	MQL/ Cold Air	120	180	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	
		2	150	180		150	200	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	
		3	200	220		200	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	
		4	200	220		200	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110	

#RPM = Vc x 318.057/Tool Dia. #mm/min = RPM x number of teeth x mm/tooth



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D\text{-}ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D\text{-}2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

2 Flute

Centre cutting high performance torus 2 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P5-P6

H1-H4

IMAGE 1

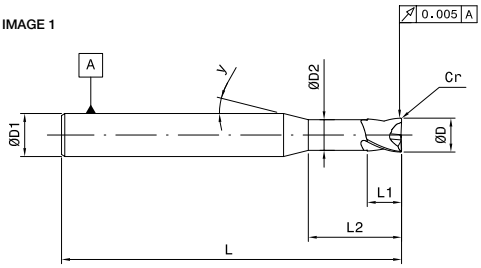
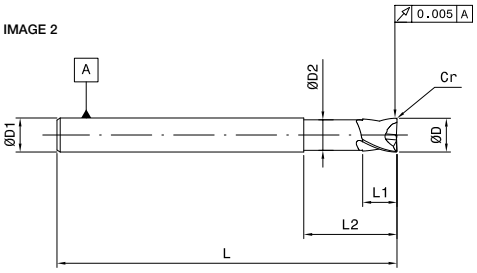


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
1.50	2.00	1.40	5.00	64.00	6.00	0.30	2	7	1	FBK0504534
1.50	2.00	1.40	10.00	64.00	6.00	0.30	2	9	1	FBK0504535
2.00	3.00	1.90	5.00	64.00	6.00	0.50	2	6	1	FBK0504536
2.00	3.00	1.90	8.00	64.00	6.00	0.50	2	7	1	FBK0505818
2.00	3.00	1.90	10.00	64.00	6.00	0.50	2	8	1	FBK0504537
2.00	3.00	1.90	15.00	78.00	6.00	0.50	2	5	1	FBK0504538
2.00	3.00	1.90	8.00	78.00	6.00	0.50	2	4	1	FBK0505819
3.00	4.00	2.90	7.00	64.00	6.00	0.50	2	5	1	FBK0504539
3.00	4.00	2.90	15.00	78.00	6.00	0.50	2	4	1	FBK0504540
4.00	5.00	3.80	8.00	64.00	6.00	0.50	2	4	1	FBK0504541
4.00	5.00	3.80	8.00	64.00	6.00	1.00	2	4	1	FBK0504542
4.00	5.00	3.80	15.00	78.00	6.00	0.50	2	3	1	FBK0504543
4.00	5.00	3.80	15.00	78.00	6.00	1.00	2	3	1	FBK0504544
5.00	5.00	4.70	10.00	64.00	6.00	0.50	2	3	1	FBK0504545
5.00	5.00	4.70	10.00	64.00	6.00	1.00	2	3	1	FBK0504546
5.00	5.00	4.70	20.00	78.00	6.00	0.50	2	3	1	FBK0504547
5.00	5.00	4.70	20.00	78.00	6.00	1.00	2	2	1	FBK0504548
6.00	6.00	5.60	25.00	64.00	6.00	0.50	2	-	2	FBK0504549
6.00	6.00	5.60	25.00	64.00	6.00	1.00	2	-	2	FBK0504550
6.00	6.00	5.60	25.00	64.00	6.00	1.50	2	-	2	FBK0504551
6.00	6.00	5.60	35.00	78.00	6.00	0.50	2	-	2	FBK0504552
6.00	6.00	5.60	35.00	78.00	6.00	1.00	2	-	2	FBK0504553
6.00	6.00	5.60	35.00	78.00	6.00	1.50	2	-	2	FBK0504554
6.00	6.00	5.60	25.00	100.00	8.00	0.50	2	2	1	FBK0504555
6.00	6.00	5.60	25.00	100.00	8.00	1.00	2	2	1	FBK0504556

Application data on page no 2.038

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2 Flute

Centre cutting high performance torus 2 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

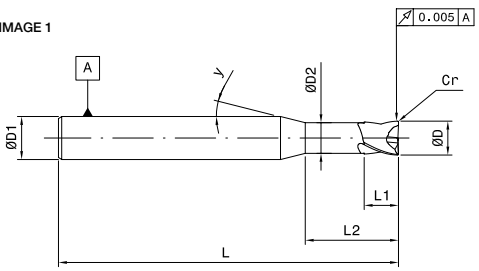
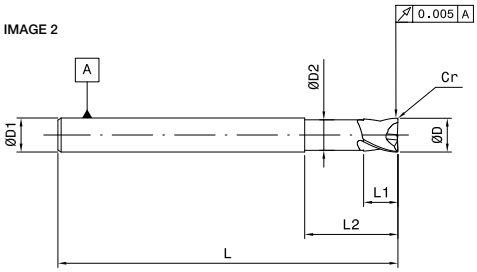


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
6.00	6.00	5.60	25.00	100.00	8.00	1.50	2	2	1	FBK0504557
8.00	8.00	7.40	25.00	64.00	8.00	0.50	2	-	2	FBK0504558
8.00	8.00	7.40	25.00	64.00	8.00	1.00	2	-	2	FBK0504559
8.00	8.00	7.40	25.00	64.00	8.00	2.00	2	-	2	FBK0504560
8.00	8.00	7.40	25.00	78.00	8.00	0.50	2	-	2	FBK0504561
8.00	8.00	7.40	35.00	78.00	8.00	1.00	2	-	2	FBK0504562
8.00	8.00	7.40	35.00	78.00	8.00	2.00	2	-	2	FBK0504563
8.00	8.00	7.40	50.00	100.00	8.00	1.00	2	-	2	FBK0504564
8.00	8.00	7.40	50.00	100.00	8.00	2.00	2	-	2	FBK0504565
8.00	8.00	7.40	30.00	120.00	10.00	1.00	2	2	1	FBK0504566
8.00	8.00	7.40	30.00	120.00	10.00	2.00	2	2	1	FBK0504567
10.00	10.00	9.40	35.00	78.00	10.00	0.50	2	-	2	FBK0504568
10.00	10.00	9.40	35.00	78.00	10.00	1.00	2	-	2	FBK0504569
10.00	10.00	9.40	35.00	78.00	10.00	2.00	2	-	2	FBK0504570
10.00	10.00	9.40	55.00	100.00	10.00	1.00	2	-	2	FBK0504571
10.00	10.00	9.40	55.00	100.00	10.00	2.00	2	-	2	FBK0504572
10.00	10.00	9.40	30.00	120.00	12.00	2.00	2	2	1	FBK0504573
12.00	12.00	11.40	35.00	78.00	12.00	0.50	2	-	2	FBK0504574
12.00	12.00	11.40	35.00	78.00	12.00	2.00	2	-	2	FBK0504575
12.00	12.00	11.40	55.00	100.00	12.00	1.00	2	-	2	FBK0504576
12.00	12.00	11.40	55.00	100.00	12.00	2.00	2	-	2	FBK0504577
12.00	12.00	11.40	40.00	120.00	16.00	2.00	2	5	1	FBK0504578
16.00	20.00	15.40	50.00	100.00	16.00	3.50	2	-	2	FBK0504579
16.00	20.00	15.40	100.00	150.00	16.00	3.50	2	-	2	FBK0504580

Application data on page no 2.038

4 Flute

Centre cutting high performance torus 4 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

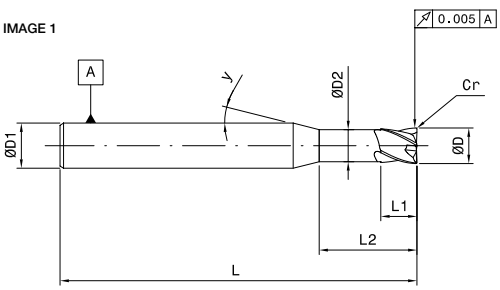
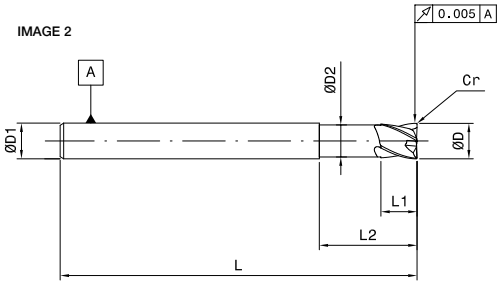


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
3.00	4.00	2.90	7.00	64.00	6.00	0.5	4	5	1	FBK0505820
3.00	4.00	2.90	15.00	78.00	6.00	0.5	4	4	1	FBK0505821
4.00	5.00	3.80	8.00	64.00	6.00	0.5	4	4	1	FBK0505822
4.00	5.00	3.80	8.00	64.00	6.00	1	4	4	1	FBK0505823
4.00	5.00	3.80	15.00	78.00	6.00	0.5	4	3	1	FBK0505824
4.00	5.00	3.80	15.00	78.00	6.00	1	4	3	1	FBK0505825
5.00	5.00	4.70	10.00	64.00	6.00	0.5	4	2	1	FBK0505826
5.00	5.00	4.70	10.00	64.00	6.00	1	4	2	1	FBK0505827
5.00	5.00	4.70	20.00	78.00	6.00	0.5	4	2	1	FBK0505828
5.00	5.00	4.70	20.00	78.00	6.00	1	4	2	1	FBK0505829
6.00	6.00	5.60	25.00	64.00	6.00	0.5	4	-	2	FBK0504581
6.00	6.00	5.60	25.00	64.00	6.00	1	4	-	2	FBK0504582
6.00	6.00	5.60	25.00	64.00	6.00	1.5	4	-	2	FBK0504583
6.00	6.00	5.60	35.00	78.00	6.00	0.5	4	-	2	FBK0504584
6.00	6.00	5.60	35.00	78.00	6.00	1.5	4	-	2	FBK0504585
6.00	6.00	5.60	25.00	100.00	8.00	0.5	4	2	1	FBK0504586
6.00	6.00	5.60	25.00	100.00	8.00	1.5	4	2	1	FBK0504587
8.00	8.00	7.40	25.00	64.00	8.00	0.5	4	-	2	FBK0504588
8.00	8.00	7.40	25.00	64.00	8.00	1	4	-	2	FBK0504589
8.00	8.00	7.40	25.00	64.00	8.00	2	4	-	2	FBK0504590

Application data on page no 2.038

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4 Flute

Centre cutting high performance torus 4 flute for 45-70 HRc

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

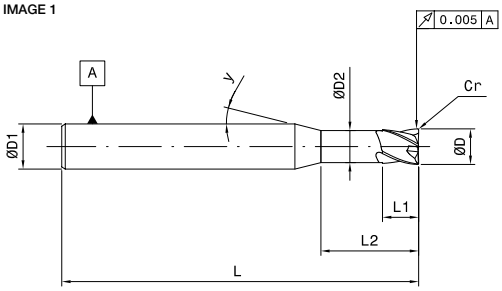
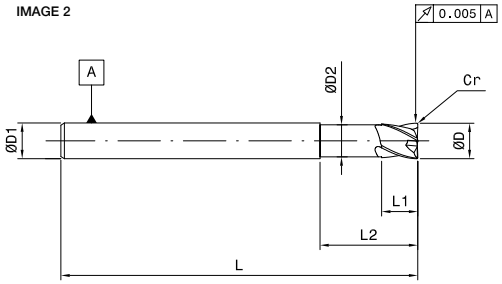


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
8.00	8.00	7.40	25.00	78.00	8.00	0.5	4	-	2	FBK0504591
8.00	8.00	7.40	35.00	78.00	8.00	1	4	-	2	FBK0504592
8.00	8.00	7.40	35.00	78.00	8.00	2	4	-	2	FBK0504593
8.00	8.00	7.40	50.00	100.00	8.00	0.5	4	-	2	FBK0505830
8.00	8.00	7.40	50.00	100.00	8.00	1	4	-	2	FBK0504594
8.00	8.00	7.40	50.00	100.00	8.00	2	4	-	2	FBK0504595
8.00	8.00	7.40	30.00	120.00	10.00	1	4	-	2	FBK0504596
8.00	8.00	7.40	30.00	120.00	10.00	2	4	2	1	FBK0504597
10.00	10.00	9.40	35.00	78.00	10.00	0.5	4	2	1	FBK0504598
10.00	10.00	9.40	35.00	78.00	10.00	2	4	-	2	FBK0504599
10.00	10.00	9.40	55.00	100.00	10.00	1	4	-	2	FBK0504600
10.00	10.00	9.40	55.00	100.00	10.00	2	4	-	2	FBK0504601
10.00	10.00	9.40	30.00	120.00	12.00	2	4	-	2	FBK0504602
12.00	12.00	11.40	35.00	78.00	12.00	0.5	4	2	1	FBK0504603
12.00	12.00	11.40	35.00	78.00	12.00	2	4	-	2	FBK0504604
12.00	12.00	11.40	55.00	100.00	12.00	1	4	-	2	FBK0504605
12.00	12.00	11.40	55.00	100.00	12.00	2	4	-	2	FBK0504606
12.00	12.00	11.40	40.00	120.00	16.00	2	4	-	2	FBK0504607
16.00	20.00	15.40	50.00	100.00	16.00	3.5	4	5	1	FBK0504608
16.00	20.00	15.40	100.00	150.00	16.00	3.5	4	-	2	FBK0504609

Application data on page no 2.038

Cutting parameters

- Centre cutting high performance torus 2 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm
- Centre cutting high performance torus 4 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
			Shoulder Milling (Rough Milling)	Profile Milling (Finish Milling)				Diameter in mm											
								mm	1.0		1.5		2.0		3.0		4.0		5.0	
			ap 1D ae/D 30%	ap 1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	150	180	Emulsion	150	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		6	120	150		120	200	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
			ap 0.5D ae/D 5%	ap 0.5D ae/D 2%		Cutting Speed (Vc) m/min		mm	1.0		1.5		2.0		3.0		4.0		5.0	
						min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	1	120	150	MQL/ Cold Air	120	180	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		2	150	180		150	200	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		3	200	220		200	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050
		4	200	220		200	250	fz	0.015	0.025	0.020	0.030	0.025	0.035	0.028	0.040	0.030	0.045	0.035	0.050

- Centre cutting high performance torus 2 flute for 45-70 HRc (Roughing+ Finishing) - 6.0 mm to 16.0 mm
- Centre cutting high performance torus 4 flute for 45-70 HRc (Roughing+ Finishing) - 6.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
			Shoulder Milling (Rough Milling)	Profile Milling (Finish Milling)				Diameter in mm											
								mm	6.0		8.0		10.0		12.0		16.0			
			ap 1D ae/D 30%	ap 1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	150	180	Emulsion	150	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		
		6	120	150		120	200	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		
			ap 0.5D ae/D 5%	ap 0.5D ae/D 2%		Cutting Speed (Vc) m/min		mm	6.0		8.0		10.0		12.0		16.0			
						min	max	Range	min	max	min	max	min	max	min	max	min	max		
Hardened Steel	H	1	120	150	MQL/ Cold Air	120	180	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		
		2	150	180		150	200	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		
		3	200	220		200	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		
		4	200	220		200	250	fz	0.040	0.055	0.050	0.065	0.055	0.080	0.065	0.090	0.075	0.110		

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Tips:

Radial runout determines tool life
- Our tools are manufactured with precison tolerance

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Multi Flute

Centre cutting high performance multi flute finisher for 45-70 HRc

HPM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

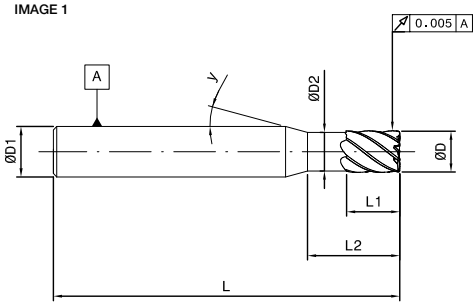
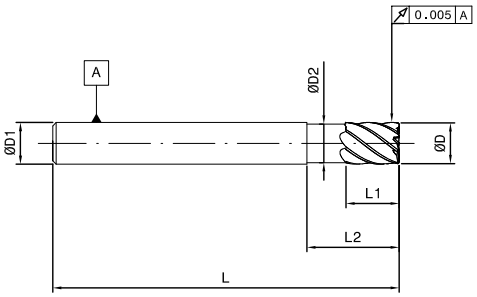


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Short										
3.00	3.00	2.90	10.00	64.00	6.00	-	6	15	1	FBK0504610
4.00	4.00	3.80	10.00	64.00	6.00	-	6	15	1	FBK0504611
5.00	5.00	4.70	15.00	64.00	6.00	-	6	15	1	FBK0504612
6.00	6.00	5.60	20.00	64.00	6.00	-	6	-	2	FBK0504613
8.00	8.00	7.40	20.00	64.00	8.00	-	6	-	2	FBK0504614
10.00	10.00	9.40	25.00	70.00	10.00	-	6	-	2	FBK0504615
12.00	12.00	11.40	25.00	78.00	12.00	-	6	-	2	FBK0504616
16.00	16.00	15.40	35.00	89.00	16.00	-	6	-	2	FBK0504617
20.00	20.00	19.40	40.00	102.00	20.00	-	8	-	2	FBK0504618

Application data on page no 2.041

Multi Flute

Centre cutting high performance multi flute finisher for 45-70 HRc

HPM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

P5-P6

H1-H4

IMAGE 1

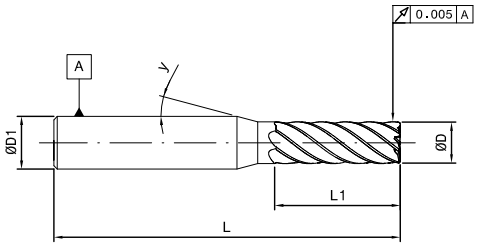
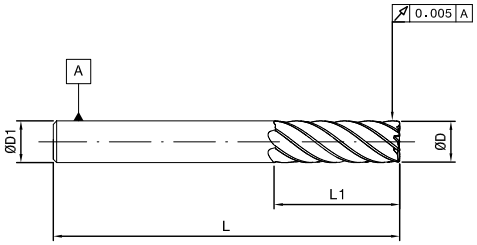


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Standard										
3.00	10.00	-	-	64.00	6.00	-	6	15	1	FBK0504619
4.00	10.00	-	-	64.00	6.00	-	6	15	1	FBK0504620
5.00	15.00	-	-	64.00	6.00	-	6	15	1	FBK0504621
6.00	20.00	-	-	64.00	6.00	-	6	15	1	FBK0504622
8.00	20.00	-	-	64.00	8.00	-	6	-	2	FBK0504623
10.00	25.00	-	-	70.00	10.00	-	6	-	2	FBK0504624
12.00	25.00	-	-	78.00	12.00	-	6	-	2	FBK0504625
16.00	30.00	-	-	89.00	16.00	-	6	-	2	FBK0504626
20.00	40.00	-	-	102.00	20.00	-	8	-	2	FBK0504627

Application data on page no 2.041

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Cutting parameters

Centre cutting high performance multi flute finisher for 45-70 HRc - 3.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling (Finish Milling)  ap 2D ae/D 10%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																	
							Diameter in mm																	
							mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0		16.0		20.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	130	Emulsion	130	180	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140
		6	100		100	160	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140
			ap 2D ae/D 1%		Cutting Speed (Vc) m/min		mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0		16.0		20.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	1	150	MQL/ Cold Air	150	200	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140
		2	120		120	180	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140
		3	80		80	150	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140
		4	80		80	150	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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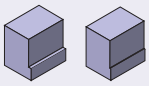
Multi Flute

Centre cutting high performance multi flute finisher with corner radius for 45-70 HRc



HPM HSM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

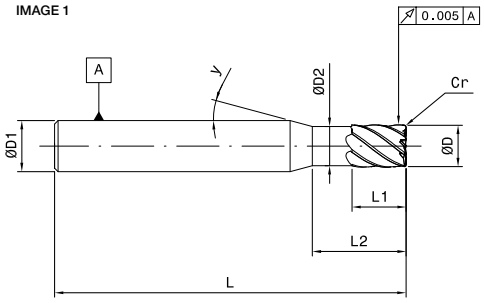
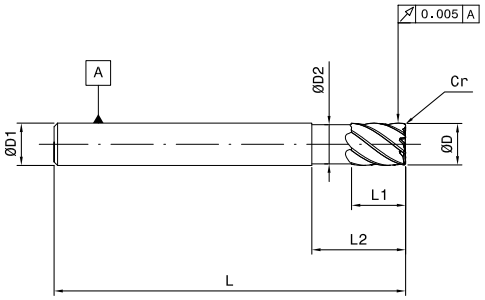


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Short										
3.00	3.00	2.90	10.00	64.00	6.00	0.30	6	15	1	FBK0504632
4.00	4.00	3.80	10.00	64.00	6.00	0.30	6	15	1	FBK0504633
5.00	5.00	4.70	15.00	64.00	6.00	0.30	6	15	1	FBK0504634
5.00	5.00	4.70	15.00	64.00	6.00	0.50	6	15	1	FBK0504635
6.00	6.00	5.60	20.00	64.00	6.00	0.50	6	-	2	FBK0504636
6.00	6.00	5.60	20.00	64.00	6.00	1.00	6	-	2	FBK0504637
8.00	8.00	7.40	20.00	64.00	8.00	0.50	6	-	2	FBK0504638
8.00	8.00	7.40	20.00	64.00	8.00	1.00	6	-	2	FBK0504639
10.00	10.00	9.40	25.00	70.00	10.00	0.50	6	-	2	FBK0504640
10.00	10.00	9.40	25.00	70.00	10.00	1.00	6	-	2	FBK0504641
10.00	10.00	9.40	25.00	70.00	10.00	1.50	6	-	2	FBK0504642
12.00	12.00	11.40	25.00	78.00	12.00	0.50	6	-	2	FBK0504643
12.00	12.00	11.40	25.00	78.00	12.00	1.00	6	-	2	FBK0504644
12.00	12.00	11.40	25.00	78.00	12.00	2.00	6	-	2	FBK0504645
16.00	16.00	15.40	35.00	89.00	16.00	1.00	6	-	2	FBK0504646
16.00	16.00	15.40	35.00	89.00	16.00	2.00	6	-	2	FBK0504647
20.00	20.00	19.40	40.00	102.00	20.00	1.00	8	-	2	FBK0504648
20.00	20.00	19.40	40.00	102.00	20.00	2.00	8	-	2	FBK0504649

Application data on page no 2.044

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Multi Flute

Centre cutting high performance multi flute finisher with corner radius for 45-70 HRc

HPM HSM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

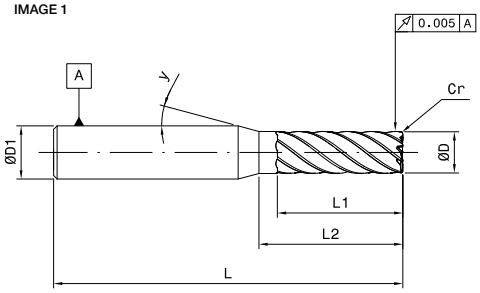
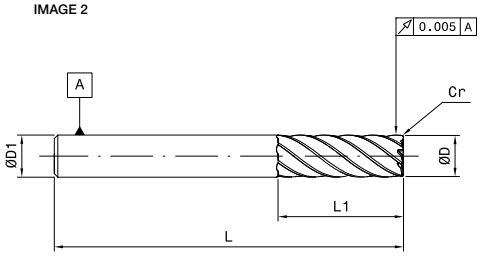


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Standard										
3.00	10.00	-	-	64.00	6.00	0.30	6	15	1	FBK0504650
4.00	10.00	-	-	64.00	6.00	0.30	6	15	1	FBK0504651
5.00	15.00	-	-	64.00	6.00	0.30	6	15	1	FBK0504652
5.00	15.00	-	-	64.00	6.00	0.50	6	15	1	FBK0504653
6.00	20.00	-	-	64.00	6.00	0.50	6	-	2	FBK0504654
6.00	20.00	-	-	64.00	6.00	1.00	6	-	2	FBK0504655
8.00	20.00	-	-	64.00	8.00	0.50	6	-	2	FBK0504656
8.00	20.00	-	-	64.00	8.00	1.00	6	-	2	FBK0504657
10.00	25.00	-	-	70.00	10.00	0.50	6	-	2	FBK0504658
10.00	25.00	-	-	70.00	10.00	1.00	6	-	2	FBK0504659
10.00	25.00	-	-	70.00	10.00	1.50	6	-	2	FBK0504660
12.00	25.00	-	-	78.00	12.00	0.50	6	-	2	FBK0504661
12.00	25.00	-	-	78.00	12.00	1.00	6	-	2	FBK0504662
12.00	25.00	-	-	78.00	12.00	2.00	6	-	2	FBK0504663
16.00	35.00	-	-	89.00	16.00	1.00	6	-	2	FBK0504664
16.00	35.00	-	-	89.00	16.00	2.00	6	-	2	FBK0504665
20.00	40.00	-	-	102.00	20.00	1.00	8	-	2	FBK0504666
20.00	40.00	-	-	102.00	20.00	2.00	8	-	2	FBK0504667

Application data on page no 2.044

Cutting parameters

Centre cutting high performance multi flute finisher with corner radius for 45-70 HRc - 3.0 mm to 8.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling, Semi Finish Milling	Cutting Speed (Vc) m/min: Shoulder Milling, Finish Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)									
								Diameter in mm									
						mm		3.0		4.0		5.0		6.0		8.0	
			ap 2D ae/D 10%	ap 2D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max
Steel	P	5	130	155	Emulsion	130	180	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080
		6	100	125		100	160	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080
			ap 2D ae/D 1%	ap 2D ae/D 1%		Cutting Speed (Vc) m/min		mm	3.0		4.0		5.0		6.0		8.0	
						min	max	Range	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H	1	150	180	MQL/ Cold Air	150	200	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080
		2	120	150		120	180	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080
		3	80	110		80	150	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080
		4	80	110		80	150	fz	0.020	0.035	0.030	0.045	0.035	0.055	0.045	0.065	0.060	0.080

Centre cutting high performance multi flute finisher with corner radius for 45-70 HRc - 10.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling, Semi Finish Milling	Cutting Speed (Vc) m/min: Shoulder Milling, Finish Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)									
								Diameter in mm									
						mm		10.0		12.0		16.0		20.0			
			ap 2D ae/D 10%	ap 2D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max	min	max
Steel	P	5	130	155	Emulsion	130	180	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
		6	100	125		100	160	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
			ap 2D ae/D 1%	ap 2D ae/D 1%		Cutting Speed (Vc) m/min		mm	10.0		12.0		16.0		20.0			
						min	max	Range	min	max	min	max	min	max	min	max		
Hardened Steel	H	1	150	180	MQL/ Cold Air	150	200	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
		2	120	150		120	180	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
		3	80	110		80	150	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		
		4	80	110		80	150	fz	0.070	0.095	0.085	0.110	0.095	0.125	0.105	0.140		

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

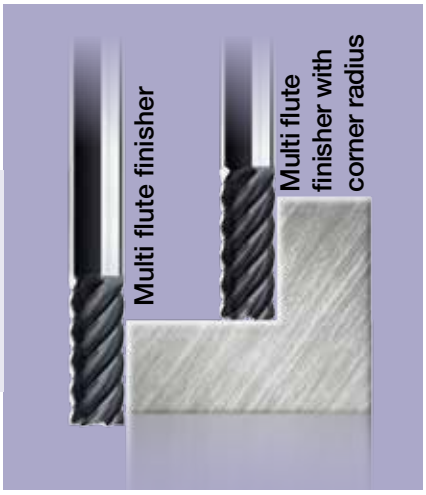
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Multi flute finisher
Recommended for Side milling.

Multi flute finisher with corner radius
Recommended for Shoulder milling.



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4 Flute

Centre cutting high performance torus cutter for high feed machining

HVM HPM | e8 | 6535 HA | h5 | TiAlN

P3-P4

H1

IMAGE 1

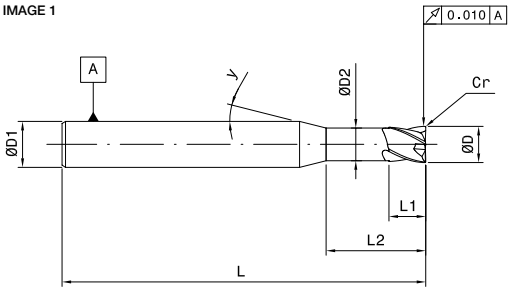
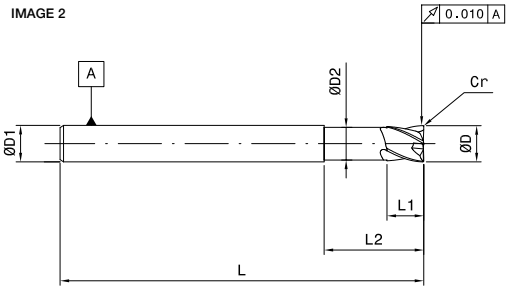


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
2.00	1.00	1.80	4.00	60.00	6.00	0.50	4	15	1	FBK0503979
2.00	1.00	1.80	8.00	60.00	6.00	0.50	4	15	1	FBK0503980
3.00	1.50	2.70	6.00	60.00	6.00	0.75	4	15	1	FBK0503981
3.00	1.50	2.70	12.00	60.00	6.00	0.75	4	15	1	FBK0503982
4.00	2.00	3.60	8.00	60.00	6.00	1.00	4	15	1	FBK0503983
4.00	2.00	3.60	16.00	60.00	6.00	1.00	4	15	1	FBK0503984
6.00	3.00	5.50	12.00	80.00	6.00	1.50	4	-	2	FBK0503659
6.00	3.00	5.50	24.00	80.00	6.00	1.50	4	-	2	FBK0503986
8.00	4.00	7.40	16.00	90.00	8.00	2.00	4	-	2	FBK0503987
8.00	4.00	7.40	32.00	90.00	8.00	2.00	4	-	2	FBK0503988
10.00	5.00	9.20	20.00	100.00	10.00	2.50	4	-	2	FBK0503989
10.00	5.00	9.20	40.00	100.00	10.00	2.50	4	-	2	FBK0503990
12.00	6.00	11.00	24.00	110.00	12.00	3.00	4	-	2	FBK0503991
12.00	6.00	11.00	48.00	110.00	12.00	3.00	4	-	2	FBK0503992

Tolerance chart

Diameter range	Shank	Cutting diameter	Cutting diameter	Cutting diameter	Cutting diameter
	ØD1-h5	ØD-e8	ØD-f7	ØD-g7	ØFHC
D ≤ 3	0	-0.014	-0.006	-0.002	0
	-0.004	-0.028	-0.016	-0.012	-0.025
3 < D ≤ 6	0	-0.020	-0.010	-0.004	0
	-0.005	-0.038	-0.022	-0.016	-0.030
6 < D ≤ 10	0	-0.025	-0.013	-0.005	0
	-0.006	-0.047	-0.028	-0.02	-0.036
10 < D ≤ 18	0	-0.032	-0.016	-0.006	0
	-0.008	-0.059	-0.034	-0.024	-0.043
18 < D ≤ 30	0	-0.040	-0.020	-0.006	0
	-0.009	-0.073	-0.041	-0.024	-0.052

Application data on page no 2.046

Cutting parameters

Centre cutting high performance torus cutter for high feed machining - 2.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling  ap<0.05D ae/D-60%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
							Diameter in mm													
							mm	2.0		3.0		4.0		6.0		8.0		10.0		12.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	230	Emulsion	230	330	fz	0.100	0.140	0.150	0.220	0.220	0.300	0.340	0.500	0.450	0.600	0.560	0.750	0.670	0.840
		4	200		200	250	fz	0.100	0.140	0.150	0.220	0.220	0.300	0.340	0.500	0.450	0.600	0.560	0.750	0.670	0.840
Hardened Steel	H	1	80	MQL/ Cold Air	80	120	fz	0.100	0.140	0.150	0.220	0.220	0.300	0.340	0.500	0.450	0.600	0.560	0.750	0.670	0.840

Centre cutting high performance torus cutter for high feed machining - 2.0 mm to 12.0 mm

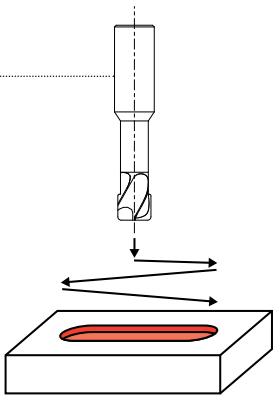
Material Group			Cutting Speed (Vc) m/min for Slot Milling  ap<0.05D ae/D 100%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
							Diameter in mm													
							mm	2.0		3.0		4.0		6.0		8.0		10.0		12.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	230	Emulsion	230	330	fz	0.070	0.100	0.120	0.190	0.180	0.250	0.280	0.400	0.400	0.550	0.500	0.700	0.600	0.800
		4	200		200	250	fz	0.070	0.100	0.120	0.190	0.180	0.250	0.280	0.400	0.400	0.550	0.500	0.700	0.600	0.800
Hardened Steel	H	1	80	MQL/ Cold Air	80	120	fz	0.070	0.100	0.120	0.190	0.180	0.250	0.280	0.400	0.400	0.550	0.500	0.700	0.600	0.800

FBK0503987
Workpiece material: 1.2311

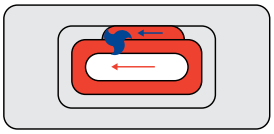
	Totem
Ø	8mm
Z	4 Flute
vc	150 m/min
n	6000 rpm
fz	0.,70 mm/t
vf	16800 mm/min
ap	0.,5 mm
ae	8.0 mm
Coolant	emulsion

Q	67.2 cm^3/min

This endmill can be used for pocket milling; for strategy see drawings above.



Always mill from inside to outside. If possible use helicoidal down-milling, otherwise ramping down.



Advantages

- High feed rates
- Lower cycle time for roughing

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
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2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

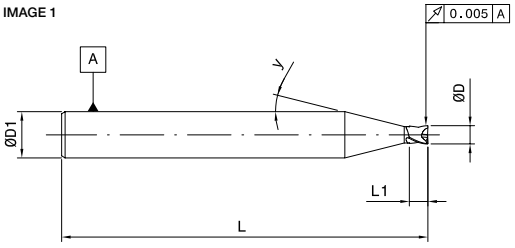
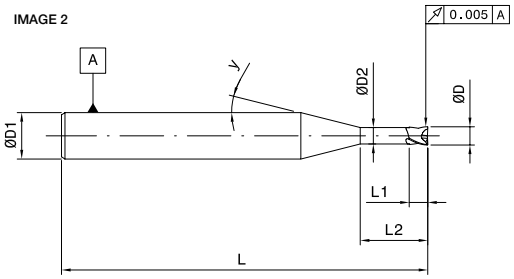


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.15	-	-	51.00	4.00	-	2	15	1	0.634	0.656	0.705	0.762	FBK0505434
0.20	0.25	-	-	51.00	4.00	-	2	15	1	0.737	0.763	0.820	0.887	FBK0505435
0.30	0.30	-	-	51.00	4.00	-	2	15	1	1.099	1.137	1.223	1.322	FBK0505436
0.30	0.30	0.28	1.50	51.00	4.00	-	2	15	2	1.861	1.926	2.070	2.238	FBK0505437
0.30	0.30	0.28	3.00	51.00	4.00	-	2	15	2	3.412	3.531	3.795	4.103	FBK0505438
0.40	0.40	-	-	51.00	4.00	-	2	15	1	1.202	1.244	1.338	1.446	FBK0505439
0.40	0.40	0.38	2.00	51.00	4.00	-	2	15	2	2.378	2.461	2.645	2.860	FBK0505440
0.40	0.40	0.38	4.00	51.00	4.00	-	2	15	2	4.445	4.600	4.945	5.346	FBK0505441
0.50	0.50	-	-	51.00	4.00	-	2	15	1	1.306	1.351	1.453	1.570	FBK0505442
0.50	0.50	0.47	3.00	51.00	4.00	-	2	15	2	3.431	3.551	3.817	4.126	FBK0505443
0.50	0.50	0.47	6.00	51.00	4.00	-	2	15	2	6.532	6.760	7.266	7.856	FBK0505444
0.50	0.50	0.47	8.00	51.00	4.00	-	2	15	2	8.599	8.899	9.566	10.342	FBK0505445
0.50	0.50	0.47	10.00	51.00	4.00	-	2	15	2	10.667	11.038	11.866	12.828	FBK0505446
0.60	0.60	-	-	51.00	4.00	-	2	15	1	2.062	2.134	2.294	2.480	FBK0505447
0.60	0.60	0.55	2.00	51.00	4.00	-	2	15	2	2.572	2.662	2.861	3.093	FBK0505448
0.60	0.60	0.55	4.00	51.00	4.00	-	2	15	2	4.639	4.801	5.161	5.580	FBK0505449
0.60	0.60	0.55	6.00	51.00	4.00	-	2	15	2	6.707	6.940	7.461	8.066	FBK0505450
0.60	0.60	0.55	8.00	51.00	4.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0505451
0.60	0.60	0.55	10.00	51.00	4.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0505452
0.80	0.80	-	-	51.00	4.00	-	2	15	1	2.269	2.348	2.524	2.729	FBK0505453
0.80	0.80	0.75	2.50	51.00	4.00	-	2	15	2	3.089	3.196	3.436	3.715	FBK0505454
0.80	0.80	0.75	5.00	51.00	4.00	-	2	15	2	5.673	5.871	6.311	6.823	FBK0505455
0.80	0.80	0.75	8.00	51.00	4.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0505456
0.80	0.80	0.75	10.00	51.00	4.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0505457
1.00	1.00	-	-	51.00	4.00	-	2	15	1	2.476	2.562	2.754	2.977	FBK0505458

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

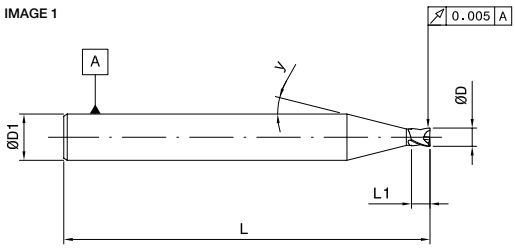
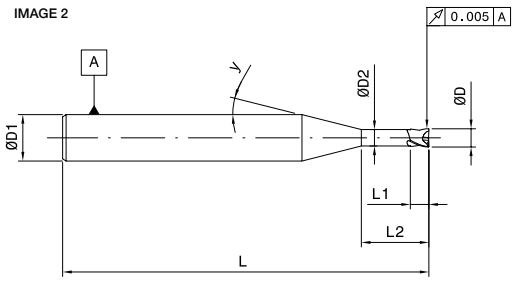


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.00	0.95	4.00	51.00	4.00	-	2	15	2	4.639	4.801	5.161	5.580	FBK0505459
1.00	1.00	0.95	6.00	51.00	4.00	-	2	15	2	6.707	6.940	7.461	8.066	FBK0505460
1.00	1.00	0.95	8.00	51.00	4.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0505461
1.00	1.00	0.95	10.00	51.00	4.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0505462
1.00	1.00	0.95	12.00	51.00	4.00	-	2	15	2	12.909	13.358	14.36	15.525	FBK0505463
1.00	1.00	0.95	15.00	51.00	4.00	-	2	15	2	16.01	16.568	17.809	19.254	FBK0505464
1.00	1.00	0.95	20.00	60.00	4.00	-	2	15	2	21.178	21.916	23.559	25.470	FBK0505465
1.00	1.00	0.95	25.00	60.00	4.00	-	2	15	2	26.346	27.264	29.308	∞	FBK0505466
1.20	1.20	-	-	51.00	4.00	-	2	15	1	3.471	3.592	3.862	4.175	FBK0505467
1.20	1.20	1.15	4.00	51.00	4.00	-	2	15	2	4.912	5.083	5.464	5.907	FBK0505468
1.20	1.20	1.15	6.00	51.00	4.00	-	2	15	2	6.979	7.222	7.763	8.393	FBK0505469
1.20	1.20	1.15	8.00	51.00	4.00	-	2	15	2	9.046	9.361	10.063	10.879	FBK0505470
1.20	1.20	1.15	12.00	51.00	4.00	-	2	15	2	13.181	13.64	14.662	15.852	FBK0505471
1.20	1.20	1.15	16.00	51.00	4.00	-	2	15	2	17.316	17.919	19.262	20.825	FBK0505472
1.50	1.50	-	-	51.00	4.00	-	2	15	1	3.781	3.913	4.206	4.548	FBK0505473
1.50	1.50	1.45	4.00	51.00	4.00	-	2	15	2	4.912	5.083	5.464	5.907	FBK0505474
1.50	1.50	1.45	6.00	51.00	4.00	-	2	15	2	6.979	7.222	7.763	8.393	FBK0505475
1.50	1.50	1.45	8.00	51.00	4.00	-	2	15	2	9.046	9.361	10.063	10.879	FBK0505476
1.50	1.50	1.45	10.00	51.00	4.00	-	2	15	2	11.114	11.501	12.363	13.366	FBK0505477
1.50	1.50	1.45	12.00	51.00	4.00	-	2	15	2	13.181	13.64	14.662	15.852	FBK0505478
1.50	1.50	1.45	15.00	51.00	4.00	-	2	15	2	16.282	16.849	18.112	19.581	FBK0505479
1.50	1.50	1.45	20.00	60.00	4.00	-	2	15	2	21.45	22.198	23.861	∞	FBK0505480
1.50	1.50	1.45	25.00	60.00	4.00	-	2	15	2	26.619	27.546	29.611	∞	FBK0505481
2.00	2.00	-	-	51.00	4.00	-	2	15	1	4.298	4.448	4.781	5.169	FBK0505482
2.00	2.00	1.90	6.00	51.00	4.00	-	2	15	2	7.075	7.322	7.871	8.509	FBK0505483

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P5-P6
K1
M1-M3
S1-S4
H1-H4

IMAGE 1

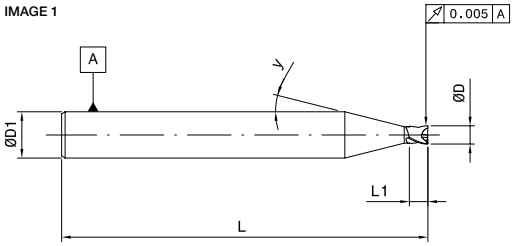
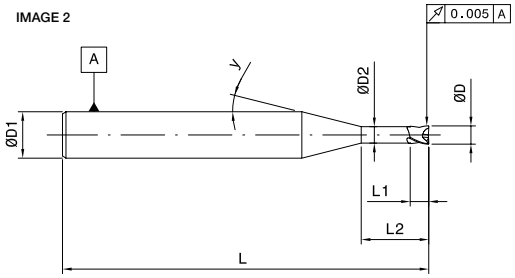


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	2.00	1.90	8.00	51.00	4.00	-	2	15	2	9.143	9.461	10.17	10.995	FBK0505484
2.00	2.00	1.90	10.00	51.00	4.00	-	2	15	2	11.21	11.601	12.47	13.482	FBK0505485
2.00	2.00	1.90	12.00	51.00	4.00	-	2	15	2	13.277	13.74	14.77	15.968	FBK0505486
2.00	2.00	1.90	16.00	51.00	4.00	-	2	15	2	17.412	18.019	19.369	∞	FBK0505487
2.00	2.00	1.90	20.00	60.00	4.00	-	2	15	2	21.547	22.297	23.969	∞	FBK0505488
2.00	2.00	1.90	25.00	60.00	4.00	-	2	15	2	26.715	27.646	∞	∞	FBK0505489
2.00	2.00	1.90	30.00	64.00	4.00	-	2	15	2	31.883	32.994	∞	∞	FBK0505490
2.50	2.50	-	-	51.00	4.00	-	2	15	1	4.815	4.983	5.356	5.791	FBK0505491
2.50	2.50	2.40	6.00	51.00	4.00	-	2	15	2	7.075	7.322	7.871	8.509	FBK0505492
2.50	2.50	2.40	8.00	51.00	4.00	-	2	15	2	9.143	9.461	10.170	10.995	FBK0505493
2.50	2.50	2.40	10.00	51.00	4.00	-	2	15	2	11.21	11.601	12.470	13.482	FBK0505494
2.50	2.50	2.40	12.00	51.00	4.00	-	2	15	2	13.277	13.74	14.770	∞	FBK0505495
2.50	2.50	2.40	16.00	51.00	4.00	-	2	15	2	17.412	18.019	19.369	∞	FBK0505496
2.50	2.50	2.40	20.00	60.00	4.00	-	2	15	2	21.547	22.297	∞	∞	FBK0505497
2.50	2.50	2.40	25.00	60.00	4.00	-	2	15	2	26.715	27.646	∞	∞	FBK0505498
2.50	2.50	2.40	30.00	64.00	4.00	-	2	15	2	31.883	32.994	∞	∞	FBK0505499
3.00	3.00	-	-	51.00	4.00	-	2	15	1	5.332	5.518	5.931	6.412	FBK0505500
3.00	3.00	2.90	6.00	51.00	4.00	-	2	15	2	7.075	7.322	7.871	8.509	FBK0505501
3.00	3.00	2.90	8.00	51.00	4.00	-	2	15	2	9.143	9.461	10.170	∞	FBK0505502
3.00	3.00	2.90	10.00	51.00	4.00	-	2	15	2	11.21	11.601	12.470	∞	FBK0505503
3.00	3.00	2.90	12.00	51.00	4.00	-	2	15	2	13.277	13.74	∞	∞	FBK0505504
3.00	3.00	2.90	16.00	51.00	4.00	-	2	15	2	17.412	18.019	∞	∞	FBK0505505
3.00	3.00	2.90	20.00	60.00	4.00	-	2	15	2	21.547	22.297	∞	∞	FBK0505506
3.00	3.00	2.90	25.00	60.00	4.00	-	2	15	2	26.715	27.646	∞	∞	FBK0505507
3.00	3.00	2.90	30.00	64.00	4.00	-	2	15	2	31.883	∞	∞	∞	FBK0505508

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

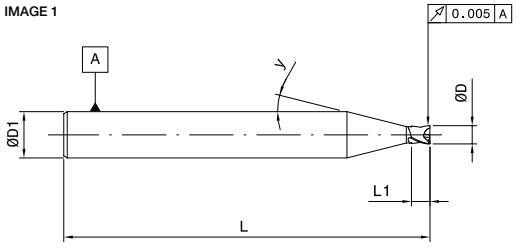
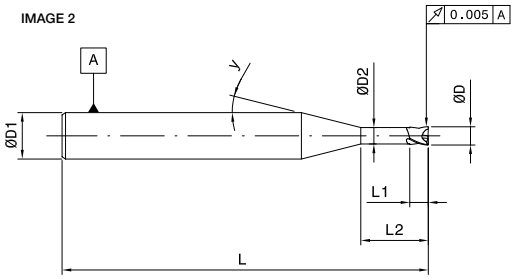


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.15	-	-	64.00	6.00	-	2	10	1	0.552	0.583	0.655	0.747	FBK0503664
0.20	0.50	-	-	64.00	6.00	-	2	10	1	0.710	0.749	0.842	0.960	FBK0505831
0.30	0.50	-	-	64.00	6.00	-	2	10	1	1.236	1.304	1.465	1.672	FBK0505546
0.30	0.50	0.28	1.50	64.00	6.00	-	2	11	2	1.826	1.916	2.126	2.388	FBK0503667
0.30	0.50	0.28	3.00	64.00	6.00	-	2	12	2	3.397	3.549	3.898	4.323	FBK0503668
0.40	0.60	-	-	64.00	6.00	-	2	10	1	1.341	1.415	1.590	1.814	FBK0505547
0.40	0.60	0.38	2.00	64.00	6.00	-	2	11	2	2.350	2.465	2.735	3.072	FBK0503670
0.40	0.60	0.38	4.00	64.00	6.00	-	2	13	2	4.439	4.621	5.032	5.525	FBK0503671
0.50	0.80	-	-	64.00	6.00	-	2	10	1	1.552	1.637	1.839	2.099	FBK0505548
0.50	0.80	0.47	3.00	64.00	6.00	-	2	12	2	3.421	3.574	3.926	4.354	FBK0503673
0.50	0.80	0.47	6.00	64.00	6.00	-	2	15	2	6.532	6.760	7.266	7.856	FBK0503674
0.50	0.80	0.47	8.00	64.00	6.00	-	2	15	2	8.599	8.899	9.566	10.342	FBK0503675
0.50	0.80	0.47	10.00	64.00	6.00	-	2	15	2	10.667	11.038	11.866	12.828	FBK0503676
0.60	0.90	-	-	64.00	6.00	-	2	10	1	1.749	1.845	2.073	2.366	FBK0505549
0.60	0.90	0.55	2.00	64.00	6.00	-	2	11	2	2.531	2.656	2.947	3.310	FBK0503678
0.60	0.90	0.55	4.00	64.00	6.00	-	2	12	2	4.623	4.830	5.304	5.884	FBK0503679
0.60	0.90	0.55	6.00	64.00	6.00	-	2	15	2	6.707	6.940	7.461	8.066	FBK0503680
0.60	0.90	0.55	8.00	64.00	6.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0503681
0.60	0.90	0.55	10.00	64.00	6.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0503682
0.80	1.20	-	-	64.00	6.00	-	2	10	1	2.591	2.733	3.071	3.504	FBK0505550
0.80	1.20	0.75	2.50	64.00	6.00	-	2	11	2	3.055	3.205	3.556	3.994	FBK0503684
0.80	1.20	0.75	5.00	64.00	6.00	-	2	13	2	5.664	5.896	6.421	7.051	FBK0503685
0.80	1.20	0.75	8.00	64.00	6.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0503686
0.80	1.20	0.75	10.00	64.00	6.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0503687

Application data on page no 2.073 & 2.074

sales@forbes.co.in

2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

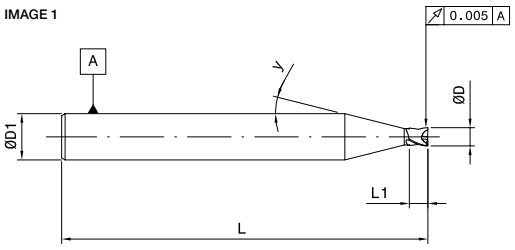
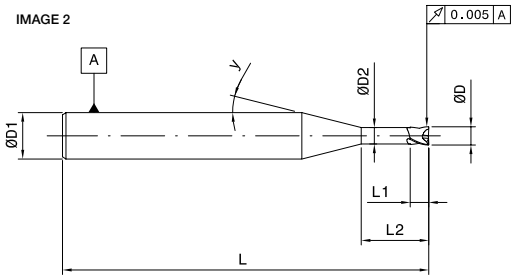


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.50	-	-	64.00	6.00	-	2	10	1	2.906	3.066	3.445	3.931	FBK0505551
1.00	1.50	0.95	4.00	64.00	6.00	-	2	11	2	4.625	4.853	5.385	6.048	FBK0503689
1.00	1.50	0.95	6.00	64.00	6.00	-	2	14	2	6.703	6.956	7.522	8.19	FBK0503690
1.00	1.50	0.95	8.00	64.00	6.00	-	2	15	2	8.774	9.080	9.760	10.552	FBK0505195
1.00	1.50	0.95	10.00	64.00	6.00	-	2	15	2	10.841	11.219	12.06	13.038	FBK0503691
1.00	1.50	0.95	12.00	64.00	6.00	-	2	15	2	12.909	13.358	14.36	15.525	FBK0505196
1.00	1.50	0.95	15.00	64.00	6.00	-	2	15	2	16.010	16.568	17.809	19.254	FBK0503692
1.00	1.50	0.95	20.00	64.00	6.00	-	2	15	2	21.178	21.916	23.559	25.47	FBK0503693
1.00	1.50	0.95	25.00	64.00	6.00	-	2	15	2	26.346	27.264	29.308	31.686	FBK0503694
1.20	1.80	-	-	64.00	6.00	-	2	10	1	3.932	4.148	4.66	5.318	FBK0505552
1.20	1.80	1.15	4.00	64.00	6.00	-	2	11	2	4.827	5.065	5.62	6.312	FBK0503696
1.20	1.80	1.15	6.00	64.00	6.00	-	2	13	2	6.940	7.224	7.868	8.639	FBK0503697
1.20	1.80	1.15	8.00	64.00	6.00	-	2	15	2	9.046	9.361	10.063	10.879	FBK0503698
1.20	1.80	1.15	12.00	64.00	6.00	-	2	15	2	13.181	13.64	14.662	15.852	FBK0503699
1.20	1.80	1.15	16.00	64.00	6.00	-	2	15	2	17.316	17.919	19.262	20.825	FBK0503700
1.50	2.30	-	-	64.00	6.00	-	2	9	1	4.438	4.713	5.38	6.267	FBK0505553
1.50	2.30	1.45	4.00	64.00	6.00	-	2	10	2	4.818	5.082	5.71	6.516	FBK0505197
1.50	2.30	1.45	6.00	64.00	6.00	-	2	12	2	6.928	7.237	7.949	8.817	FBK0503702
1.50	2.30	1.45	8.00	64.00	6.00	-	2	15	2	9.046	9.361	10.063	10.879	FBK0505198
1.50	2.30	1.45	10.00	64.00	6.00	-	2	15	2	11.114	11.501	12.363	13.366	FBK0503703
1.50	2.30	1.45	12.00	64.00	6.00	-	2	15	2	13.181	13.64	14.662	15.852	FBK0505199
1.50	2.30	1.45	15.00	64.00	6.00	-	2	15	2	16.282	16.849	18.112	19.581	FBK0503704
1.50	2.30	1.45	20.00	64.00	6.00	-	2	15	2	21.450	22.198	23.861	25.797	FBK0503705
1.50	2.30	1.45	25.00	64.00	6.00	-	2	15	2	26.619	27.546	29.611	32.013	FBK0503706
2.00	3.00	-	-	64.00	6.00	-	2	8	1	5.171	5.537	6.453	7.733	FBK0503707
2.00	3.00	1.90	6.00	64.00	6.00	-	2	11	2	7.055	7.403	8.214	9.226	FBK0503708

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

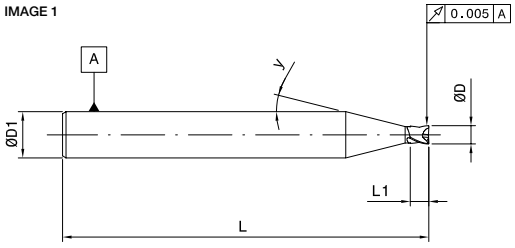
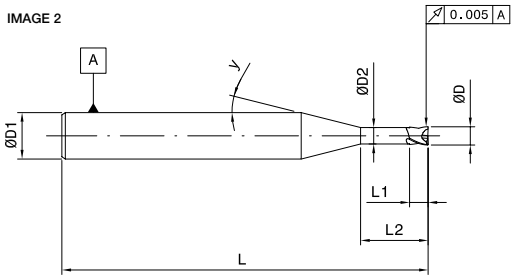


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle 0.5°	1°	2°	3°	EDP No
2.00	3.00	1.90	8.00	64.00	6.00	-	2	14	2	9.134	9.478	10.250	11.160	FBK0505200
2.00	3.00	1.90	10.00	64.00	6.00	-	2	15	2	11.210	11.601	12.470	13.482	FBK0503709
2.00	3.00	1.90	12.00	64.00	6.00	-	2	15	2	13.277	13.740	14.770	15.968	FBK0505201
2.00	3.00	1.90	16.00	64.00	6.00	-	2	15	2	17.412	18.019	19.369	20.941	FBK0503710
2.00	3.00	1.90	20.00	64.00	6.00	-	2	15	2	21.547	22.297	23.969	25.913	FBK0503711
2.00	3.00	1.90	25.00	64.00	6.00	-	2	15	2	26.715	27.646	29.718	32.129	FBK0503712
2.00	3.00	1.90	30.00	64.00	6.00	-	2	15	2	31.883	32.994	35.467	38.345	FBK0503713
2.50	3.00	-	-	64.00	6.00	-	2	8	1	5.171	5.537	6.453	7.733	FBK0503714
2.50	3.00	2.40	6.00	64.00	6.00	-	2	10	2	7.071	7.459	8.381	9.563	FBK0503715
2.50	3.00	2.40	8.00	64.00	6.00	-	2	12	2	9.136	9.545	10.483	11.628	FBK0505202
2.50	3.00	2.40	10.00	64.00	6.00	-	2	15	2	11.21	11.601	12.470	13.482	FBK0503716
2.50	3.00	2.40	12.00	64.00	6.00	-	2	15	2	13.277	13.740	14.770	15.968	FBK0505203
2.50	3.00	2.40	16.00	64.00	6.00	-	2	15	2	17.412	18.019	19.369	20.941	FBK0503717
2.50	3.00	2.40	20.00	64.00	6.00	-	2	15	2	21.547	22.297	23.969	25.913	FBK0503718
2.50	3.00	2.40	25.00	64.00	6.00	-	2	15	2	26.715	27.646	29.718	32.129	FBK0503719
2.50	3.00	2.40	30.00	64.00	6.00	-	2	15	2	31.883	32.994	35.467	38.345	FBK0505204
3.00	3.00	-	-	64.00	6.00	-	2	7	1	5.174	5.602	6.716	8.385	FBK0503720
3.00	3.00	2.90	6.00	64.00	6.00	-	2	8	2	7.149	7.656	8.922	10.693	FBK0503721
3.00	3.00	2.90	8.00	64.00	6.00	-	2	10	2	9.175	9.679	10.875	12.409	FBK0505205
3.00	3.00	2.90	10.00	64.00	6.00	-	2	13	2	11.21	11.668	12.709	13.954	FBK0503722
3.00	3.00	2.90	12.00	64.00	6.00	-	2	15	2	13.277	13.740	14.770	15.968	FBK0505206
3.00	3.00	2.90	16.00	64.00	6.00	-	2	15	2	17.412	18.019	19.369	20.941	FBK0503723
3.00	3.00	2.90	20.00	64.00	6.00	-	2	15	2	21.547	22.297	23.969	25.913	FBK0503724
3.00	3.00	2.90	25.00	64.00	6.00	-	2	15	2	26.715	27.646	29.718	32.129	FBK0503725
3.00	3.00	2.90	30.00	64.00	6.00	-	2	15	2	31.883	32.994	35.467	38.345	FBK0503726

Application data on page no 2.073 & 2.074

sales@forbes.co.in

4 Flute

Centre cutting high performance 4 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

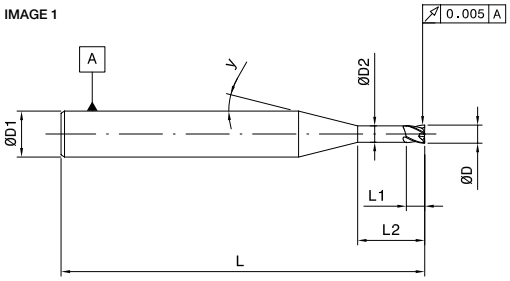
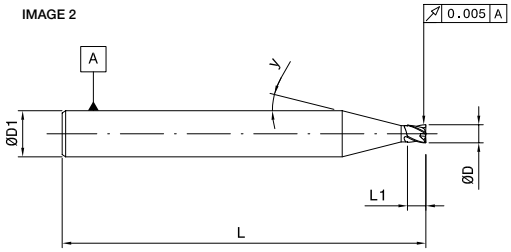


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.25	0.18	2.00	51.00	4.00	-	4	15	1	2.378	2.461	2.645	2.860	FBK0505509
0.20	0.25	0.18	4.00	51.00	4.00	-	4	15	1	4.445	4.600	4.945	5.346	FBK0505510
0.40	0.40	0.38	2.00	51.00	4.00	-	4	15	1	2.378	2.461	2.645	2.860	FBK0505511
0.40	0.40	0.38	4.00	51.00	4.00	-	4	15	1	4.445	4.600	4.945	5.346	FBK0505512
0.40	0.40	0.38	6.00	51.00	4.00	-	4	15	1	6.513	6.740	7.245	7.833	FBK0505513
0.40	0.40	0.38	8.00	51.00	4.00	-	4	15	1	8.580	8.879	9.545	10.319	FBK0505514
0.40	0.40	0.38	10.00	51.00	4.00	-	4	15	1	10.647	11.018	11.844	12.805	FBK0505515
0.50	0.50	0.46	2.00	51.00	4.00	-	4	15	1	2.397	2.481	2.667	2.883	FBK0505516
0.50	0.50	0.46	4.00	51.00	4.00	-	4	15	1	4.465	4.620	4.967	5.369	FBK0505517
0.50	0.50	0.46	6.00	51.00	4.00	-	4	15	1	6.532	6.760	7.266	7.856	FBK0505518
0.50	0.50	0.46	8.00	51.00	4.00	-	4	15	1	8.599	8.899	9.566	10.342	FBK0505519
0.50	0.50	0.46	10.00	51.00	4.00	-	4	15	1	10.667	11.038	11.866	12.828	FBK0505520
1.00	1.00	0.94	2.00	51.00	4.00	-	4	15	1	2.572	2.662	2.861	3.093	FBK0505521
1.00	1.00	0.94	4.00	51.00	4.00	-	4	15	1	4.639	4.801	5.161	5.580	FBK0505522
1.00	1.00	0.94	6.00	51.00	4.00	-	4	15	1	6.707	6.940	7.461	8.066	FBK0505523
1.00	1.00	0.94	8.00	51.00	4.00	-	4	15	1	8.774	9.080	9.760	10.552	FBK0505524
1.00	1.00	0.94	10.00	51.00	4.00	-	4	15	1	10.841	11.219	12.06	13.038	FBK0505525
1.50	1.50	-	-	51.00	4.00	-	4	15	2	3.781	3.913	4.206	4.548	FBK0505526
1.50	1.50	1.44	4.00	51.00	4.00	-	4	15	1	4.912	5.083	5.464	5.907	FBK0505527

Application data on page no 2.073 & 2.074

4 Flute

Centre cutting high performance 4 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

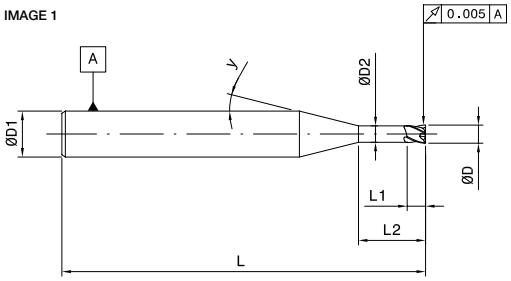
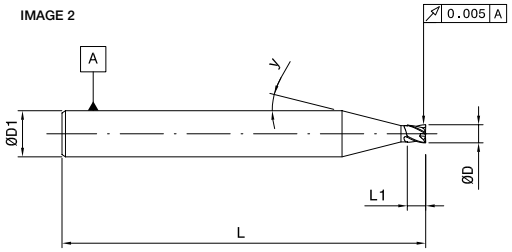


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	1.50	1.44	6.00	51.00	4.00	-	4	15	1	6.979	7.222	7.763	8.393	FBK0505528
1.50	1.50	1.44	8.00	51.00	4.00	-	4	15	1	9.046	9.361	10.063	10.879	FBK0505529
1.50	1.50	1.44	10.00	51.00	4.00	-	4	15	1	11.114	11.501	12.363	13.366	FBK0505530
2.00	2.00	-	-	51.00	4.00	-	4	15	2	4.298	4.448	4.781	5.169	FBK0505531
2.00	2.00	1.90	4.00	51.00	4.00	-	4	15	1	5.008	5.182	5.571	6.023	FBK0505532
2.00	2.00	1.90	6.00	51.00	4.00	-	4	15	1	7.075	7.322	7.871	8.509	FBK0505533
2.00	2.00	1.90	8.00	51.00	4.00	-	4	15	1	9.143	9.461	10.170	10.995	FBK0505534
2.00	2.00	1.90	10.00	51.00	4.00	-	4	15	1	11.210	11.601	12.470	13.482	FBK0505535
2.50	2.50	-	-	51.00	4.00	-	4	15	2	4.815	4.983	5.356	5.791	FBK0505536
2.50	2.50	2.40	4.00	51.00	4.00	-	4	15	1	5.008	5.182	5.571	6.023	FBK0505537
2.50	2.50	2.40	6.00	51.00	4.00	-	4	15	1	7.075	7.322	7.871	8.509	FBK0505538
2.50	2.50	2.40	8.00	51.00	4.00	-	4	15	1	9.143	9.461	10.170	10.995	FBK0505539
2.50	2.50	2.40	10.00	51.00	4.00	-	4	15	1	11.210	11.601	12.470	13.482	FBK0505540
3.00	3.00	-	-	51.00	4.00	-	4	15	2	5.332	5.518	5.931	6.412	FBK0505541
3.00	3.00	2.90	5.00	51.00	4.00	-	4	15	1	5.525	5.717	6.146	6.644	FBK0505542
3.00	3.00	2.90	6.00	51.00	4.00	-	4	15	1	7.075	7.322	7.871	8.509	FBK0505543
3.00	3.00	2.90	8.00	51.00	4.00	-	4	15	1	9.143	9.461	10.170	∞	FBK0505544
3.00	3.00	2.90	10.00	51.00	4.00	-	4	15	1	11.210	11.601	12.470	∞	FBK0505545

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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4 Flute

Centre cutting high performance 4 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

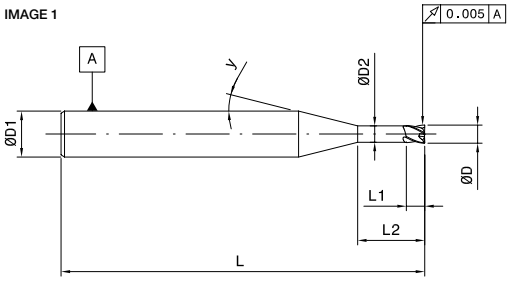
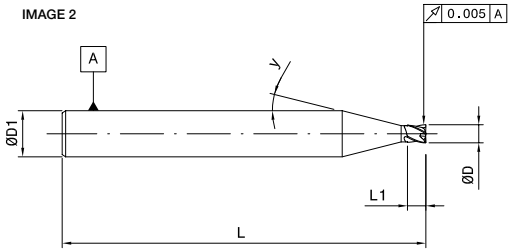


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.30	0.18	2.00	64.00	6.00	-	4	11	1	2.350	2.465	2.735	3.072	FBK0505554
0.20	0.30	0.18	4.00	64.00	6.00	-	4	13	1	4.439	4.621	5.032	5.525	FBK0505555
0.20	0.30	0.18	6.00	64.00	6.00	-	4	15	1	6.513	6.740	7.245	7.833	FBK0505832
0.20	0.30	0.18	8.00	64.00	6.00	-	4	15	1	8.580	8.879	9.545	10.319	FBK0505833
0.20	0.30	0.18	10.00	64.00	6.00	-	4	15	1	10.647	11.018	11.844	12.805	FBK0505834
0.40	0.60	0.38	2.00	64.00	6.00	-	4	11	1	2.350	2.465	2.735	3.072	FBK0505556
0.40	0.60	0.38	4.00	64.00	6.00	-	4	13	1	4.439	4.621	5.032	5.525	FBK0505557
0.40	0.60	0.38	6.00	64.00	6.00	-	4	15	1	6.513	6.740	7.245	7.833	FBK0505558
0.40	0.60	0.38	8.00	64.00	6.00	-	4	15	1	8.580	8.879	9.545	10.319	FBK0505559
0.40	0.60	0.38	10.00	64.00	6.00	-	4	15	1	10.647	11.018	11.844	12.805	FBK0505560
0.50	0.80	0.47	2.00	64.00	6.00	-	4	11	1	2.376	2.494	2.767	3.108	FBK0505561
0.50	0.80	0.47	4.00	64.00	6.00	-	4	12	1	4.464	4.664	5.122	5.682	FBK0505562
0.50	0.80	0.47	6.00	64.00	6.00	-	4	15	1	6.532	6.760	7.266	7.856	FBK0505563
0.50	0.80	0.47	8.00	64.00	6.00	-	4	15	1	8.599	8.899	9.566	10.342	FBK0505564
0.50	0.80	0.47	10.00	64.00	6.00	-	4	15	1	10.667	11.038	11.866	12.828	FBK0505565
1.00	1.50	-	-	64.00	6.00	-	4	10	2	3.055	3.223	3.621	4.133	FBK0505566
1.00	1.50	0.95	4.00	64.00	6.00	-	4	11	1	4.625	4.853	5.385	6.048	FBK0505567
1.00	1.50	0.95	6.00	64.00	6.00	-	4	14	1	6.703	6.956	7.522	8.190	FBK0505568
1.00	1.50	0.95	8.00	64.00	6.00	-	4	15	1	8.774	9.080	9.760	10.552	FBK0505569
1.00	1.50	0.95	10.00	64.00	6.00	-	4	15	1	10.841	11.219	12.06	13.038	FBK0505570

Application data on page no 2.073 & 2.074

TOTEM

Solid Carbide End Mills

Proton HD Series

4 Flute

Centre cutting high performance 4 flute micro end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

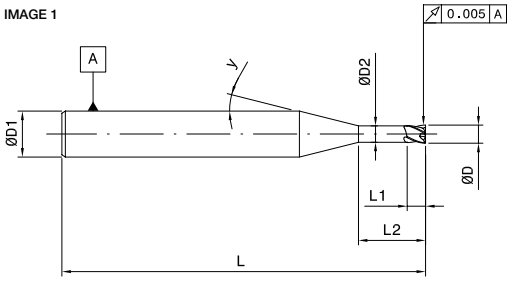
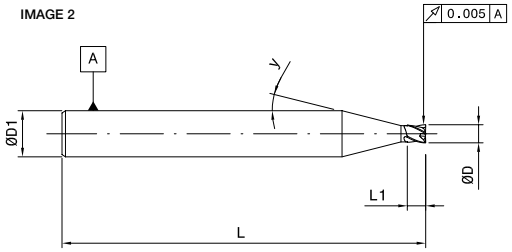


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	2.30	-	-	64.00	6.00	-	4	9	2	4.438	4.713	5.380	6.267	FBK0505571
1.50	2.30	1.45	4.00	64.00	6.00	-	4	10	1	4.818	5.082	5.710	6.516	FBK0505572
1.50	2.30	1.45	6.00	64.00	6.00	-	4	12	1	6.928	7.237	7.949	8.817	FBK0505573
1.50	2.30	1.45	8.00	64.00	6.00	-	4	15	1	9.046	9.361	10.063	10.879	FBK0505574
1.50	2.30	1.45	10.00	64.00	6.00	-	4	15	1	11.114	11.501	12.363	13.366	FBK0505575
2.00	3.00	-	-	64.00	6.00	-	4	8	2	5.171	5.537	6.453	7.733	FBK0505576
2.00	3.00	1.90	4.50	64.00	6.00	-	4	9	1	5.513	5.854	6.683	7.785	FBK0505577
2.00	3.00	1.90	6.00	64.00	6.00	-	4	11	1	7.055	7.403	8.214	9.226	FBK0505578
2.00	3.00	1.90	8.00	64.00	6.00	-	4	14	1	9.134	9.478	10.25	11.16	FBK0505579
2.00	3.00	1.90	10.00	64.00	6.00	-	4	15	1	11.210	11.601	12.470	13.482	FBK0505580
2.50	3.00	-	-	64.00	6.00	-	4	8	2	5.171	5.537	6.453	7.733	FBK0505581
2.50	3.00	2.40	4.50	64.00	6.00	-	4	9	1	5.513	5.854	6.683	7.785	FBK0505582
2.50	3.00	2.40	6.00	64.00	6.00	-	4	11	1	7.055	7.403	8.214	9.226	FBK0505583
2.50	3.00	2.40	8.00	64.00	6.00	-	4	14	1	9.134	9.478	10.250	11.160	FBK0505584
2.50	3.00	2.40	10.00	64.00	6.00	-	4	15	1	11.21	11.601	12.470	13.482	FBK0505585
3.00	3.00	-	-	64.00	6.00	-	4	6	2	5.193	5.710	7.131	9.498	FBK0505586
3.00	3.00	2.90	4.50	64.00	6.00	-	4	7	1	5.612	6.077	7.285	9.095	FBK0505587
3.00	3.00	2.90	6.00	64.00	6.00	-	4	8	1	7.149	7.656	8.922	10.693	FBK0505588
3.00	3.00	2.90	8.00	64.00	6.00	-	4	10	1	9.175	9.679	10.875	12.409	FBK0505589
3.00	3.00	2.90	10.00	64.00	6.00	-	4	13	1	11.21	11.668	12.709	13.954	FBK0505590

Application data on page no 2.073 & 2.074

sales@forbes.co.in

2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

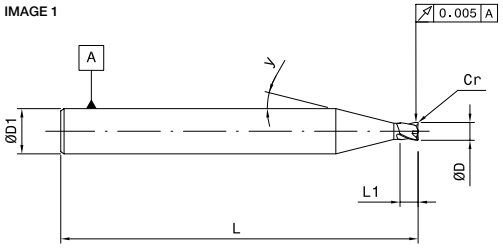
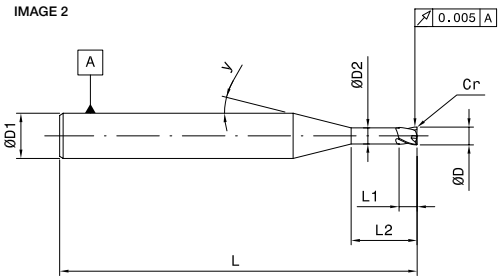


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.20	-	-	51.00	4.00	0.03	2	7	1	0.560	0.604	0.718	0.889	FBK0505835
0.10	0.15	-	-	51.00	4.00	0.03	2	15	1	0.633	0.654	0.701	0.755	FBK0505293
0.20	0.25	-	-	51.00	4.00	0.03	2	15	1	0.736	0.761	0.816	0.879	FBK0505294
0.30	0.30	-	-	51.00	4.00	0.05	2	15	1	1.097	1.134	1.215	1.310	FBK0505295
0.30	0.30	0.28	1.50	51.00	4.00	0.05	2	15	2	1.860	1.923	2.063	2.226	FBK0505296
0.30	0.30	0.28	3.00	51.00	4.00	0.05	2	15	2	3.410	3.527	3.788	4.091	FBK0505297
0.40	0.40	-	-	51.00	4.00	0.05	2	15	1	1.201	1.241	1.330	1.434	FBK0505298
0.40	0.40	0.38	2.00	51.00	4.00	0.05	2	15	2	2.376	2.457	2.638	2.848	FBK0505299
0.40	0.40	0.38	4.00	51.00	4.00	0.05	2	15	2	4.444	4.597	4.938	5.334	FBK0505300
0.50	0.50	-	-	51.00	4.00	0.05	2	15	1	1.304	1.348	1.445	1.558	FBK0505301
0.50	0.50	0.47	1.00	51.00	4.00	0.05	2	15	2	1.362	1.408	1.509	1.628	FBK0505302
0.50	0.50	0.47	3.00	51.00	4.00	0.05	2	15	2	3.429	3.547	3.809	4.114	FBK0505303
0.50	0.50	0.47	6.00	51.00	4.00	0.05	2	15	2	6.530	6.756	7.259	7.844	FBK0505304
0.50	0.50	0.47	8.00	51.00	4.00	0.05	2	15	2	8.598	8.896	9.558	10.33	FBK0505305
0.50	0.50	0.47	10.00	51.00	4.00	0.05	2	15	2	10.665	11.035	11.858	12.816	FBK0505306
0.60	0.60	-	-	51.00	4.00	0.05	2	15	1	2.060	2.130	2.286	2.468	FBK0505307
0.60	0.60	0.55	2.00	51.00	4.00	0.05	2	15	2	2.570	2.658	2.854	3.081	FBK0505308
0.60	0.60	0.55	4.00	51.00	4.00	0.05	2	15	2	4.638	4.798	5.153	5.567	FBK0505309
0.60	0.60	0.55	6.00	51.00	4.00	0.05	2	15	2	6.705	6.937	7.453	8.054	FBK0505310
0.60	0.60	0.55	8.00	51.00	4.00	0.05	2	15	2	8.772	9.076	9.753	10.54	FBK0505311
0.60	0.60	0.55	10.00	51.00	4.00	0.05	2	15	2	10.84	11.216	12.052	13.026	FBK0505312
0.80	0.80	-	-	51.00	4.00	0.05	2	15	1	2.267	2.344	2.516	2.716	FBK0505313
0.80	0.80	0.75	2.50	51.00	4.00	0.05	2	15	2	3.087	3.193	3.429	3.703	FBK0505314
0.80	0.80	0.75	5.00	51.00	4.00	0.05	2	15	2	5.671	5.867	6.303	6.811	FBK0505315
0.80	0.80	0.75	8.00	51.00	4.00	0.05	2	15	2	8.772	9.076	9.753	10.54	FBK0505316
0.80	0.80	0.75	10.00	51.00	4.00	0.05	2	15	2	10.84	11.216	12.052	13.026	FBK0505317
1.00	1.00	-	-	51.00	4.00	0.10	2	15	1	2.472	2.555	2.739	2.953	FBK0505318
1.00	1.00	0.95	2.00	51.00	4.00	0.10	2	15	2	2.569	2.655	2.846	3.069	FBK0505319

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

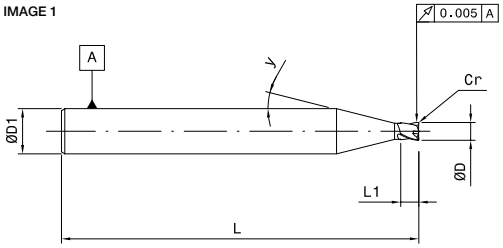
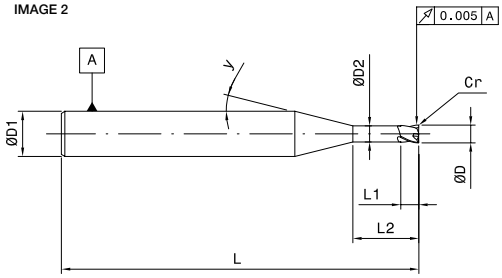


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.00	0.95	4.00	51.00	4.00	0.10	2	15	2	4.636	4.794	5.146	5.555	FBK0505320
1.00	1.00	0.95	6.00	51.00	4.00	0.10	2	15	2	6.703	6.933	7.446	8.042	FBK0505321
1.00	1.00	0.95	8.00	51.00	4.00	0.10	2	15	2	8.771	9.073	9.745	10.528	FBK0505322
1.00	1.00	0.95	10.00	51.00	4.00	0.10	2	15	2	10.838	11.212	12.045	13.014	FBK0505323
1.00	1.00	0.95	12.00	51.00	4.00	0.10	2	15	2	12.905	13.352	14.345	15.500	FBK0505324
1.00	1.00	0.95	15.00	51.00	4.00	0.10	2	15	2	16.006	16.561	17.794	19.230	FBK0505325
1.00	1.00	0.95	20.00	60.00	4.00	0.10	2	15	2	21.175	21.909	23.544	25.446	FBK0505326
1.00	1.00	0.95	25.00	60.00	4.00	0.10	2	15	2	26.343	27.257	29.293	∞	FBK0505327
1.20	1.20	-	-	51.00	4.00	0.10	2	15	1	3.468	3.585	3.847	4.150	FBK0505328
1.20	1.20	1.15	4.00	51.00	4.00	0.10	2	15	2	4.908	5.076	5.449	5.883	FBK0505329
1.20	1.20	1.15	6.00	51.00	4.00	0.10	2	15	2	6.975	7.215	7.748	8.369	FBK0505330
1.20	1.20	1.15	8.00	51.00	4.00	0.10	2	15	2	9.043	9.354	10.048	10.855	FBK0505331
1.20	1.20	1.15	12.00	51.00	4.00	0.10	2	15	2	13.177	13.633	14.647	15.828	FBK0505332
1.20	1.20	1.15	16.00	51.00	4.00	0.10	2	15	2	17.312	17.912	19.247	20.800	FBK0505333
1.50	1.50	-	-	51.00	4.00	0.15	2	15	1	3.776	3.903	4.184	4.511	FBK0505334
1.50	1.50	1.45	3.00	51.00	4.00	0.15	2	15	2	3.873	4.003	4.291	4.627	FBK0505335
1.50	1.50	1.45	4.00	51.00	4.00	0.15	2	15	2	4.906	5.072	5.441	5.870	FBK0505336
1.50	1.50	1.45	6.00	51.00	4.00	0.15	2	15	2	6.974	7.212	7.741	8.357	FBK0505337
1.50	1.50	1.45	8.00	51.00	4.00	0.15	2	15	2	9.041	9.351	10.041	10.843	FBK0505338
1.50	1.50	1.45	10.00	51.00	4.00	0.15	2	15	2	11.108	11.49	12.340	13.329	FBK0505339
1.50	1.50	1.45	12.00	51.00	4.00	0.15	2	15	2	13.176	13.63	14.640	15.816	FBK0505340
1.50	1.50	1.45	15.00	51.00	4.00	0.15	2	15	2	16.277	16.839	18.090	19.545	FBK0505341
1.50	1.50	1.45	20.00	60.00	4.00	0.15	2	15	2	21.445	22.187	23.839	∞	FBK0505342
1.50	1.50	1.45	25.00	60.00	4.00	0.15	2	15	2	26.613	27.536	29.588	∞	FBK0505343
2.00	2.00	-	-	51.00	4.00	0.20	2	15	1	4.292	4.434	4.751	5.121	FBK0505344
2.00	2.00	1.90	4.00	51.00	4.00	0.20	2	15	2	5.001	5.169	5.541	5.974	FBK0505345

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

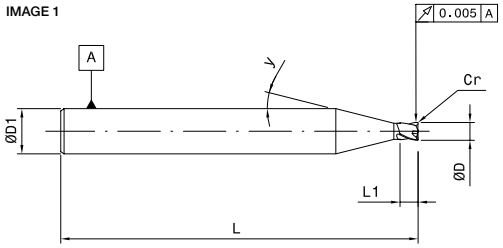
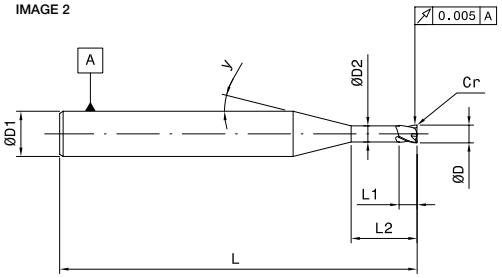


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	2.00	1.90	6.00	51.00	4.00	0.20	2	15	2	7.069	7.308	7.841	8.461	FBK0505346
2.00	2.00	1.90	8.00	51.00	4.00	0.20	2	15	2	9.136	9.447	10.14	10.947	FBK0505347
2.00	2.00	1.90	10.00	51.00	4.00	0.20	2	15	2	11.203	11.587	12.44	13.433	FBK0505348
2.00	2.00	1.90	12.00	51.00	4.00	0.20	2	15	2	13.271	13.726	14.74	15.919	FBK0505349
2.00	2.00	1.90	16.00	51.00	4.00	0.20	2	15	2	17.405	18.005	19.339	∞	FBK0505350
2.00	2.00	1.90	20.00	60.00	4.00	0.20	2	15	2	21.540	22.283	23.939	∞	FBK0505351
2.00	2.00	1.90	25.00	60.00	4.00	0.20	2	15	2	26.708	27.632	∞	∞	FBK0505352
2.00	2.00	1.90	30.00	64.00	4.00	0.20	2	15	2	31.877	32.980	∞	∞	FBK0505353
2.50	2.50	-	-	51.00	4.00	0.20	2	15	1	4.808	4.969	5.326	5.742	FBK0505354
2.50	2.50	2.40	4.00	51.00	4.00	0.20	2	15	2	5.001	5.169	5.541	5.974	FBK0505355
2.50	2.50	2.40	6.00	51.00	4.00	0.20	2	15	2	7.069	7.308	7.841	8.461	FBK0505356
2.50	2.50	2.40	8.00	51.00	4.00	0.20	2	15	2	9.136	9.447	10.140	10.947	FBK0505357
2.50	2.50	2.40	10.00	51.00	4.00	0.20	2	15	2	11.203	11.587	12.440	13.433	FBK0505358
2.50	2.50	2.40	12.00	51.00	4.00	0.20	2	15	2	13.271	13.726	14.740	∞	FBK0505359
2.50	2.50	2.40	16.00	51.00	4.00	0.20	2	15	2	17.405	18.005	19.339	∞	FBK0505360
2.50	2.50	2.40	20.00	60.00	4.00	0.20	2	15	2	21.540	22.283	∞	∞	FBK0505361
2.50	2.50	2.40	25.00	60.00	4.00	0.20	2	15	2	26.708	27.632	∞	∞	FBK0505362
2.50	2.50	2.40	30.00	64.00	4.00	0.20	2	15	2	31.877	32.980	∞	∞	FBK0505363
3.00	3.00	-	-	51.00	4.00	0.30	2	15	1	5.322	5.497	5.886	6.340	FBK0505364
3.00	3.00	2.90	6.00	51.00	4.00	0.30	2	15	2	7.065	7.301	7.826	∞	FBK0505365
3.00	3.00	2.90	8.00	51.00	4.00	0.30	2	15	2	9.133	9.440	10.125	∞	FBK0505366
3.00	3.00	2.90	10.00	51.00	4.00	0.30	2	15	2	11.200	11.580	12.425	∞	FBK0505367
3.00	3.00	2.90	12.00	51.00	4.00	0.30	2	15	2	13.267	13.719	14.725	∞	FBK0505368
3.00	3.00	2.90	16.00	51.00	4.00	0.30	2	15	2	17.402	17.998	∞	∞	FBK0505369
3.00	3.00	2.90	20.00	60.00	4.00	0.30	2	15	2	21.537	22.276	∞	∞	FBK0505370
3.00	3.00	2.90	25.00	60.00	4.00	0.30	2	15	2	26.705	27.625	∞	∞	FBK0505371
3.00	3.00	2.90	30.00	64.00	4.00	0.30	2	15	2	31.873	∞	∞	∞	FBK0505372

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

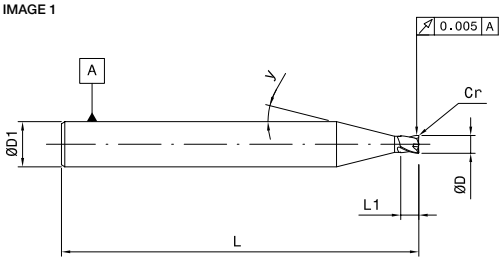
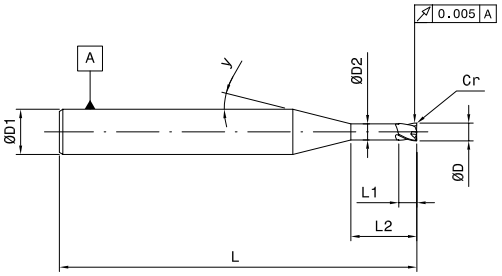


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.30	-	-	64.00	6.00	0.03	2	10	1	0.709	0.746	0.834	0.948	FBK0505137
0.30	0.50	-	-	64.00	6.00	0.05	2	10	1	1.234	1.299	1.453	1.651	FBK0505410
0.30	0.50	0.28	1.50	64.00	6.00	0.05	2	11	2	1.824	1.911	2.115	2.369	FBK0503728
0.30	0.50	0.28	3.00	64.00	6.00	0.05	2	12	2	3.395	3.544	3.888	4.307	FBK0503729
0.40	0.60	-	-	64.00	6.00	0.05	2	10	1	1.339	1.410	1.577	1.793	FBK0505411
0.40	0.60	0.38	2.00	64.00	6.00	0.05	2	11	2	2.347	2.460	2.725	3.054	FBK0503731
0.40	0.60	0.38	4.00	64.00	6.00	0.05	2	13	2	4.437	4.616	5.023	5.511	FBK0503732
0.50	0.80	-	-	64.00	6.00	0.05	2	10	1	1.549	1.632	1.827	2.078	FBK0505412
0.50	0.80	0.47	3.00	64.00	6.00	0.05	2	12	2	3.419	3.570	3.916	4.338	FBK0503734
0.50	0.80	0.47	6.00	64.00	6.00	0.05	2	15	2	6.530	6.756	7.259	7.844	FBK0503735
0.50	0.80	0.47	8.00	64.00	6.00	0.05	2	15	2	8.598	8.896	9.558	10.330	FBK0503736
0.50	0.80	0.47	10.00	64.00	6.00	0.05	2	15	2	10.665	11.035	11.858	12.816	FBK0503737
0.60	0.90	-	-	64.00	6.00	0.05	2	10	1	2.272	2.395	2.684	3.056	FBK0505413
0.60	0.90	0.55	2.00	64.00	6.00	0.05	2	11	2	2.529	2.651	2.936	3.291	FBK0503739
0.60	0.90	0.55	4.00	64.00	6.00	0.05	2	12	2	4.621	4.825	5.295	5.867	FBK0503740
0.60	0.90	0.55	6.00	64.00	6.00	0.05	2	15	2	6.705	6.937	7.453	8.054	FBK0503741
0.60	0.90	0.55	8.00	64.00	6.00	0.05	2	15	2	8.772	9.076	9.753	10.540	FBK0503742
0.60	0.90	0.55	10.00	64.00	6.00	0.05	2	15	2	10.840	11.216	12.052	13.026	FBK0503743
0.80	1.20	-	-	64.00	6.00	0.05	2	10	1	2.588	2.728	3.058	3.483	FBK0505414
0.80	1.20	0.75	2.50	64.00	6.00	0.05	2	11	2	3.052	3.200	3.545	3.976	FBK0503745
0.80	1.20	0.75	5.00	64.00	6.00	0.05	2	13	2	5.662	5.892	6.412	7.036	FBK0503746
0.80	1.20	0.75	8.00	64.00	6.00	0.05	2	15	2	8.772	9.076	9.753	10.54	FBK0503747
0.80	1.20	0.75	10.00	64.00	6.00	0.05	2	15	2	10.840	11.216	12.052	13.026	FBK0503748
1.00	1.50	-	-	64.00	6.00	0.10	2	9	1	2.890	3.063	3.482	4.040	FBK0505415
1.00	1.50	0.95	4.00	64.00	6.00	0.10	2	11	2	4.620	4.843	5.363	6.011	FBK0503750
1.00	1.50	0.95	6.00	64.00	6.00	0.10	2	14	2	6.700	6.948	7.506	8.164	FBK0503751

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

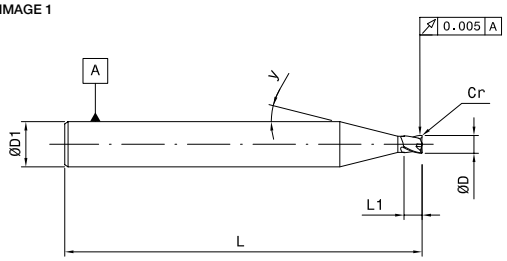
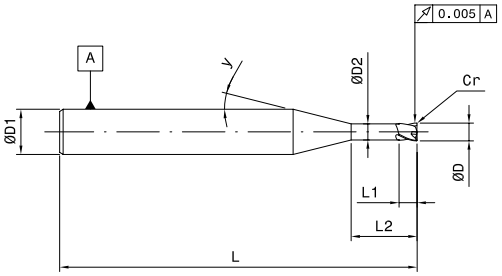


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.50	0.95	8.00	64.00	6.00	0.10	2	15	2	8.771	9.073	9.745	10.528	FBK0505138
1.00	1.50	0.95	10.00	64.00	6.00	0.10	2	15	2	10.838	11.212	12.045	13.014	FBK0503752
1.00	1.50	0.95	12.00	64.00	6.00	0.10	2	15	2	12.905	13.352	14.345	15.500	FBK0505139
1.00	1.50	0.95	15.00	64.00	6.00	0.10	2	15	2	16.006	16.561	17.794	19.23	FBK0503753
1.00	1.50	0.95	20.00	64.00	6.00	0.10	2	15	2	21.175	21.909	23.544	25.446	FBK0503754
1.00	1.50	0.95	25.00	64.00	6.00	0.10	2	15	2	26.343	27.257	29.293	31.661	FBK0503755
1.20	1.80	-	-	64.00	6.00	0.10	2	9	1	3.903	4.139	4.710	5.471	FBK0505416
1.20	1.80	1.15	4.00	64.00	6.00	0.10	2	11	2	4.822	5.055	5.598	6.275	FBK0503757
1.20	1.80	1.15	6.00	64.00	6.00	0.10	2	13	2	6.936	7.216	7.850	8.610	FBK0503758
1.20	1.80	1.15	8.00	64.00	6.00	0.10	2	15	2	9.043	9.354	10.048	10.855	FBK0503759
1.20	1.80	1.15	12.00	64.00	6.00	0.10	2	15	2	13.177	13.633	14.647	15.828	FBK0503760
1.20	1.80	1.15	16.00	64.00	6.00	0.10	2	15	2	17.312	17.912	19.247	20.800	FBK0503761
1.50	2.30	-	-	64.00	6.00	0.15	2	9	1	4.429	4.694	5.337	6.193	FBK0505417
1.50	2.30	1.45	4.00	64.00	6.00	0.15	2	10	2	4.810	5.066	5.673	6.452	FBK0505140
1.50	2.30	1.45	6.00	64.00	6.00	0.15	2	12	2	6.921	7.224	7.920	8.768	FBK0503763
1.50	2.30	1.45	8.00	64.00	6.00	0.15	2	15	2	9.041	9.351	10.041	10.843	FBK0505141
1.50	2.30	1.45	10.00	64.00	6.00	0.15	2	15	2	11.108	11.49	12.34	13.329	FBK0503764
1.50	2.30	1.45	12.00	64.00	6.00	0.15	2	15	2	13.176	13.63	14.640	15.816	FBK0505142
1.50	2.30	1.45	15.00	64.00	6.00	0.15	2	15	2	16.277	16.839	18.090	19.545	FBK0503765
1.50	2.30	1.45	20.00	64.00	6.00	0.15	2	15	2	21.445	22.187	23.839	25.761	FBK0503766
1.50	2.30	1.45	25.00	64.00	6.00	0.15	2	15	2	26.613	27.536	29.588	31.976	FBK0503767
2.00	3.00	-	-	64.00	6.00	0.20	2	8	1	5.157	5.509	6.387	7.615	FBK0503768
2.00	3.00	1.90	4.00	64.00	6.00	0.20	2	9	2	4.972	5.268	5.985	6.939	FBK0505143
2.00	3.00	1.90	6.00	64.00	6.00	0.20	2	11	2	7.046	7.384	8.171	9.152	FBK0503769

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

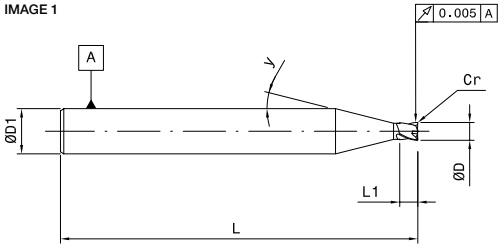
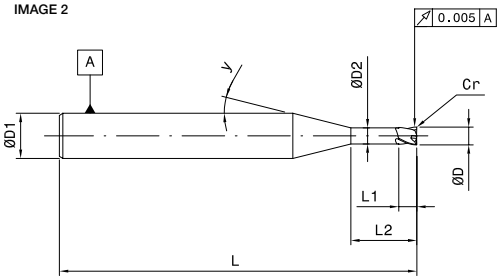


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	3.00	1.90	8.00	64.00	6.00	0.20	2	14	2	9.127	9.463	10.218	11.107	FBK0505144
2.00	3.00	1.90	10.00	64.00	6.00	0.20	2	15	2	11.203	11.587	12.440	13.433	FBK0503770
2.00	3.00	1.90	12.00	64.00	6.00	0.20	2	15	2	13.271	13.726	14.740	15.919	FBK0505145
2.00	3.00	1.90	16.00	64.00	6.00	0.20	2	15	2	17.405	18.005	19.339	20.892	FBK0503771
2.00	3.00	1.90	20.00	64.00	6.00	0.20	2	15	2	21.540	22.283	23.939	25.865	FBK0503772
2.00	3.00	1.90	25.00	64.00	6.00	0.20	2	15	2	26.708	27.632	29.688	32.080	FBK0503773
2.00	3.00	1.90	30.00	64.00	6.00	0.20	2	15	2	31.877	32.980	35.437	38.296	FBK0503774
2.50	3.00	-	-	64.00	6.00	0.20	2	7	1	5.158	5.569	6.636	8.236	FBK0503775
2.50	3.00	2.40	6.00	64.00	6.00	0.20	2	10	2	7.061	7.437	8.331	9.479	FBK0503776
2.50	3.00	2.40	8.00	64.00	6.00	0.20	2	12	2	9.127	9.527	10.444	11.562	FBK0505146
2.50	3.00	2.40	10.00	64.00	6.00	0.20	2	15	2	11.203	11.587	12.440	13.433	FBK0503777
2.50	3.00	2.40	12.00	64.00	6.00	0.20	2	15	2	13.271	13.726	14.740	15.919	FBK0505147
2.50	3.00	2.40	16.00	64.00	6.00	0.20	2	15	2	17.405	18.005	19.339	20.892	FBK0503778
2.50	3.00	2.40	20.00	64.00	6.00	0.20	2	15	2	21.540	22.283	23.939	25.865	FBK0503779
2.50	3.00	2.40	25.00	64.00	6.00	0.20	2	15	2	26.708	27.632	29.688	32.08	FBK0503780
2.50	3.00	2.40	30.00	64.00	6.00	0.20	2	15	2	31.877	32.980	35.437	38.296	FBK0505148
3.00	3.00	-	-	64.00	6.00	0.30	2	6	1	5.166	5.651	6.982	9.200	FBK0503781
3.00	3.00	2.90	6.00	64.00	6.00	0.30	2	8	2	7.129	7.614	8.823	10.514	FBK0503782
3.00	3.00	2.90	8.00	64.00	6.00	0.30	2	10	2	9.159	9.646	10.801	12.282	FBK0505149
3.00	3.00	2.90	10.00	64.00	6.00	0.30	2	13	2	11.198	11.644	12.655	13.866	FBK0503783
3.00	3.00	2.90	12.00	64.00	6.00	0.30	2	15	2	13.267	13.719	14.725	15.895	FBK0505418
3.00	3.00	2.90	16.00	64.00	6.00	0.30	2	15	2	17.402	17.998	19.324	20.868	FBK0503784
3.00	3.00	2.90	20.00	64.00	6.00	0.30	2	15	2	21.537	22.276	23.924	25.84	FBK0503785
3.00	3.00	2.90	25.00	64.00	6.00	0.30	2	15	2	26.705	27.625	29.673	32.056	FBK0503786
3.00	3.00	2.90	30.00	64.00	6.00	0.30	2	15	2	31.873	32.973	35.422	38.272	FBK0503787

Application data on page no 2.073 & 2.074

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4 Flute

Centre cutting high performance 4 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

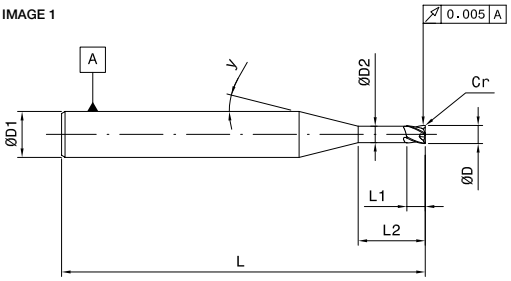
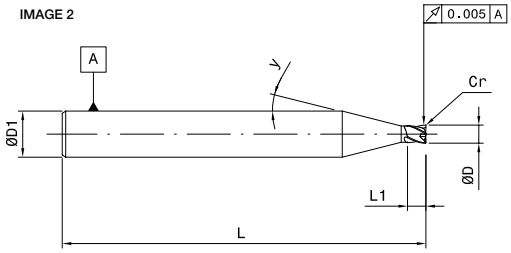


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.25	0.18	2.00	51.00	4.00	0.03	4	15	1	2.377	2.459	2.641	2.853	FBK0505373
0.20	0.25	0.18	4.00	51.00	4.00	0.03	4	15	1	4.444	4.598	4.941	5.339	FBK0505374
0.40	0.40	0.38	2.00	51.00	4.00	0.05	4	15	1	2.376	2.457	2.638	2.848	FBK0505375
0.40	0.40	0.38	4.00	51.00	4.00	0.05	4	15	1	4.444	4.597	4.938	5.334	FBK0505376
0.40	0.40	0.38	6.00	51.00	4.00	0.05	4	15	1	6.511	6.736	7.237	7.820	FBK0505377
0.40	0.40	0.38	8.00	51.00	4.00	0.05	4	15	1	8.578	8.876	9.537	10.307	FBK0505378
0.40	0.40	0.38	10.00	51.00	4.00	0.05	4	15	1	10.646	11.015	11.837	12.793	FBK0505379
0.50	0.50	0.47	2.00	51.00	4.00	0.05	4	15	1	2.396	2.477	2.659	2.871	FBK0505380
0.50	0.50	0.47	4.00	51.00	4.00	0.05	4	15	1	4.463	4.617	4.959	5.357	FBK0505381
0.50	0.50	0.47	6.00	51.00	4.00	0.05	4	15	1	6.530	6.756	7.259	7.844	FBK0505382
0.50	0.50	0.47	8.00	51.00	4.00	0.05	4	15	1	8.598	8.896	9.558	10.330	FBK0505383
0.50	0.50	0.47	10.00	51.00	4.00	0.05	4	15	1	10.665	11.035	11.858	12.816	FBK0505384
1.00	1.00	0.95	2.00	51.00	4.00	0.10	4	15	1	2.569	2.655	2.846	3.069	FBK0505385
1.00	1.00	0.95	4.00	51.00	4.00	0.10	4	15	1	4.636	4.794	5.146	5.555	FBK0505386
1.00	1.00	0.95	6.00	51.00	4.00	0.10	4	15	1	6.703	6.933	7.446	8.042	FBK0505387
1.00	1.00	0.95	8.00	51.00	4.00	0.10	4	15	1	8.771	9.073	9.745	10.528	FBK0505388
1.00	1.00	0.95	10.00	51.00	4.00	0.10	4	15	1	10.838	11.212	12.045	13.014	FBK0505389
1.50	1.50	-	-	51.00	4.00	0.15	4	15	2	3.776	3.903	4.184	4.511	FBK0505390
1.50	1.50	1.45	4.00	51.00	4.00	0.15	4	15	1	4.906	5.072	5.441	5.870	FBK0505391

Application data on page no 2.073 & 2.074

4 Flute

Centre cutting high performance 4 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

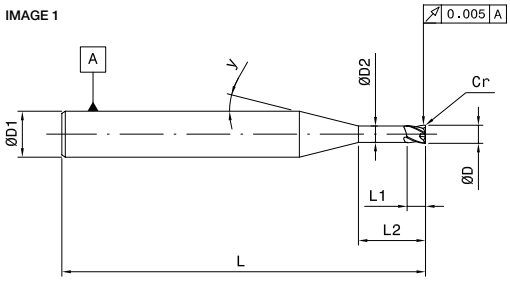
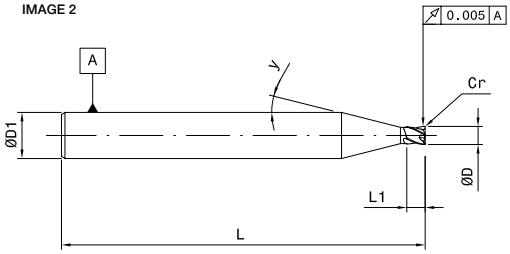


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	1.50	1.45	6.00	51.00	4.00	0.15	4	15	1	6.974	7.212	7.741	8.357	FBK0505392
1.50	1.50	1.45	8.00	51.00	4.00	0.15	4	15	1	9.041	9.351	10.041	10.843	FBK0505393
1.50	1.50	1.45	10.00	51.00	4.00	0.15	4	15	1	11.108	11.49	12.34	13.329	FBK0505394
2.00	2.00	-	-	51.00	4.00	0.20	4	15	2	4.292	4.434	4.751	5.121	FBK0505395
2.00	2.00	1.90	4.00	51.00	4.00	0.20	4	15	1	5.001	5.169	5.541	5.974	FBK0505396
2.00	2.00	1.90	6.00	51.00	4.00	0.20	4	15	1	7.069	7.308	7.841	8.461	FBK0505397
2.00	2.00	1.90	8.00	51.00	4.00	0.20	4	15	1	9.136	9.447	10.14	10.947	FBK0505398
2.00	2.00	1.90	10.00	51.00	4.00	0.20	4	15	1	11.203	11.587	12.440	13.433	FBK0505399
2.50	2.50	-	-	51.00	4.00	0.20	4	15	2	4.808	4.969	5.326	5.742	FBK0505400
2.50	2.50	2.40	4.00	51.00	4.00	0.20	4	15	1	5.001	5.169	5.541	5.974	FBK0505401
2.50	2.50	2.40	6.00	51.00	4.00	0.20	4	15	1	7.069	7.308	7.841	8.461	FBK0505402
2.50	2.50	2.40	8.00	51.00	4.00	0.20	4	15	1	9.136	9.447	10.140	10.947	FBK0505403
2.50	2.50	2.40	10.00	51.00	4.00	0.20	4	15	1	11.203	11.587	12.440	13.433	FBK0505404
3.00	3.00	-	-	51.00	4.00	0.30	4	15	2	5.322	5.497	5.886	6.340	FBK0505405
3.00	3.00	2.90	4.00	51.00	4.00	0.30	4	15	1	4.998	5.162	5.526	5.950	FBK0505406
3.00	3.00	2.90	6.00	51.00	4.00	0.30	4	15	1	7.065	7.301	7.826	8.436	FBK0505407
3.00	3.00	2.90	8.00	51.00	4.00	0.30	4	15	1	9.133	9.440	10.125	∞	FBK0505408
3.00	3.00	2.90	10.00	51.00	4.00	0.30	4	15	1	11.200	11.58	12.425	∞	FBK0505409

Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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4 Flute

Centre cutting high performance 4 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

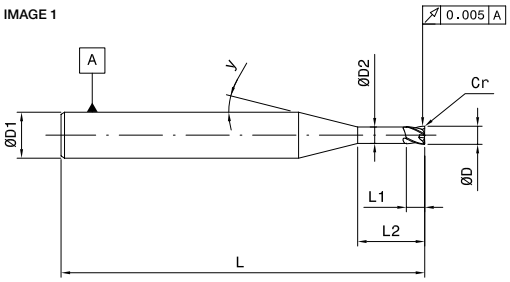
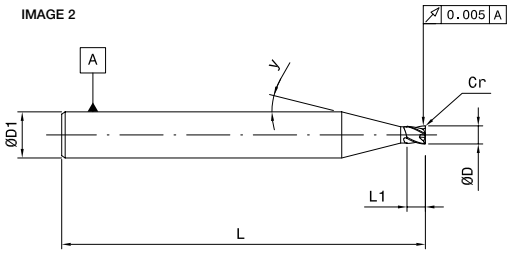


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.30	0.18	2.00	64.00	6.00	0.03	4	11	1	2.348	2.462	2.729	3.061	FBK0505151
0.20	0.30	0.18	4.00	64.00	6.00	0.03	4	13	1	4.438	4.618	5.027	5.517	FBK0505152
0.40	0.60	0.38	2.00	64.00	6.00	0.05	4	11	1	2.347	2.460	2.725	3.054	FBK0505156
0.40	0.60	0.38	4.00	64.00	6.00	0.05	4	13	1	4.437	4.616	5.023	5.511	FBK0505157
0.40	0.60	0.38	6.00	64.00	6.00	0.05	4	15	1	6.511	6.736	7.237	7.820	FBK0505158
0.40	0.60	0.38	8.00	64.00	6.00	0.05	4	15	1	8.578	8.876	9.537	10.307	FBK0505159
0.40	0.60	0.38	10.00	64.00	6.00	0.05	4	15	1	10.646	11.015	11.837	12.793	FBK0505160
0.50	0.80	0.47	2.00	64.00	6.00	0.05	4	11	1	2.374	2.489	2.756	3.089	FBK0505161
0.50	0.80	0.47	4.00	64.00	6.00	0.05	4	12	1	4.462	4.659	5.112	5.665	FBK0505162
0.50	0.80	0.47	6.00	64.00	6.00	0.05	4	15	1	6.530	6.756	7.259	7.844	FBK0505163
0.50	0.80	0.47	8.00	64.00	6.00	0.05	4	15	1	8.598	8.896	9.558	10.330	FBK0505164
0.50	0.80	0.47	10.00	64.00	6.00	0.05	4	15	1	10.665	11.035	11.858	12.816	FBK0505165
1.00	1.50	-	-	64.00	6.00	0.10	4	10	2	3.050	3.212	3.597	4.090	FBK0505419
1.00	1.50	0.95	4.00	64.00	6.00	0.10	4	11	1	4.620	4.843	5.363	6.011	FBK0505167
1.00	1.50	0.95	6.00	64.00	6.00	0.10	4	14	1	6.700	6.948	7.506	8.164	FBK0505168
1.00	1.50	0.95	8.00	64.00	6.00	0.10	4	15	1	8.771	9.073	9.745	10.528	FBK0505169
1.00	1.50	0.95	10.00	64.00	6.00	0.10	4	15	1	10.838	11.212	12.045	13.014	FBK0505170
1.50	2.30	-	-	64.00	6.00	0.15	4	9	2	4.429	4.694	5.337	6.193	FBK0505420
1.50	2.30	1.45	4.00	64.00	6.00	0.15	4	10	1	4.810	5.066	5.673	6.452	FBK0505172
1.50	2.30	1.45	6.00	64.00	6.00	0.15	4	12	1	6.921	7.224	7.920	8.768	FBK0505173

Application data on page no 2.073 & 2.074

4 Flute

Centre cutting high performance 4 flute micro end mill with corner radius

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

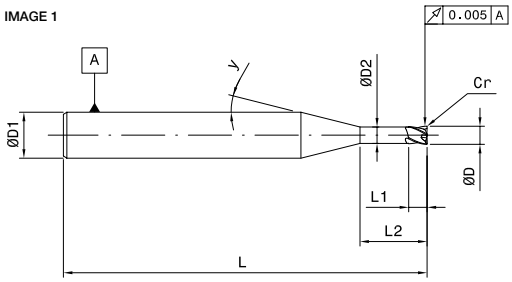
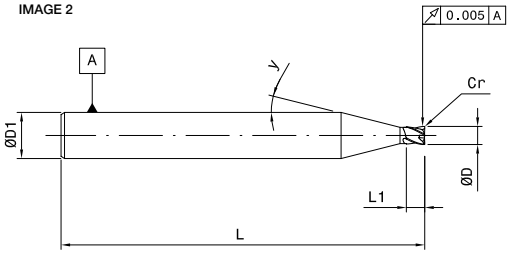


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.50	2.30	1.45	8.00	64.00	6.00	0.15	4	15	1	9.041	9.351	10.041	10.843	FBK0505421
1.50	2.30	1.45	10.00	64.00	6.00	0.15	4	15	1	11.108	11.490	12.340	13.329	FBK0505175
2.00	3.00	-	-	64.00	6.00	0.20	4	8	2	5.157	5.509	6.387	7.615	FBK0505422
2.00	3.00	1.90	4.50	64.00	6.00	0.20	4	9	1	5.501	5.830	6.626	7.686	FBK0505423
2.00	3.00	1.90	6.00	64.00	6.00	0.20	4	11	1	7.046	7.384	8.171	9.152	FBK0505178
2.00	3.00	1.90	8.00	64.00	6.00	0.20	4	14	1	9.127	9.463	10.218	11.107	FBK0505179
2.00	3.00	1.90	10.00	64.00	6.00	0.20	4	15	1	11.203	11.587	12.440	13.433	FBK0505180
2.50	3.00	-	-	64.00	6.00	0.20	4	8	2	5.157	5.509	6.387	7.615	FBK0505424
2.50	3.00	2.40	4.50	64.00	6.00	0.20	4	9	1	5.501	5.830	6.626	7.686	FBK0505425
2.50	3.00	2.40	6.00	64.00	6.00	0.20	4	11	1	7.046	7.384	8.171	9.152	FBK0505426
2.50	3.00	2.40	8.00	64.00	6.00	0.20	4	14	1	9.127	9.463	10.218	11.107	FBK0505427
2.50	3.00	2.40	10.00	64.00	6.00	0.20	4	15	1	11.203	11.587	12.440	13.433	FBK0505428
3.00	3.00	-	-	64.00	6.00	0.30	4	6	2	5.166	5.651	6.982	9.200	FBK0505429
3.00	3.00	2.90	4.50	64.00	6.00	0.30	4	7	1	5.589	6.027	7.166	8.872	FBK0505430
3.00	3.00	2.90	6.00	64.00	6.00	0.30	4	8	1	7.129	7.614	8.823	10.514	FBK0505431
3.00	3.00	2.90	8.00	64.00	6.00	0.30	4	10	1	9.159	9.646	10.801	12.282	FBK0505432
3.00	3.00	2.90	10.00	64.00	6.00	0.30	4	13	1	11.198	11.644	12.655	13.866	FBK0505433

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro ball nose

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P5-P6
K1
M1-M3
S1-S4
H1-H4

IMAGE 1

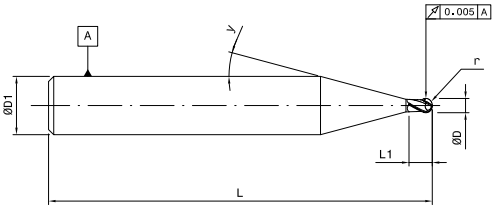
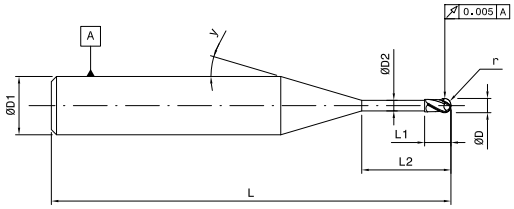


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.10	0.20	-	-	51.00	4.00	0.05	2	15	1	0.684	0.706	0.755	0.812	FBK0505207
0.10	0.20	-	-	60.00	4.00	0.05	2	10	1	0.602	0.633	0.705	0.797	FBK0505208
0.20	0.30	-	-	51.00	4.00	0.10	2	15	1	0.786	0.810	0.863	0.925	FBK0505209
0.30	0.40	-	-	51.00	4.00	0.15	2	15	1	1.197	1.234	1.315	1.41	FBK0505210
0.30	0.40	0.28	1.50	51.00	4.00	0.15	2	15	2	1.856	1.916	2.048	2.202	FBK0505211
0.30	0.40	0.28	3.00	51.00	4.00	0.15	2	15	2	3.407	3.520	3.773	4.067	FBK0505212
0.40	0.50	-	-	51.00	4.00	0.20	2	15	1	1.299	1.337	1.423	1.522	FBK0505213
0.40	0.50	0.38	2.00	51.00	4.00	0.20	2	15	2	2.371	2.447	2.615	2.811	FBK0505214
0.40	0.50	0.38	4.00	51.00	4.00	0.20	2	15	2	4.439	4.586	4.915	5.298	FBK0505215
0.50	0.70	-	-	51.00	4.00	0.25	2	15	1	1.504	1.548	1.645	1.758	FBK0505216
0.50	0.70	0.47	3.00	51.00	4.00	0.25	2	15	2	3.423	3.533	3.779	4.066	FBK0505217
0.50	0.70	0.47	6.00	51.00	4.00	0.25	2	15	2	6.524	6.742	7.229	7.795	FBK0505218
0.50	0.70	0.47	8.00	51.00	4.00	0.25	2	15	2	8.591	8.882	9.529	10.281	FBK0505219
0.50	0.70	0.47	10.00	51.00	4.00	0.25	2	15	2	10.658	11.021	11.828	12.768	FBK0505220
0.60	0.80	-	-	51.00	4.00	0.30	2	15	1	2.259	2.327	2.479	2.656	FBK0505221
0.60	0.80	0.55	2.00	51.00	4.00	0.30	2	15	2	2.562	2.641	2.816	3.02	FBK0505222
0.60	0.80	0.55	4.00	51.00	4.00	0.30	2	15	2	4.629	4.780	5.116	5.507	FBK0505223
0.60	0.80	0.55	6.00	51.00	4.00	0.30	2	15	2	6.697	6.919	7.416	7.993	FBK0505224
0.60	0.80	0.55	8.00	51.00	4.00	0.30	2	15	2	8.764	9.059	9.715	10.479	FBK0505225
0.60	0.80	0.55	10.00	51.00	4.00	0.30	2	15	2	10.831	11.198	12.015	12.965	FBK0505226
0.80	1.00	-	-	51.00	4.00	0.40	2	15	1	2.462	2.534	2.694	2.88	FBK0505227
0.80	1.00	0.75	2.50	51.00	4.00	0.40	2	15	2	3.075	3.169	3.376	3.618	FBK0505228
0.80	1.00	0.75	5.00	51.00	4.00	0.40	2	15	2	5.660	5.843	6.251	6.725	FBK0505229
0.80	1.00	0.75	8.00	51.00	4.00	0.40	2	15	2	8.761	9.052	9.700	10.455	FBK0505230
0.80	1.00	0.75	10.00	51.00	4.00	0.40	2	15	2	10.828	11.191	12.000	12.941	FBK0505231
1.00	1.20	-	-	51.00	4.00	0.50	2	15	1	2.665	2.741	2.909	3.104	FBK0505232

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro ball nose

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P5-P6
K1
M1-M3
S1-S4
H1-H4

IMAGE 1

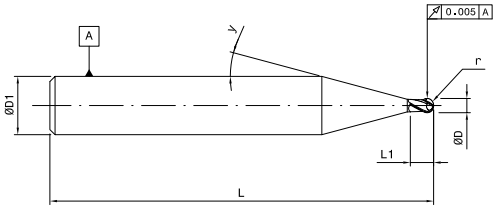
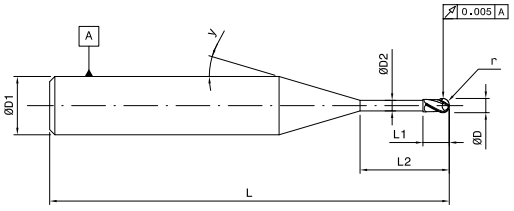


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.20	0.95	4.00	51.00	4.00	0.50	2	15	2	4.623	4.766	5.086	5.458	FBK0505233
1.00	1.20	0.95	6.00	51.00	4.00	0.50	2	15	2	6.690	6.906	7.386	7.944	FBK0505234
1.00	1.20	0.95	8.00	51.00	4.00	0.50	2	15	2	8.757	9.045	9.685	10.431	FBK0505235
1.00	1.20	0.95	10.00	51.00	4.00	0.50	2	15	2	10.825	11.184	11.985	12.917	FBK0505236
1.00	1.20	0.95	12.00	51.00	4.00	0.50	2	15	2	12.892	13.324	14.285	15.403	FBK0505237
1.00	1.20	0.95	15.00	51.00	4.00	0.50	2	15	2	15.993	16.533	17.734	19.133	FBK0505238
1.00	1.20	0.95	20.00	60.00	4.00	0.50	2	15	2	21.161	21.881	23.484	25.348	FBK0505239
1.00	1.20	0.95	25.00	60.00	4.00	0.50	2	15	2	26.330	27.23	29.233	∞	FBK0505240
1.20	1.40	-	-	51.00	4.00	0.60	2	15	1	3.658	3.764	4.002	4.278	FBK0505241
1.20	1.40	1.15	4.00	51.00	4.00	0.60	2	15	2	4.891	5.041	5.374	5.761	FBK0505242
1.20	1.40	1.15	6.00	51.00	4.00	0.60	2	15	2	6.959	7.180	7.673	8.247	FBK0505243
1.20	1.40	1.15	8.00	51.00	4.00	0.60	2	15	2	9.026	9.320	9.973	10.734	FBK0505244
1.20	1.40	1.15	12.00	51.00	4.00	0.60	2	15	2	13.161	13.598	14.573	15.706	FBK0505245
1.20	1.40	1.15	16.00	51.00	4.00	0.60	2	15	2	17.295	17.877	19.172	20.679	FBK0505246
1.50	1.80	-	-	51.00	4.00	0.75	2	15	1	4.066	4.182	4.439	4.738	FBK0505247
1.50	1.80	1.46	4.00	51.00	4.00	0.75	2	15	2	4.867	5.010	5.330	5.701	FBK0505248
1.50	1.80	1.45	6.00	51.00	4.00	0.75	2	15	2	6.954	7.170	7.651	8.211	FBK0505249
1.50	1.80	1.45	8.00	51.00	4.00	0.75	2	15	2	9.021	9.309	9.951	10.697	FBK0505250
1.50	1.80	1.45	10.00	51.00	4.00	0.75	2	15	2	11.088	11.448	12.25	13.183	FBK0505251
1.50	1.80	1.45	12.00	51.00	4.00	0.75	2	15	2	13.156	13.588	14.55	15.670	FBK0505252
1.50	1.80	1.45	15.00	51.00	4.00	0.75	2	15	2	16.257	16.797	18.000	19.399	FBK0505253
1.50	1.80	1.45	20.00	60.00	4.00	0.75	2	15	2	21.425	22.145	23.749	∞	FBK0505254
1.50	1.80	1.45	25.00	60.00	4.00	0.75	2	15	2	26.593	27.494	29.498	∞	FBK0505255
2.00	2.50	-	-	51.00	4.00	1.00	2	15	1	4.781	4.913	5.206	5.548	FBK0505256
2.00	2.50	1.90	4.00	51.00	4.00	1.00	2	15	2	4.974	5.113	5.421	5.780	FBK0505257
2.00	2.50	1.90	6.00	51.00	4.00	1.00	2	15	2	7.042	7.252	7.721	8.266	FBK0505258

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0
Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro ball nose

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

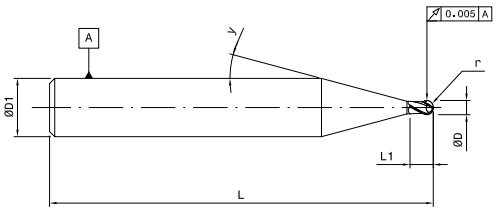
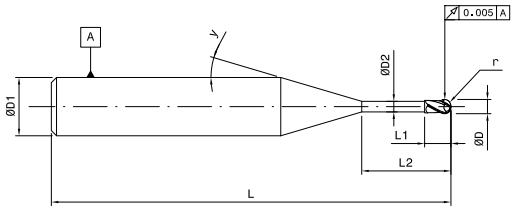


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	2.50	1.90	8.00	51.00	4.00	1.00	2	15	2	9.109	9.392	10.020	10.752	FBK0505259
2.00	2.50	1.90	10.00	51.00	4.00	1.00	2	15	2	11.176	11.531	12.320	13.239	FBK0505260
2.00	2.50	1.90	12.00	51.00	4.00	1.00	2	15	2	13.244	13.670	14.620	15.725	FBK0505261
2.00	2.50	1.90	16.00	51.00	4.00	1.00	2	15	2	17.378	17.949	19.219	∞	FBK0505262
2.00	2.50	1.90	20.00	60.00	4.00	1.00	2	15	2	21.513	22.228	23.819	∞	FBK0505263
2.00	2.50	1.90	25.00	60.00	4.00	1.00	2	15	2	26.681	27.576	29.568	∞	FBK0505264
2.00	2.50	1.90	30.00	64.00	4.00	1.00	2	15	2	31.850	32.925	∞	∞	FBK0505265
2.50	3.50	-	-	51.00	4.00	1.25	2	15	1	5.807	5.965	6.319	6.730	FBK0505266
2.50	3.50	2.40	6.00	51.00	4.00	1.25	2	15	2	7.033	7.235	7.683	8.205	FBK0505267
2.50	3.50	2.40	8.00	51.00	4.00	1.25	2	15	2	9.101	9.374	9.983	10.692	FBK0505268
2.50	3.50	2.40	10.00	51.00	4.00	1.25	2	15	2	11.168	11.513	12.283	13.178	FBK0505269
2.50	3.50	2.40	12.00	51.00	4.00	1.25	2	15	2	13.235	13.653	14.582	15.664	FBK0505270
2.50	3.50	2.40	16.00	51.00	4.00	1.25	2	15	2	17.370	17.932	19.182	∞	FBK0505271
2.50	3.50	2.40	20.00	60.00	4.00	1.25	2	15	2	21.505	22.210	∞	∞	FBK0505272
2.50	3.50	2.40	25.00	60.00	4.00	1.25	2	15	2	26.673	27.559	∞	∞	FBK0505273
2.50	3.50	2.40	30.00	64.00	4.00	1.25	2	15	2	31.841	32.907	∞	∞	FBK0505274
3.00	3.50	-	-	51.00	4.00	1.50	2	15	1	5.798	5.948	6.281	6.669	FBK0505275
3.00	3.50	2.90	6.00	51.00	4.00	1.50	2	15	2	7.025	7.217	7.646	8.144	FBK0505276
3.00	3.50	2.90	8.00	51.00	4.00	1.50	2	15	2	9.092	9.357	9.946	10.631	FBK0505277
3.00	3.50	2.90	10.00	51.00	4.00	1.50	2	15	2	11.159	11.496	12.245	∞	FBK0505278
3.00	3.50	2.90	12.00	51.00	4.00	1.50	2	15	2	13.227	13.635	14.545	∞	FBK0505279
3.00	3.50	2.90	16.00	51.00	4.00	1.50	2	15	2	17.361	17.914	∞	∞	FBK0505280
3.00	3.50	2.90	20.00	60.00	4.00	1.50	2	15	2	21.496	22.193	∞	∞	FBK0505281
3.00	3.50	2.90	25.00	60.00	4.00	1.50	2	15	2	26.664	27.541	∞	∞	FBK0505282
3.00	3.50	2.90	30.00	64.00	4.00	1.50	2	15	2	31.833	∞	∞	∞	FBK0505283

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0
Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro ball nose

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

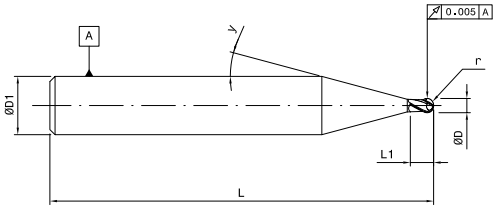
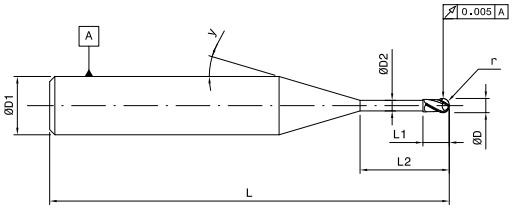


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.20	0.30	-	-	64.00	6.00	0.10	2	10	1	0.705	0.738	0.817	0.918	FBK0503789
0.30	0.50	-	-	64.00	6.00	0.15	2	10	1	1.228	1.288	1.428	1.608	FBK0505284
0.30	0.50	0.28	1.50	64.00	6.00	0.15	2	11	2	1.819	1.901	2.093	2.332	FBK0503791
0.30	0.50	0.28	3.00	64.00	6.00	0.15	2	12	2	3.390	3.535	3.868	4.274	FBK0503792
0.40	0.60	-	-	64.00	6.00	0.20	2	10	1	1.331	1.393	1.540	1.730	FBK0505285
0.40	0.60	0.38	2.00	64.00	6.00	0.20	2	11	2	2.340	2.446	2.692	2.999	FBK0503794
0.40	0.60	0.38	4.00	64.00	6.00	0.20	2	13	2	4.431	4.604	4.997	5.467	FBK0503795
0.50	0.80	-	-	64.00	6.00	0.25	2	10	1	1.539	1.610	1.777	1.993	FBK0505286
0.50	0.80	0.47	3.00	64.00	6.00	0.25	2	12	2	3.411	3.552	3.877	4.273	FBK0503797
0.50	0.80	0.47	6.00	64.00	6.00	0.25	2	15	2	6.524	6.742	7.229	7.795	FBK0503798
0.50	0.80	0.47	8.00	64.00	6.00	0.25	2	15	2	8.591	8.882	9.529	10.281	FBK0503799
0.50	0.80	0.47	10.00	64.00	6.00	0.25	2	15	2	10.658	11.021	11.828	12.768	FBK0503660
0.60	0.90	-	-	64.00	6.00	0.30	2	10	1	2.259	2.367	2.622	2.950	FBK0505287
0.60	0.90	0.55	2.00	64.00	6.00	0.30	2	11	2	2.517	2.626	2.881	3.199	FBK0503802
0.60	0.90	0.55	4.00	64.00	6.00	0.30	2	12	2	4.610	4.803	5.245	5.785	FBK0503663
0.60	0.90	0.55	6.00	64.00	6.00	0.30	2	15	2	6.697	6.919	7.416	7.993	FBK0503804
0.60	0.90	0.55	8.00	64.00	6.00	0.30	2	15	2	8.764	9.059	9.715	10.479	FBK0503805
0.60	0.90	0.55	10.00	64.00	6.00	0.30	2	15	2	10.831	11.198	12.015	12.965	FBK0503806
0.80	1.20	-	-	64.00	6.00	0.40	2	10	1	2.570	2.689	2.972	3.335	FBK0505288
0.80	1.20	0.75	2.50	64.00	6.00	0.40	2	11	2	3.036	3.166	3.469	3.847	FBK0503808
0.80	1.20	0.75	5.00	64.00	6.00	0.40	2	13	2	5.648	5.863	6.350	6.933	FBK0503809
0.80	1.20	0.75	8.00	64.00	6.00	0.40	2	15	2	8.761	9.052	9.700	10.455	FBK0503810
0.80	1.20	0.75	10.00	64.00	6.00	0.40	2	15	2	10.828	11.191	12.000	12.941	FBK0503811
1.00	1.50	-	-	64.00	6.00	0.50	2	9	1	2.866	3.013	3.369	3.842	FBK0505289
1.00	1.50	0.95	4.00	64.00	6.00	0.50	2	11	2	4.602	4.804	5.275	5.864	FBK0503813
1.00	1.50	0.95	6.00	64.00	6.00	0.50	2	14	2	6.685	6.918	7.441	8.057	FBK0503814

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Application data on page no 2.073 & 2.074

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2 Flute

Centre cutting high performance 2 flute micro ball nose

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

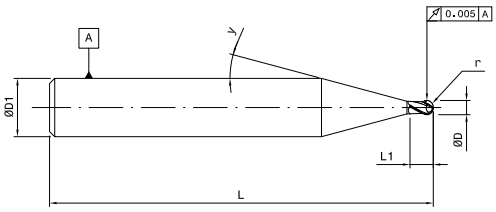
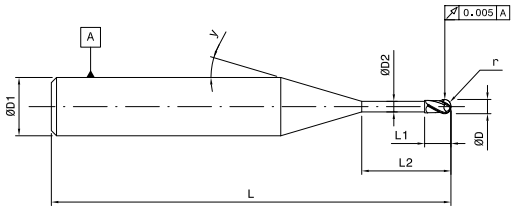


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
1.00	1.50	0.95	8.00	64.00	6.00	0.50	2	15	2	8.757	9.045	9.685	10.431	FBK0505181
1.00	1.50	0.95	10.00	64.00	6.00	0.50	2	15	2	10.825	11.184	11.985	12.917	FBK0503815
1.00	1.50	0.95	12.00	64.00	6.00	0.50	2	15	2	12.892	13.324	14.285	15.403	FBK0503815
1.00	1.50	0.95	15.00	64.00	6.00	0.50	2	15	2	15.993	16.533	17.734	19.133	FBK0503816
1.00	1.50	0.95	20.00	64.00	6.00	0.50	2	15	2	21.161	21.881	23.484	25.348	FBK0503817
1.00	1.50	0.95	25.00	64.00	6.00	0.50	2	15	2	26.330	27.230	29.233	31.564	FBK0503818
1.20	1.80	-	-	64.00	6.00	0.60	2	9	1	3.874	4.077	4.568	5.223	FBK0503819
1.20	1.80	1.15	4.00	64.00	6.00	0.60	2	11	2	4.799	5.006	5.488	6.090	FBK0503820
1.20	1.80	1.15	6.00	64.00	6.00	0.60	2	13	2	6.917	7.175	7.761	8.463	FBK0503821
1.20	1.80	1.15	8.00	64.00	6.00	0.60	2	15	2	9.026	9.320	9.973	10.734	FBK0503822
1.20	1.80	1.15	12.00	64.00	6.00	0.60	2	15	2	13.161	13.598	14.573	15.706	FBK0503823
1.20	1.80	1.15	16.00	64.00	6.00	0.60	2	15	2	17.295	17.877	19.172	20.679	FBK0503824
1.50	2.30	-	-	64.00	6.00	0.75	2	9	1	4.394	4.620	5.167	5.896	FBK0505291
1.50	2.30	1.46	4.00	64.00	6.00	0.75	2	10	2	4.749	4.968	5.490	6.158	FBK0505183
1.50	2.30	1.45	6.00	64.00	6.00	0.75	2	12	2	6.895	7.170	7.802	8.572	FBK0503826
1.50	2.30	1.45	8.00	64.00	6.00	0.75	2	15	2	9.021	9.309	9.951	10.697	FBK0505184
1.50	2.30	1.45	10.00	64.00	6.00	0.75	2	15	2	11.088	11.448	12.25	13.183	FBK0503827
1.50	2.30	1.45	12.00	64.00	6.00	0.75	2	15	2	13.156	13.588	14.55	15.670	FBK0505186
1.50	2.30	1.45	15.00	64.00	6.00	0.75	2	15	2	16.257	16.797	18.000	19.399	FBK0503828
1.50	2.30	1.45	20.00	64.00	6.00	0.75	2	15	2	21.425	22.145	23.749	25.615	FBK0503829
1.50	2.30	1.45	25.00	64.00	6.00	0.75	2	15	2	26.593	27.494	29.498	31.831	FBK0503830
2.00	3.00	-	-	64.00	6.00	1.00	2	8	1	5.105	5.396	6.122	7.139	FBK0503831
2.00	3.00	1.90	4.50	64.00	6.00	1.00	2	9	2	5.121	5.376	5.995	6.819	FBK0505292
2.00	3.00	1.90	6.00	64.00	6.00	1.00	2	11	2	7.008	7.305	7.995	8.857	FBK0503832

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro ball nose end mill

HPM HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

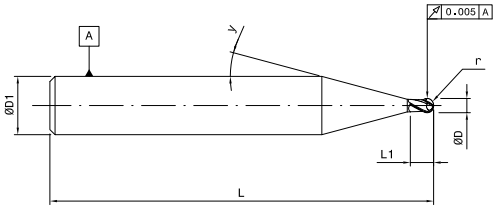
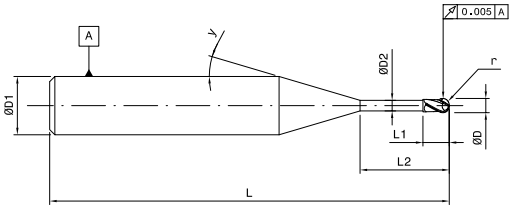


IMAGE 2



P5-P6
K1
M1-M3
S1-S4
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	3.00	1.90	8.00	64.00	6.00	1.00	2	14	2	9.098	9.403	10.087	10.894	FBK0505188
2.00	3.00	1.90	10.00	64.00	6.00	1.00	2	15	2	11.176	11.531	12.320	13.239	FBK0503833
2.00	3.00	1.90	12.00	64.00	6.00	1.00	2	15	2	13.244	13.670	14.620	15.725	FBK0505189
2.00	3.00	1.90	16.00	64.00	6.00	1.00	2	15	2	17.378	17.949	19.219	20.697	FBK0503834
2.00	3.00	1.90	20.00	64.00	6.00	1.00	2	15	2	21.513	22.228	23.819	25.670	FBK0503835
2.00	3.00	1.90	25.00	64.00	6.00	1.00	2	15	2	26.681	27.576	29.568	31.886	FBK0503836
2.00	3.00	1.90	30.00	64.00	6.00	1.00	2	15	2	31.850	32.925	35.317	38.101	FBK0503837
2.50	3.00	-	-	64.00	6.00	1.25	2	7	1	5.078	5.395	6.219	7.454	FBK0503838
2.50	3.00	2.40	6.00	64.00	6.00	1.25	2	10	2	7.006	7.322	8.072	9.035	FBK0503839
2.50	3.00	2.40	8.00	64.00	6.00	1.25	2	12	2	9.082	9.433	10.237	11.219	FBK0505190
2.50	3.00	2.40	10.00	64.00	6.00	1.25	2	15	2	11.168	11.513	12.283	13.178	FBK0503840
2.50	3.00	2.40	12.00	64.00	6.00	1.25	2	15	2	13.235	13.653	14.582	15.664	FBK0505191
2.50	3.00	2.40	16.00	64.00	6.00	1.25	2	15	2	17.370	17.932	19.182	20.637	FBK0503841
2.50	3.00	2.40	20.00	64.00	6.00	1.25	2	15	2	21.505	22.210	23.781	25.609	FBK0503842
2.50	3.00	2.40	25.00	64.00	6.00	1.25	2	15	2	26.673	27.559	29.531	31.825	FBK0503843
2.50	3.00	2.40	30.00	64.00	6.00	1.25	2	15	2	31.841	32.907	35.280	∞	FBK0505192
3.00	3.00	-	-	64.00	6.00	1.50	2	6	1	5.057	5.412	6.385	8.006	FBK0503844
3.00	3.00	2.90	6.00	64.00	6.00	1.50	2	8	2	7.050	7.444	8.426	9.801	FBK0503845
3.00	3.00	2.90	8.00	64.00	6.00	1.50	2	10	2	9.097	9.514	10.504	11.775	FBK0505193
3.00	3.00	2.90	10.00	64.00	6.00	1.50	2	13	2	11.151	11.546	12.441	13.513	FBK0503661
3.00	3.00	2.90	12.00	64.00	6.00	1.50	2	15	2	13.227	13.635	14.545	15.603	FBK0505194
3.00	3.00	2.90	16.00	64.00	6.00	1.50	2	15	2	17.361	17.914	19.144	20.576	FBK0503847
3.00	3.00	2.90	20.00	64.00	6.00	1.50	2	15	2	21.496	22.193	23.744	25.548	FBK0503848
3.00	3.00	2.90	25.00	64.00	6.00	1.50	2	15	2	26.664	27.541	29.493	∞	FBK0503849
3.00	3.00	2.90	30.00	64.00	6.00	1.50	2	15	2	31.833	32.890	35.242	∞	FBK0503850

Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0
Remark ∞ means no collusion in projection length area

Application data on page no 2.073 & 2.074

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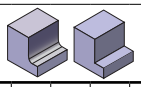
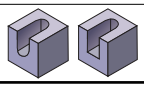
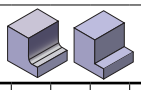
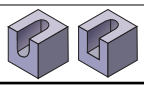
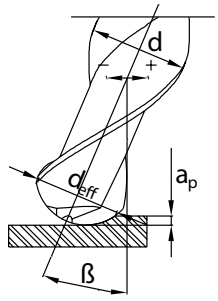
Cutting parameters

- Centre cutting high performance 2 flute micro end mill - 0.1 mm to 0.8 mm
- Centre cutting high performance 4 flute micro end mill - 0.1 mm to 0.8 mm
- Centre cutting high performance 2 flute micro end mill with corner radius - 0.1 mm to 0.8 mm
- Centre cutting high performance 4 flute micro end mill with corner radius - 0.1 mm to 0.8 mm
- Centre cutting high performance 2 flute micro ball nose - 0.1 mm to 0.8 mm

Material Group			Cutting Speed (Vc) m/min								Lubrication	Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			Shoulder Milling							Slot Milling															
																									
			5	2.3	1.6	1.4	1.2	1.1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			ap< 0.6D	ap< 0.6D	ap< 0.6D	ap< 0.5D	ap< 0.4D	ap< 0.3D	ap< 0.3D	ap< 0.3D				mm	Diameter in mm											
			ae/D 1%	ae/D 2%	ae/D 5%	ae/D 10%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	0.1		0.2		0.3		0.4		0.5		0.6		0.8	
															min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	150	129	118	107	97	93	89	72	Emulsion	72	150	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		6	180	154	141	128	115	111	107	86		86	180	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
Stainless Steel	M	1	130	112	102	93	84	81	78	62		62	130	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		2	100	86	78	71	64	62	59	48		48	100	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		3	90	77	71	65	58	56	54	43		43	90	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
Cast Iron	K	1	160	137	125	114	103	99	95	76		76	160	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
Super Alloys	S	1	60	51	47	43	38	37	36	29		29	60	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		2	70	60	55	50	45	44	42	34		34	70	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		3	50	43	40	36	32	31	30	24		24	50	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
		4	90	77	71	65	58	56	54	43		43	90	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012

- Centre cutting high performance 2 flute micro end mill - 1.0 mm to 3.0 mm
- Centre cutting high performance 4 flute micro end mill - 1.0 mm to 3.0 mm
- Centre cutting high performance 2 flute micro end mill with corner radius - 1.0 mm to 3.0 mm
- Centre cutting high performance 4 flute micro end mill with corner radius - 1.0 mm to 3.0 mm
- Centre cutting high performance 2 flute micro ball nose - 1.0 mm to 3.0 mm

Material Group			Cutting Speed (Vc) m/min								Lubrication	Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			Shoulder Milling							Slot Milling															
																									
			5	2.3	1.6	1.4	1.2	1.1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			ap< 0.6D	ap< 0.6D	ap< 0.6D	ap< 0.5D	ap< 0.4D	ap< 0.3D	ap< 0.3D	ap< 0.3D				mm	Diameter in mm											
			ae/D 1%	ae/D 2%	ae/D 5%	ae/D 10%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	1.0		1.2		1.5		2.0		2.5		3.0	
															min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	150	129	118	107	97	93	89	72	Emulsion	72	150	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		6	180	154	141	128	115	111	107	86		86	180	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
Stainless Steel	M	1	130	112	102	93	84	81	78	62		62	130	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		2	100	86	78	71	64	62	59	48		48	100	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		3	90	77	71	65	58	56	54	43		43	90	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
Cast Iron	K	1	160	137	125	114	103	99	95	76		76	160	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
Super Alloys	S	1	60	51	47	43	38	37	36	29		29	60	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		2	70	60	55	50	45	44	42	34		34	70	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		3	50	43	40	36	32	31	30	24		24	50	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
		4	90	77	71	65	58	56	54	43		43	90	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D\text{-}ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[ß + \arccos\left(\frac{D\text{-}2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.

(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

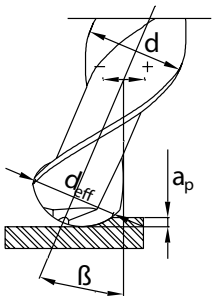
Cutting parameters

- Centre cutting high performance 2 flute micro end mill - 0.1 mm to 0.8 mm
- Centre cutting high performance 4 flute micro end mill - 0.1 mm to 0.8 mm
- Centre cutting high performance 2 flute micro end mill with corner radius - 0.1 mm to 0.8 mm
- Centre cutting high performance 4 flute micro end mill with corner radius - 0.1 mm to 0.8 mm
- Centre cutting high performance 2 flute micro ball nose - 0.1 mm to 0.8 mm

Material Group		Cutting Speed (Vc) m/min: Shoulder Milling							Slot Milling	Lubrication	Cutting Speed (Vc) m/min		mm	Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%											
		5	2.3	1.6	1.4	1.2	1.1	1	1					Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
		ap < 0.45D	ap < 0.45D	ap < 0.45D	ap <0.4D	ap < 0.35D	ap < 0.3D	ap < 0.3D	ap<0.3D					Diameter in mm											
														0.1		0.2		0.3		0.4		0.5		0.6		0.8	
		ae/D 1%	ae/D 2%	ae/D 5%	ae/D 10%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H 1	190	163	149	136	122	118	113	91	MQL/ Cold Air	91	190	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
	H 2	140	120	110	100	90	86	83	67		67	140	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
	H 3	90	77	71	65	58	56	54	43		43	90	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012
	H 4	90	77	71	65	58	56	54	43		43	90	fz	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.012

- Centre cutting high performance 2 flute micro end mill - 1.0 mm to 3.0 mm
- Centre cutting high performance 4 flute micro end mill - 1.0 mm to 3.0 mm
- Centre cutting high performance 2 flute micro end mill with corner radius - 1.0 mm to 3.0 mm
- Centre cutting high performance 4 flute micro end mill with corner radius - 1.0 mm to 3.0 mm
- Centre cutting high performance 2 flute micro ball nose - 1.0 mm to 3.0 mm

Material Group		Cutting Speed (Vc) m/min: Shoulder Milling							Slot Milling	Lubrication	Cutting Speed (Vc) m/min		mm	Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%											
		5	2.3	1.6	1.4	1.2	1.1	1	1					Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
		ap < 0.45D	ap < 0.45D	ap < 0.45D	ap <0.4D	ap < 0.35D	ap < 0.3D	ap < 0.3D	ap<0.3D					Diameter in mm											
														1.0		1.2		1.5		2.0		2.5		3.0	
		ae/D 1%	ae/D 2%	ae/D 5%	ae/D 10%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Hardened Steel	H 1	190	163	149	136	122	118	113	91	MQL/ Cold Air	91	190	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
	H 2	140	120	110	100	90	86	83	67		67	140	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
	H 3	90	77	71	65	58	56	54	43		43	90	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028
	H 4	90	77	71	65	58	56	54	43		43	90	fz	0.009	0.014	0.010	0.016	0.012	0.018	0.016	0.022	0.018	0.025	0.020	0.028



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D - ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D - 2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.

(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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FBK0503797

Workpiece material: 1.2343 (52HRc)

Ø	0.5mm
Z	2 Flutes
vc	56 m/min
n	36000 rpm
fz	0.006 mm/t
vf	432 mm/min
ap	0.01 mm
ae	0.01 mm
Coolant	min. lubrication

Advantages

- Finishing application.
- Excellent surface finsish.
- Save a polishing opperation.

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Coolant

Keep the tool cool!

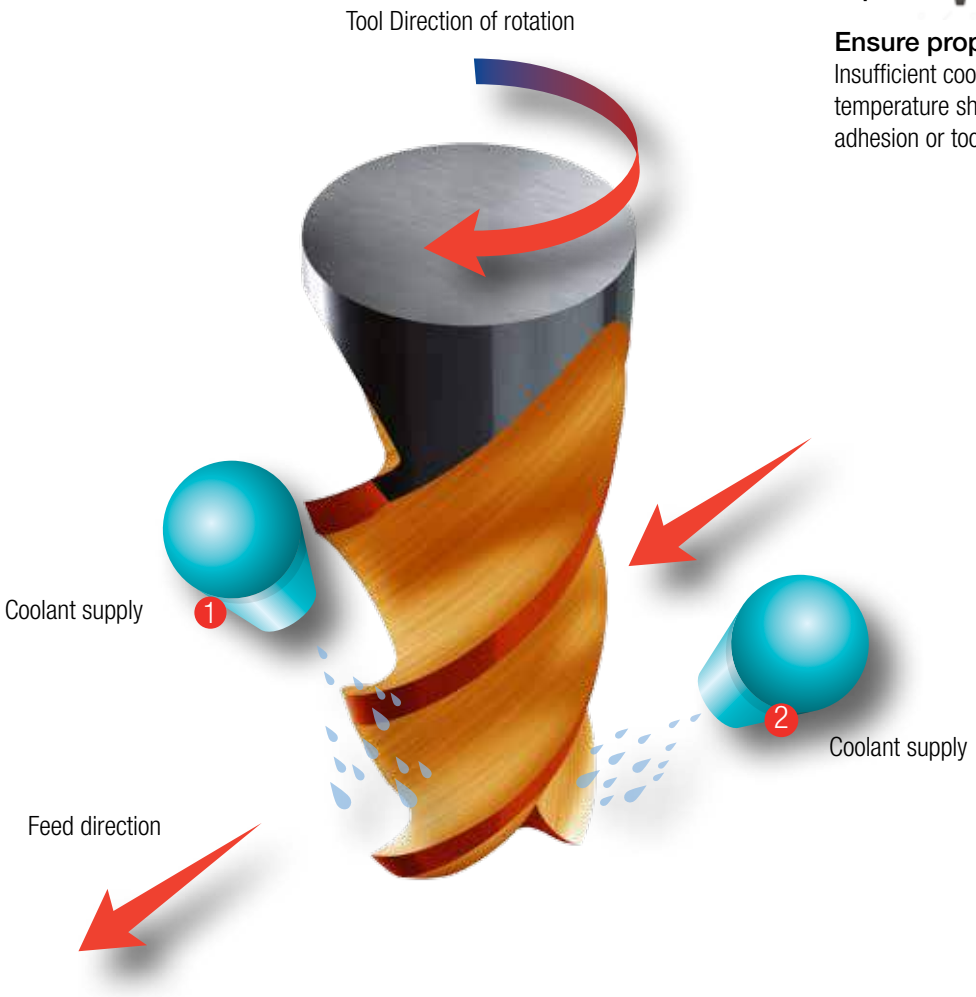
It's recommend to use coolant (emulsion, minimum lubrication, or air) if possible. Coolant contributes to improve toollife, surface finish and chip evacuation.

1. From the front into the flutes for direct cooling.
2. Pointed from the right hand side in the flutes to evacuate the chips.

When to use, what kind of coolant:*	
Emulsion	**Minimum lubrication (Preference) Or Air**
• Vc < 200 m/min	• Vc > 200 m/min
• Aluminium	• Graphite
• Copper	• Synthetics
• Exotic materials (Stainless Steel, Titanium, Hastelloy)	• Hardness over 50 HRc
• Hardness less than 50 HRc	

Tips:

Ensure proper cooling
Insufficient cooling causes temperature shocks, chip adhesion or tool breakage!



* Please follow instructions to keep the tool cool.

2 Flute

Centre cutting high performance 2 flute ball nose for exotic materials

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

IMAGE 1

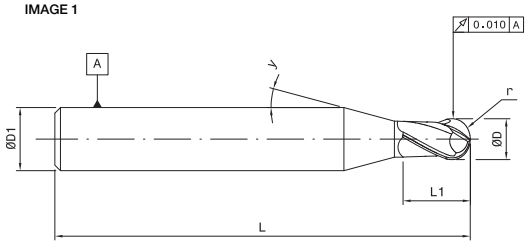
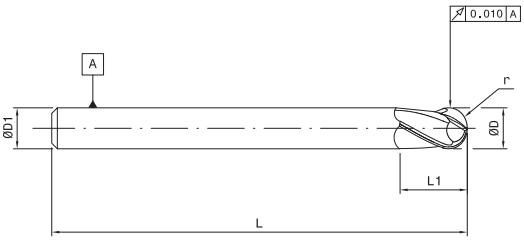


IMAGE 2



P5-P6
K1-K2
M1-M3
S1-S4
H1

* For endmills L I 100 mm.

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
0.40	0.60	51.00	4.00	0.20	2	10	1	FBK0505037
0.50	0.90	51.00	4.00	0.25	2	10	1	FBK0505038
0.60	1.20	51.00	4.00	0.30	2	10	1	FBK0505039
0.80	1.50	51.00	4.00	0.40	2	10	1	FBK0505040
1.00	2.00	51.00	4.00	0.50	2	15	1	FBK0505041
1.50	3.00	51.00	4.00	0.75	2	15	1	FBK0505042
2.00	4.00	51.00	4.00	1.00	2	15	1	FBK0505043
3.00	6.00	51.00	4.00	1.50	2	15	1	FBK0505044
4.00	8.00	57.00	6.00	2.00	2	15	1	FBK0505045
5.00	10.00	57.00	6.00	2.50	2	15	1	FBK0505046
6.00	12.00	57.00	6.00	3.00	2	-	2	FBK0505047
8.00	16.00	63.00	8.00	4.00	2	-	2	FBK0505048
10.00	20.00	72.00	10.00	5.00	2	-	2	FBK0505049
12.00	24.00	83.00	12.00	6.00	2	-	2	FBK0505050

Application data on page no 2.077

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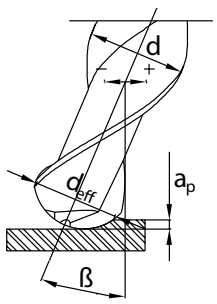
Cutting parameters

- Centre cutting high performance 2 flute ball nose end mill - 0.4 mm to 2.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			Shoulder Milling	Slot Milling				Diameter in mm													
								mm	0.4		0.5		0.6		0.8		1.0		1.5		2.0	
			ap<1.5D ae/D<30%	ap<1.5D ae/D<10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	140	160	Emulsion	140	220	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		6	100	120		100	180	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
Stainless Steel	M	1	80	100		80	130	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		2	60	80		60	100	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		3	50	70		50	90	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
Super Alloys	S	1	40	60		40	60	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		2	45	65		45	70	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		3	30	40		30	50	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
		4	60	80		60	90	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022
Hardened Steel	H	1	140	160	MQL/Dry Air	140	220	fz	0.004	0.008	0.050	0.009	0.006	0.010	0.007	0.012	0.008	0.015	0.012	0.018	0.016	0.022

- Centre cutting high performance 2 flute ball nose end mill - 3.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			Shoulder Milling	Slot Milling				Diameter in mm													
								mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0	
			ap<1.5D ae/D<30%	ap<1.5D ae/D<10%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	140	160	Emulsion	140	220	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		6	100	120		100	180	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
Stainless Steel	M	1	80	100		80	130	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		2	60	80		60	100	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		3	50	70		50	90	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
Super Alloys	S	1	40	60		40	60	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		2	45	65		45	70	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		3	30	40		30	50	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
		4	60	80		60	90	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080
Hardened Steel	H	1	140	160	MQL/Dry Air	140	220	fz	0.018	0.025	0.020	0.028	0.025	0.035	0.028	0.042	0.030	0.050	0.040	0.070	0.050	0.080



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

FBK0505048

Workpiece material: 1.4462 Duplex

	Totem
Ø	8mm
Z	2 Flutes
vc	120 m/min
n	4775 rpm
fz	0.04 mm/t
vf	385 mm/min
ap	0.1 mm
ae	0.1 mm
Coolant	emulsion

Q	2.5 Hours

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Composites and synthetics

Solutions for synthetics and composite materials

With experience in the aerospace Industry we developed Precision ground Diamond Tipped End mills for high speed machining of Synthetic Materials, CFRP and GFRP parts.

Highly accurate manufacturing by laser

Diamond tipped vs PCD

- 2 To 5 times more toollife
- More accuracy & a better surface finish
- Higher machine efficiency

FBK0506012

Workpiece material: Nylon with Glass Fibre

Hardness:

	Competitor	Totem
Ø	10mm	10mm
Z	2 Flutes	2 Flutes
V_c	251 m/min	251 m/min
n	8000 rpm	8000 rpm
fz	0.025 mm/t	0.1875 mm/t
V_f	400 mm/min	3000 mm/min
a_p	4.5 mm	1.2 mm
a_e	16 mm	10 mm
Coolant	air / external	air / external

Q	28.8 cm^3/min	36.0 cm^3/min

FBK0506012

Workpiece material: Aerospace composite T800/M21

Operation: Shoulder milling

	Totem
Ø	6mm
Z	2 Flutes
vc	235 m/min
n	12500 rpm
fz	0.12 mm/t
vf	3000 mm/min
ap	4.0 mm
ae	2.5 mm
Coolant	air / external

Result PCD	47.0 cm^3/min
Result Forbes Diamond	107.0 cm^3/min
Improvement	2.3 times higher tool life

Program

- Centre cutting high performance diamond tipped end mill with corner radius
- Centre cutting high performance diamond tipped ball nose

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2 Flute

Centre cutting high performance diamond tipped end mill with corner radius

IMAGE 1

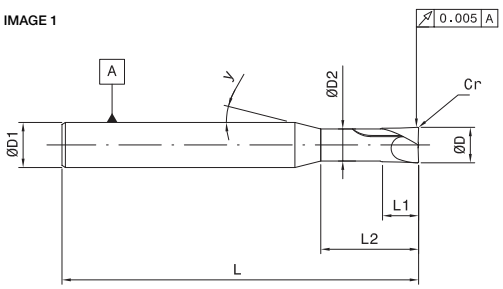
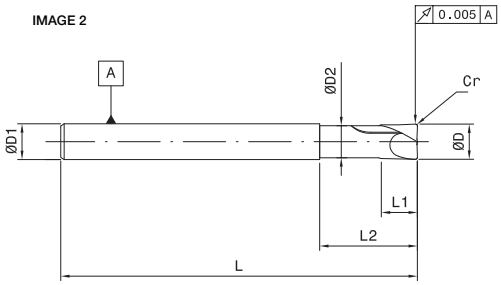


IMAGE 2



N1-N7

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Standard										
3.00	2.50	2.50	9.00	78.00	6.00	0.30	2	25	1	FBK0505977
3.00	2.50	2.50	15.00	78.00	6.00	0.30	2	25	1	FBK0505978
3.00	2.50	2.50	9.00	78.00	6.00	0.50	2	25	1	FBK0505979
3.00	2.50	2.50	15.00	78.00	6.00	0.50	2	25	1	FBK0505980
4.00	2.50	3.50	12.00	78.00	6.00	0.30	2	25	1	FBK0505981
4.00	2.50	3.50	20.00	78.00	6.00	0.30	2	25	1	FBK0505982
4.00	2.50	3.50	12.00	78.00	6.00	0.50	2	25	1	FBK0505983
4.00	2.50	3.50	20.00	78.00	6.00	0.50	2	25	1	FBK0505984
5.00	3.00	4.40	15.00	78.00	6.00	0.30	2	25	1	FBK0505985
5.00	3.00	4.40	25.00	78.00	6.00	0.30	2	25	1	FBK0505986
5.00	3.00	4.40	15.00	78.00	6.00	0.50	2	25	1	FBK0505987
5.00	3.00	4.40	25.00	78.00	6.00	0.50	2	25	1	FBK0505988
6.00	6.00	5.40	18.00	102.00	6.00	0.30	2	-	2	FBK0505989
6.00	6.00	5.40	30.00	102.00	6.00	0.30	2	-	2	FBK0505990
6.00	6.00	5.40	18.00	102.00	6.00	0.50	2	-	2	FBK0505991
6.00	6.00	5.40	30.00	102.00	6.00	0.50	2	-	2	FBK0505992
6.00	6.00	5.40	18.00	102.00	6.00	1.00	2	-	2	FBK0505993
6.00	6.00	5.40	30.00	102.00	6.00	1.00	2	-	2	FBK0505994
8.00	7.00	7.20	24.00	102.00	8.00	0.30	2	-	2	FBK0505995
8.00	7.00	7.20	24.00	102.00	8.00	0.50	2	-	2	FBK0505996
8.00	7.00	7.20	24.00	102.00	8.00	1.00	2	-	2	FBK0505997
10.00	8.00	9.00	30.00	102.00	10.00	0.50	2	-	2	FBK0505998
10.00	8.00	9.00	30.00	102.00	10.00	1.00	2	-	2	FBK0505999
12.00	9.00	11.00	36.00	107.00	12.00	0.50	2	-	2	FBK0506000
12.00	9.00	11.00	36.00	107.00	12.00	1.00	2	-	2	FBK0506001

Application data on page no 2.083

2 Flute

Centre cutting high performance diamond tipped end mill with corner radius

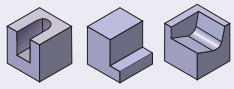


IMAGE 1

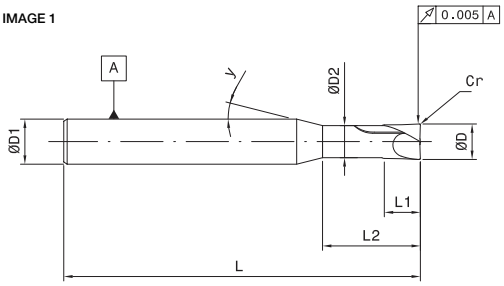
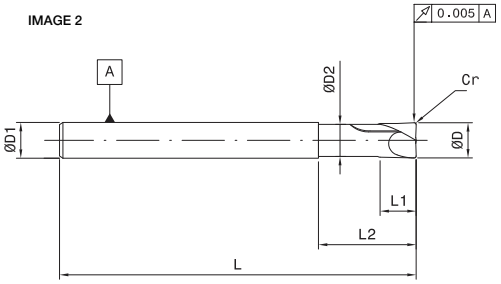


IMAGE 2



N1-N7

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Long										
3.00	3.00	2.80	9.00	78.00	6.00	0.30	2	15	1	FBK0506002
3.00	3.00	2.80	9.00	78.00	6.00	0.50	2	15	1	FBK0506003
4.00	4.00	3.80	12.00	78.00	6.00	0.30	2	15	1	FBK0506004
4.00	4.00	3.80	12.00	78.00	6.00	0.50	2	15	1	FBK0506005
5.00	5.00	4.80	15.00	78.00	6.00	0.50	2	15	1	FBK0506006
5.00	5.00	4.80	15.00	78.00	6.00	1.00	2	15	1	FBK0506007
6.00	6.00	5.80	18.00	78.00	6.00	0.50	2	-	2	FBK0506008
6.00	6.00	5.80	18.00	78.00	6.00	1.00	2	-	2	FBK0506009
8.00	8.00	7.80	24.00	78.00	8.00	0.50	2	-	2	FBK0506010
8.00	8.00	7.80	24.00	78.00	8.00	1.00	2	-	2	FBK0506011
10.00	10.00	9.80	30.00	78.00	10.00	1.00	2	-	2	FBK0506012
12.00	12.00	11.80	30.00	78.00	12.00	1.00	2	-	2	FBK0506013

Application data on page no 2.083

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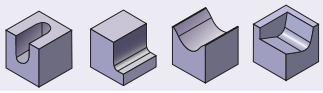
2 Flute

Centre cutting high performance diamond tipped ball nose end mill



N1-N7

IMAGE 1

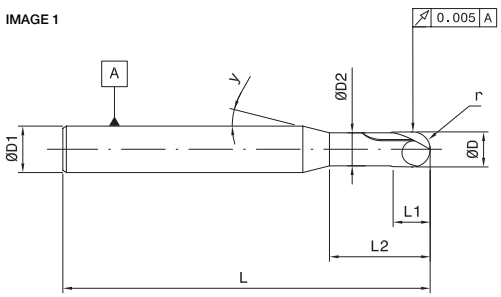
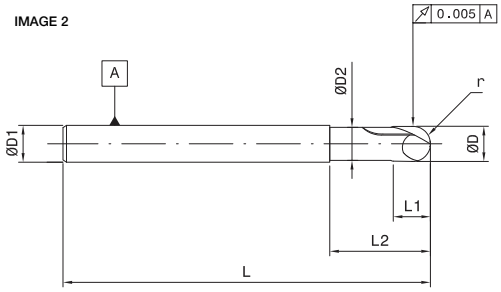


IMAGE 2



Unit : mm

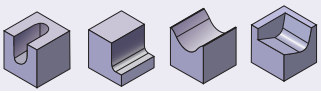
ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
Standard										
3.00	2.50	2.50	9.00	78.00	6.00	1.50	2	25	1	FBK0506014
3.00	2.50	2.50	15.00	78.00	6.00	1.50	2	25	1	FBK0506015
4.00	2.50	3.50	12.00	78.00	6.00	2.00	2	25	1	FBK0506016
4.00	2.50	3.50	20.00	78.00	6.00	2.00	2	25	1	FBK0506017
5.00	3.00	4.40	15.00	78.00	6.00	2.50	2	25	1	FBK0506018
5.00	3.00	4.40	25.00	78.00	6.00	2.50	2	25	1	FBK0506019
6.00	6.00	5.40	18.00	102.00	6.00	3.00	2	-	2	FBK0506020
6.00	6.00	5.40	30.00	102.00	6.00	3.00	2	-	2	FBK0506021
8.00	7.00	7.20	24.00	102.00	8.00	4.00	2	-	2	FBK0506022
8.00	7.00	7.20	40.00	102.00	8.00	4.00	2	-	2	FBK0506023
10.00	8.00	9.00	30.00	102.00	10.00	5.00	2	-	2	FBK0506024
10.00	8.00	9.00	50.00	102.00	10.00	5.00	2	-	2	FBK0506025
12.00	9.00	11.00	36.00	107.00	12.00	6.00	2	-	2	FBK0506026
12.00	9.00	11.00	60.00	107.00	12.00	6.00	2	-	2	FBK0506027

Available in special dimensions on request.

Application data on page no 2.083

2 Flute

Centre cutting high performance diamond tipped ball nose end mill



N1-N7

IMAGE 1

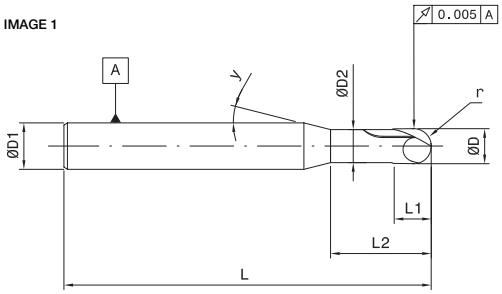
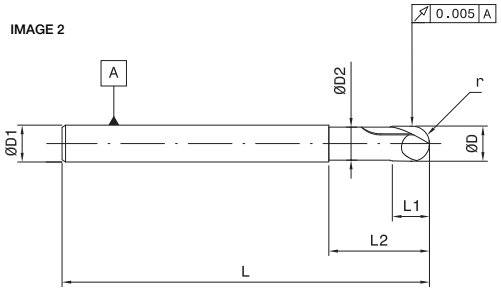


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
Long										
3.00	3.00	2.80	9.00	78.00	6.00	1.50	2	15	1	FBK0506028
4.00	4.00	3.80	12.00	78.00	6.00	2.00	2	15	1	FBK0506029
5.00	5.00	4.80	15.00	78.00	6.00	2.50	2	15	1	FBK0506030
6.00	6.00	5.80	18.00	78.00	6.00	3.00	2	-	2	FBK0506031
8.00	8.00	7.80	24.00	78.00	8.00	4.00	2	-	2	FBK0506032
10.00	10.00	9.80	30.00	78.00	10.00	5.00	2	-	2	FBK0506033
12.00	12.00	11.80	30.00	78.00	12.00	6.00	2	-	2	FBK0506034

Available in special dimensions on request.

Application data on page no 2.083

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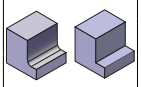
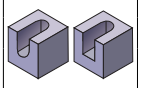
Cutting parameters

- Center cutting diamond tipped high performance end mill with corner radius - 3.0 mm to 12.0 mm
- Center cutting diamond tipped high performance ball nose - 3.0 mm to 12.0 mm

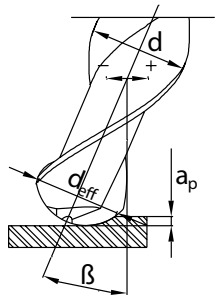
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling  ap <0.65D ae/D 40%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
							Diameter in mm													
							mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	650	Emulsion/ DRY	300	650	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		2	500		200	500	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		3	500		350	500	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		4	1000		400	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		5	1000		400	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		6	1000		700	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		7	1000		700	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120

- Center cutting diamond tipped high performance endmill with corner radius - 3.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min for Slot Milling  ap =0.2D ae/D 100%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
							Diameter in mm													
							mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	300	Emulsion/ DRY	300	650	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		2	200		200	500	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		3	350		350	500	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		4	400		400	1000	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		5	400		400	1000	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		6	700		700	1000	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100
		7	700		700	1000	fz	0.010	0.020	0.020	0.040	0.030	0.045	0.040	0.060	0.050	0.070	0.060	0.080	0.080	0.100

- Center cutting diamond tipped high performance end mill with corner radius - 3.0 mm to 12.0 mm
- Center cutting diamond tipped high performance ball nose - 3.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min for Profile Milling  ap =0.2D ae/D=10%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
							Diameter in mm													
							mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	650	Emulsion/ DRY	300	650	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		2	500		200	500	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		3	500		350	500	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		4	1000		400	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		5	1000		400	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		6	1000		700	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120
		7	1000		700	1000	fz	0.020	0.030	0.030	0.045	0.050	0.060	0.050	0.070	0.060	0.080	0.070	0.100	0.080	0.120



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Case studies

FBK0506008
Workpiece material: T800 M21
Hardness: Aerospace material

	Competitor	Totem
Ø	6mm	6mm
Z	2 Flute	2 Flute
vc	283 m/min	283 m/min
n	15000 rpm	15000 rpm
fz	0.10 mm/t	0.10 mm/t
vf	3000 mm/min	3000 mm/min
ap	4.0 mm	4.0 mm
ae	6.0 mm	6.0 mm
Coolant	emulsion	dry

Q	72 cm^3/min	72 cm^3/min
Toollife	94 min	214 min

FBK0506033
Workpiece material: Hextool
Hardness: Aerospace material

	Competitor	Totem
Ø	10mm	10mm
Z	2 Flute	2 Flute
vc	377 m/min	314 m/min
n	10000 rpm	10000 rpm
fz	0.10 mm/t	0.15 mm/t
vf	2600 mm/min	3000 mm/min
ap	0.35 mm	0.35 mm
ae	0.35 mm	0.35 mm
Coolant	dry	dry

Q	0.32 cm^3/min	0.37 cm^3/min
Toollife	5 h 33 min	14 h 10 min

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TOTEM®
High Performance Cutting Tools

HIGH PERFORMANCE END MILLS

FOR

GRAPHITE MILLING

PRODUCT RANGE

- Standard 0.1mm- 16mm available in stub/ standard/long/extra long
- Specials 0.1mm- 20mm available in stub/ standard/long/extra long/ long reach

PORTFOLIO

- Center cutting high performance rougher for graphite
- Center cutting high performance 3 flute end mill for graphite
- Center cutting high performance end mill with corner radius for graphite
- Center cutting high performance ball nose for graphite
- Center cutting high performance micro end mill with corner radius for graphite
- Center cutting high performance micro ball nose for graphite

Success stories

Challenge	Reduction in Cycle time
Component	Graphite Mould Inserts
Competiton	J.J Tools Korea
Solution	FBK0504674- EM 16.0 (FHGR 2 160 150 16 02) PHD
Cutting data	Machine : Makino- VMC, Shrinkfit- Totem, Coolant – Dry Existing Vc - 350 Proposed Vc - 600 Existing Ap - 5, Proposed Ap -15mm Existing Ae - 1, Proposed Ae - 3mm Existing Tool Life – 15 Hours Achieved Tool Life – 27 Hours
Result	180% improvement in Tool life
Benefit	Reduction in Cycle time by 7 times

Challenge	Reduction in CPC & Chatter
Component	Die Casting HK12
Competiton	ZECHA
Solution	EM 5.00MMX5XREL65X100 SH6 CR0.5 4FLT DI
Cutting data	Machine : MakinoE33-HSKA40 VMC, Shrinkfit- Totem, Coolant – Vacuum RPM 4000, Feed 1800 Depth 0.12mm Existing Tool Life – 35Hours Achieved Tool Life – 35 Hours
Result	Similar Tool life
Benefit	Reduction in CPC

Challenge	Reduction in Cycle time
Component	Semiconductor - Reppler
Competiton	Cogo
Solution	BEM 6.00(+0.01)MMX15X100 SH6 2FLT DI
Cutting data	Machine : Okuma- VMC, Shrinkfit- Totem, Coolant – Vacuum RPM 6000, Feed 2500 Existing Tool Life – 10Hours Achieved Tool Life – 10 Hours
Result	Similar Tool life
Benefit	Reduction in CPC

Challenge	Reduction in CPC & Chatter
Component	Die Casting HK12
Competiton	ZECHA
Solution	EM 4.00MMX5XREL65X100 SH6 CR0.5 4FLT DI
Cutting data	Machine : MakinoE33-HSKA40 VMC, Shrinkfit- Totem, Coolant – Vacuum RPM 4000, Feed 1800 Depth 0.12mm Existing Tool Life – 35Hours Achieved Tool Life – 35 Hours
Result	Similar Tool life
Benefit	Reduction in CPC

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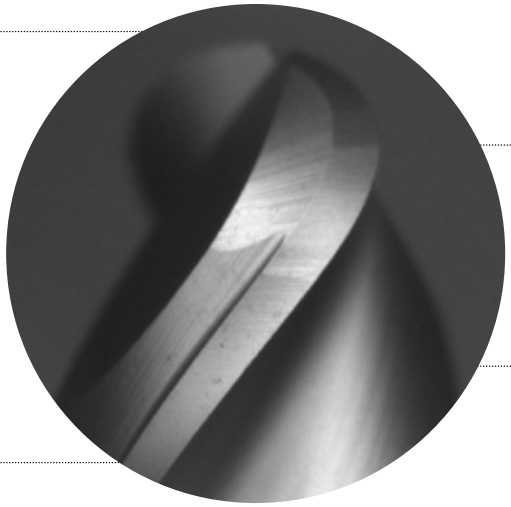
Diamond coated end mills for applications on graphite

End mills for graphite milling
- Accuracy
- Process times
- Smooth surface finish
- Toollife
- Technology to minimize droplets
- Superior accuracy and tolerances
- Improved performance and toollife



Advantages
- Better toollife
- Excellent accuracy
- High production efficiency
- Excellent surface finish

Program
- Center cutting high performance rougher for graphite
- Center cutting high performance 3 flute end mill for graphite
- Center cutting high performance end mill with corner radius for graphite
- Center cutting high performance ball nose for graphite
- Center cutting high performance micro end mill with corner radius for graphite
- Center cutting high performance micro ball nose for graphite

FBK0504670
Workpiece material: SGL Graphite
Hardness: R8500

	Competitor	Totem
Ø	8mm	8mm
Z	2 Flutes	2 Flutes
vc	302 m/min	503 m/min
n	12,000 rpm	20,000 rpm
fz	0.167 mm/t	0.113 mm/t
vf	4,000 mm/min	4,500 mm/min
ap	1.5 mm	8.0 mm
ae	12 mm	8 mm
Coolant	air	air

Q	72 cm^3/min	288 cm^3/min

Higher productivity

2 Flute

Centre cutting high performance 2 flute rougher for graphite

HVM | 25° | 0 - 0.1 | 6535 HA | h5 | D

IMAGE 1

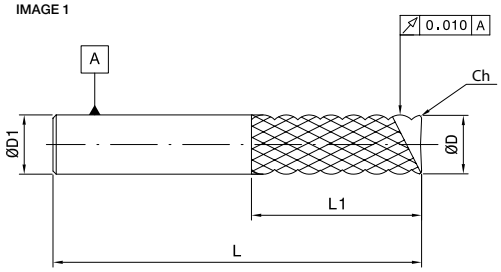
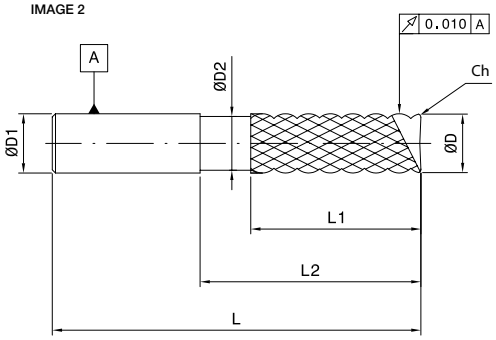


IMAGE 2



N5-N7

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Ch (mm)	z	γ (°)	Image	EDP No
Standard										
4.00	12.00	-	-	60.00	4.00	0.25	2	-	1	FBK0504668
6.00	18.00	-	-	78.00	6.00	0.30	2	-	1	FBK0504669
8.00	24.00	-	-	78.00	8.00	0.35	2	-	1	FBK0504670
10.00	30.00	-	-	78.00	10.00	0.40	2	-	1	FBK0504671
12.00	36.00	-	-	89.00	12.00	0.50	2	-	1	FBK0504672
12.00	36.00	11.40	50.00	150.00	12.00	0.50	2	-	2	FBK0504673
16.00	36.00	15.20	70.00	150.00	16.00	0.50	2	-	2	FBK0504674

Tolerance chart

Diameter range	Shank	Cutting diameter	Cutting diameter	Cutting diameter	Cutting diameter
	ØD1-h5	ØD-e8	ØD-f7	ØD-g7	ØFHC
D ≤ 3	0	-0.014	-0.006	-0.002	0
	-0.004	-0.028	-0.016	-0.012	-0.025
3 < D ≤ 6	0	-0.020	-0.010	-0.004	0
	-0.005	-0.038	-0.022	-0.016	-0.030
6 < D ≤ 10	0	-0.025	-0.013	-0.005	0
	-0.006	-0.047	-0.028	-0.02	-0.036
10 < D ≤ 18	0	-0.032	-0.016	-0.006	0
	-0.008	-0.059	-0.034	-0.024	-0.043
18 < D ≤ 30	0	-0.040	-0.020	-0.006	0
	-0.009	-0.073	-0.041	-0.024	-0.052

Application data on page no 2.089

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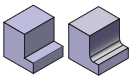
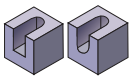
Cutting parameters

Centre cutting high performance 2 flute rougher for graphite - 4.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling			Cutting Speed (Vc) m/min for Slot Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
										Diameter in mm													
										mm	4.0		6.0		8.0		10		12		16	
			ap 2.5D ae/D 10%	ap 2D ae/D 25%	ap 1D ae/D 50%	ap 1D ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	525	500	DRY	500	<600	fz	0.039	0.047	0.071	0.085	0.260	0.151	0.196	0.235	0.283	0.339	0.471	0.566
		6						500	<600	fz	0.039	0.047	0.071	0.085	0.260	0.151	0.196	0.235	0.283	0.339	0.471	0.566
		7						350	500	fz	0.039	0.047	0.071	0.085	0.260	0.151	0.196	0.235	0.283	0.339	0.471	0.566

FBK0504671

Workpiece material: EDM200 Graphite

	Totem
Ø	10mm
Z	2 Flutes
vc	628 m/min
n	20000 rpm
fz	0.15 mm/t
vf	6000 mm/min
ap	12 mm
ae	2 mm
Coolant	air

Q	144 cm^3/min

Higher productivity

To be used for roughing applications on graphite:

Advantages

- High material removal rate.
- Special roughing pitch.
- Designed for high feeds on graphite applications.

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

3 Flute

Centre cutting high performance 3 flute end mill for graphite

HPM HSM | 40° | FHC | 6535 HA | h5 | D

IMAGE 1

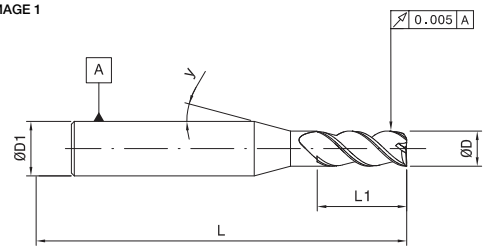
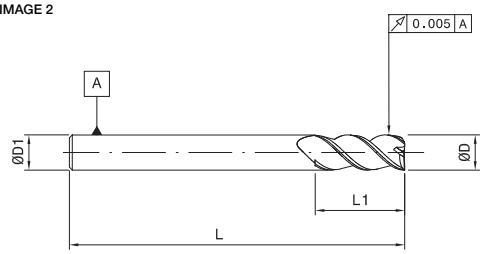


IMAGE 2



N5-N7

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
Standard							
2.00	10.00	50.00	3.00	3	15	1	FBK0503940
3.00	10.00	50.00	3.00	3	-	2	FBK0503941
4.00	15.00	60.00	4.00	3	-	2	FBK0503942
5.00	20.00	60.00	5.00	3	-	2	FBK0503943
6.00	30.00	78.00	6.00	3	-	2	FBK0503944
8.00	30.00	78.00	8.00	3	-	2	FBK0503945
10.00	30.00	78.00	10.00	3	-	2	FBK0503946
12.00	30.00	89.00	12.00	3	-	2	FBK0503947

Application data on page no 2.094

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Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite

HPM HSM | 2-3-4 | 40° | FHC | 6535 HA | h5 | D

N5-N7

IMAGE 1

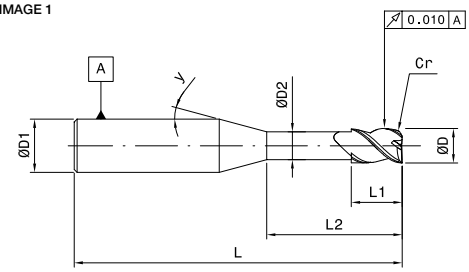
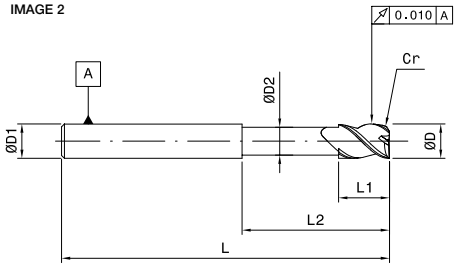


IMAGE 2



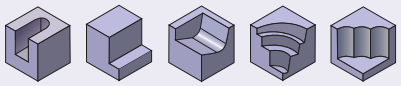
Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Short										
2.00	3.00	1.80	10.00	50.00	3.00	0.10	2	15	1	FBK0504675
3.00	4.00	2.80	10.00	51.00	6.00	0.10	2	15	1	FBK0504676
4.00	4.00	3.80	10.00	51.00	6.00	0.20	4	15	1	FBK0504677
5.00	5.00	4.70	10.00	51.00	6.00	0.20	4	15	1	FBK0504678
6.00	6.00	5.60	10.00	51.00	6.00	0.30	4	-	2	FBK0504679
8.00	8.00	7.40	15.00	64.00	8.00	0.30	4	-	2	FBK0504680
10.00	10.00	9.40	20.00	78.00	10.00	0.30	4	-	2	FBK0504681
12.00	10.00	11.40	20.00	78.00	12.00	0.30	4	-	2	FBK0504682

Application data on page no 2.094

Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite



HPM HSM | 2-3-4 | 40° | FHC | 6535 HA | h5 | D

N5-N7

IMAGE 1

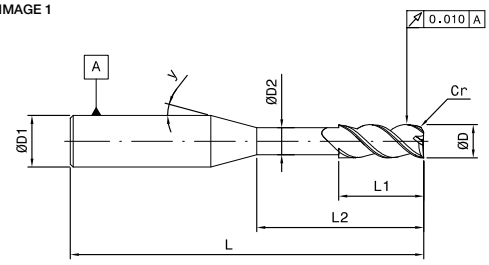


IMAGE 2

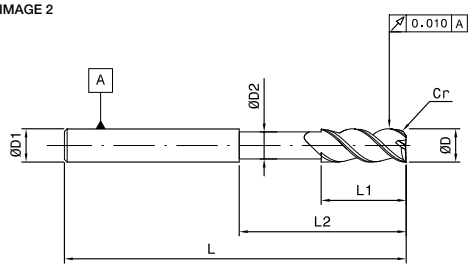


IMAGE 3

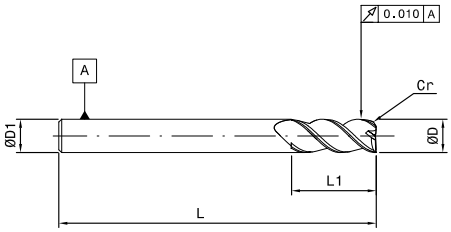
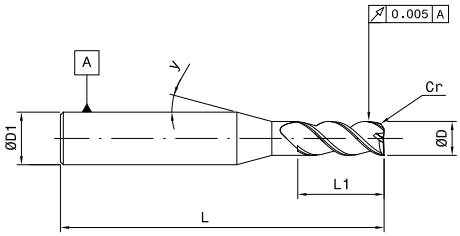


IMAGE 4



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Standard										
2.00	10.00	-	-	50.00	2.00	0.10	3	-	3	FBK0504683
2.00	10.00	-	-	50.00	3.00	0.10	3	15	4	FBK0504684
2.00	10.00	1.80	15.00	50.00	3.00	0.10	3	10	1	FBK0504685
2.00	10.00	1.80	20.00	50.00	3.00	0.10	3	15	1	FBK0506035
2.00	10.00	1.80	30.00	65.00	3.00	0.10	3	15	1	FBK0504686
2.00	10.00	1.80	30.00	80.00	3.00	0.10	3	15	1	FBK0504687
3.00	10.00	-	-	50.00	3.00	0.10	3	-	3	FBK0504688
3.00	10.00	2.80	20.00	65.00	3.00	0.10	3	-	2	FBK0506036
3.00	10.00	2.80	30.00	65.00	3.00	0.10	3	-	2	FBK0504689
3.00	10.00	2.80	30.00	80.00	3.00	0.10	3	-	2	FBK0504690
4.00	15.00	-	-	60.00	4.00	0.20	3	-	3	FBK0504691
5.00	20.00	-	-	60.00	5.00	0.20	3	-	3	FBK0504692
6.00	30.00	-	-	78.00	6.00	0.30	3	-	3	FBK0504693
8.00	30.00	-	-	78.00	8.00	0.30	3	-	3	FBK0504694
10.00	30.00	-	-	78.00	10.00	0.30	3	-	3	FBK0504695
12.00	30.00	-	-	89.00	12.00	0.30	3	-	3	FBK0504696

Application data on page no 2.094

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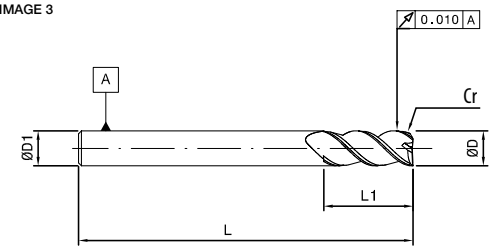
Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite

HPM HSM | 2-3-4 | 40° | FHC | 6535 HA | h5 | D

IMAGE 3



N5-N7

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
Long										
4.00	10.00	-	-	102.00	4.00	0.30	2	-	3	FBK0504697
5.00	13.00	-	-	102.00	5.00	0.50	2	-	3	FBK0504698
6.00	42.00	-	-	102.00	6.00	0.50	2	-	3	FBK0504699
6.00	26.00	-	-	150.00	6.00	0.50	2	-	3	FBK0504700
8.00	41.00	-	-	150.00	8.00	0.50	2	-	3	FBK0504701
10.00	42.00	-	-	150.00	10.00	0.50	2	-	3	FBK0504702

Application data on page no 2.094

Cutting parameters

- Center cutting high performance 3 flute end mill for graphite - 2.0 mm to 5.0 mm
- Center cutting high performance end mill with corner radius for graphite - 2.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min						Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%								
			Shoulder Milling			Slot Milling						Diameter in mm								
												mm	2.0		3.0		4.0		5.0	
			1.6	1.4	1.2	1						Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
			ap 2D ae/D 10%	ap 1.5D ae/D 15%	ap 1D ae/D 20%	ap 1D ae/D 100%	Lubrication	min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	525	500	DRY	500	<600	fz	0.010	0.030	0.015	0.040	0.025	0.050	0.035	0.060
		6						500	<600	fz	0.010	0.030	0.015	0.040	0.025	0.050	0.035	0.060
		7						350	500	fz	0.010	0.030	0.015	0.040	0.025	0.050	0.035	0.060

- Center cutting high performance 3 flute end mill for graphite - 6.0 mm to 12.0 mm
- Center cutting high performance end mill with corner radius for graphite - 6.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min						Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%								
			Shoulder Milling			Slot Milling						Diameter in mm								
												mm	6.0		8.0		10.0		12.0	
			1.6	1.4	1.2	1						Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
			ap 2D ae/D 10%	ap 1.5D ae/D 15%	ap 1D ae/D 20%	ap 1D ae/D 100%	Lubrication	min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	525	500	DRY	500	<600	fz	0.045	0.080	0.055	0.100	0.075	0.120	0.090	0.140
		6						500	<600	fz	0.045	0.080	0.055	0.100	0.075	0.120	0.090	0.140
		7						350	500	fz	0.045	0.080	0.055	0.100	0.075	0.120	0.090	0.140

FBK0503944
Workpiece material: Graphite

	Competitor	Totem
Ø	6 mm	6 mm
Z	3 Flutes	3 Flutes
vc	547 m/min	547 m/min
n	29000 rpm	29000 rpm
fz	0.005 mm/t	0.023 mm/t
vf	580 mm/min	2000 mm/min
ap	3 mm	3 mm
ae	0.5 mm	0.5 mm
Coolant	air	air

Q	0.87 cm^3/min	3.00 cm^3/min
Toollife	2 h 37 min	7 h 14 min

Higher tool life

FBK0504691
Workpiece material: EDM-3 Graphite

	Totem
Ø	4 mm
Z	3 Flutes
vc	440 m/min
n	35000 rpm
Fz	0.049 mm/t
vf	5145 mm/min
ap	0.8 mm
ae	1.6 mm
Coolant	air

Q	6.60 cm^3/min

Higher MRR

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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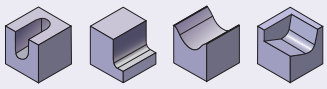
Optimum Flutes

Centre cutting high performance ball nose for graphite



HPM HSM | 2-3 | 40° | FHC | 6535 HA | h5 | D

IMAGE 1

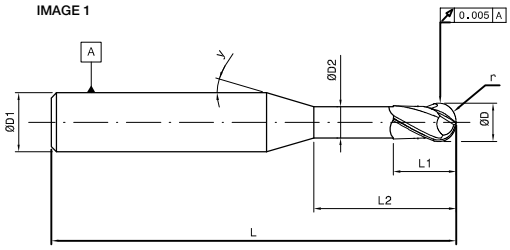
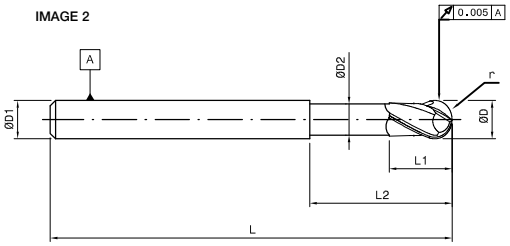


IMAGE 2



N5-N7

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
Short										
2.00	3.00	1.80	10.00	50.00	3.00	1.00	2	15	1	FBK0504272
3.00	4.00	2.80	10.00	51.00	6.00	1.50	2	15	1	FBK0504273
4.00	4.00	3.80	10.00	51.00	6.00	2.00	4	15	1	FBK0504274
5.00	5.00	4.70	10.00	51.00	6.00	2.50	4	15	1	FBK0504275
6.00	6.00	5.60	10.00	51.00	6.00	3.00	4	-	2	FBK0504276
8.00	8.00	7.40	15.00	64.00	8.00	4.00	4	-	2	FBK0504277
10.00	10.00	9.40	20.00	78.00	10.00	5.00	4	-	2	FBK0504278
12.00	10.00	11.40	20.00	78.00	12.00	6.00	4	-	2	FBK0504279

Application data on page no 2.098

Optimum Flutes

Centre cutting high performance ball nose for graphite

HPM HSM | 2-3 | 40° | FHC | 6535 HA | h5 | D

N5-N7

IMAGE 1

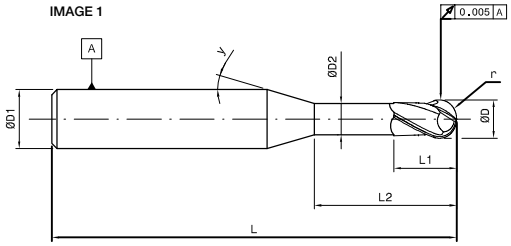


IMAGE 2

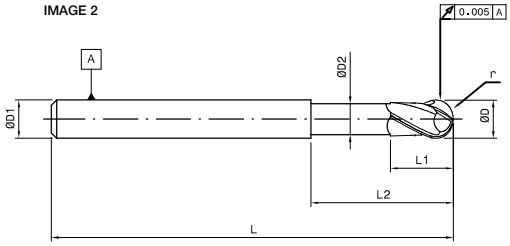


IMAGE 3

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
Standard										
2.00	10.00	-	-	50.00	2.00	1.00	3	-	3	FBK0504280
2.00	10.00	-	-	50.00	3.00	1.00	3	15	1	FBK0504281
2.00	10.00	1.80	15.00	50.00	3.00	1.00	3	15	1	FBK0506037
2.00	10.00	1.80	20.00	50.00	3.00	1.00	3	15	1	FBK0506038
2.00	10.00	1.80	30.00	65.00	3.00	1.00	3	15	1	FBK0506039
3.00	10.00	-	-	50.00	3.00	1.50	3	-	3	FBK0504282
3.00	10.00	2.80	15.00	50.00	3.00	1.50	3	-	2	FBK0506040
3.00	10.00	2.80	20.00	50.00	3.00	1.50	3	-	2	FBK0506041
3.00	10.00	2.80	30.00	50.00	3.00	1.50	3	-	2	FBK0506042
4.00	15.00	-	-	60.00	4.00	2.00	3	-	3	FBK0504283
5.00	20.00	-	-	60.00	5.00	2.50	3	-	3	FBK0504284
6.00	30.00	-	-	78.00	6.00	3.00	3	-	3	FBK0504285
8.00	30.00	-	-	78.00	8.00	4.00	3	-	3	FBK0504286
10.00	30.00	-	-	78.00	10.00	5.00	3	-	3	FBK0504287
12.00	30.00	-	-	89.00	12.00	6.00	3	-	3	FBK0504288

Application data on page no 2.098

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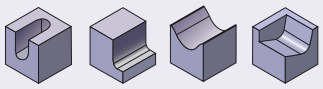
Optimum Flutes

Centre cutting high performance ball nose for graphite



HPM HSM | 2-3 | 40° | FHC | 6535 HA | h5 | D

N5-N7

IMAGE 1

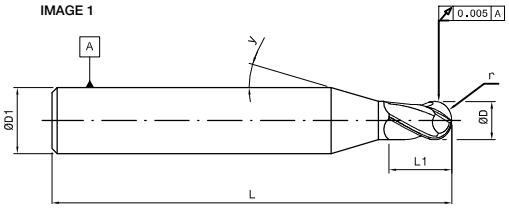


IMAGE 2

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
Long										
2.00	6.00	-	-	102.00	3.00	1.00	2	15	1	FBK0504289
3.00	16.00	-	-	102.00	3.00	1.50	2	-	2	FBK0504290
4.00	16.00	-	-	102.00	4.00	2.00	2	-	2	FBK0504291
6.00	42.00	-	-	102.00	6.00	3.00	2	-	2	FBK0504292
6.00	42.00	-	-	150.00	6.00	3.00	2	-	2	FBK0504293
8.00	42.00	-	-	102.00	8.00	4.00	2	-	2	FBK0504294
8.00	42.00	-	-	150.00	8.00	4.00	2	-	2	FBK0504295
10.00	45.00	-	-	150.00	10.00	5.00	2	-	2	FBK0504296
12.00	65.00	-	-	150.00	12.00	6.00	2	-	2	FBK0504297

Application data on page no 2.098

Cutting parameters

Centre cutting high performance ball nose for graphite - 2.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)								
			Roughing	Finishing				Diameter in mm								
								mm	2.0		3.0		4.0		5.0	
			ap 2D ae/D 20%	ap 2D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	DRY	500	<600	fz	0.012	0.036	0.018	0.048	0.030	0.060	0.042	0.072
		6				500	<600	fz	0.012	0.036	0.018	0.048	0.030	0.060	0.042	0.072
		7				350	500	fz	0.012	0.036	0.018	0.048	0.030	0.060	0.042	0.072

Centre cutting high performance ball nose for graphite - 6.0 mm to 12.0 mm

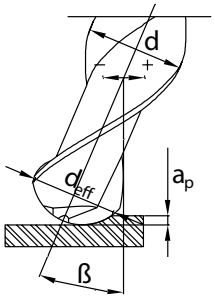
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)								
			Roughing	Finishing				Diameter in mm								
								mm	6.0		8.0		10.0		12.0	
			ap 2D ae/D 20%	ap 2D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	DRY	500	<600	fz	0.054	0.096	0.066	0.120	0.090	0.144	0.108	0.168
		6				500	<600	fz	0.054	0.096	0.066	0.120	0.090	0.144	0.108	0.168
		7				350	500	fz	0.054	0.096	0.066	0.120	0.090	0.144	0.108	0.168

FBK0504283

Workpiece material: ISO 63

	Totem
Ø	4mm
Z	3 Flutes
vc	276 m/min
n	22000 rpm
fz	0.121 mm/t
vf	8000 mm/min
ap	5.0 mm
ae	0.1 mm
Coolant	air

Q	4.0 cm^3/min



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D\text{-}ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D\text{-}2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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2 Flute

Centre cutting high performance micro end mill with corner radius for graphite

HPM HSM | 40° | FHC | 6535 HA | h5 | D

IMAGE 1

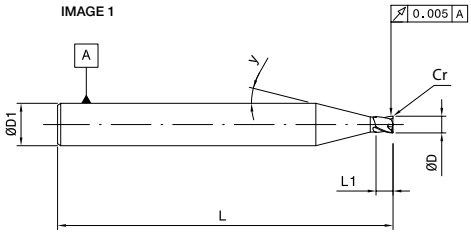
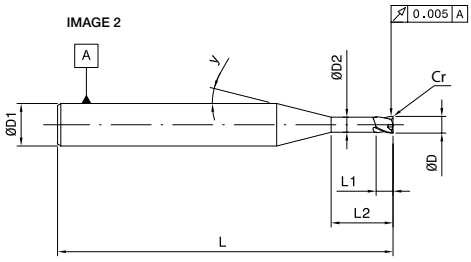


IMAGE 2



N5-N7

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	mm	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.30	1.00	-	-	64.00	6.00	0.05	2	7	1	1.743	1.896	2.304	2.944	FBK0504298
0.30	1.50	0.28	2.50	64.00	6.00	0.05	2	7	2	2.908	3.148	3.771	4.710	FBK0504299
0.30	1.50	0.28	5.00	64.00	6.00	0.05	2	8	2	5.562	5.967	6.988	8.436	FBK0504300
0.40	1.50	-	-	64.00	6.00	0.05	2	6	1	1.744	1.900	2.319	2.985	FBK0504301
0.40	1.50	0.38	2.50	64.00	6.00	0.05	2	7	2	2.912	3.156	3.797	4.773	FBK0504302
0.40	1.50	0.38	5.00	64.00	6.00	0.05	2	8	2	5.568	5.982	7.029	8.529	FBK0504303
0.50	1.50	-	-	64.00	6.00	0.05	2	6	1	2.286	2.492	3.043	3.918	FBK0504304
0.50	1.50	0.48	3.50	64.00	6.00	0.05	2	7	2	3.984	4.310	5.158	6.429	FBK0504305
0.50	1.50	0.48	7.00	64.00	6.00	0.05	2	8	2	7.671	8.192	9.480	11.256	FBK0504306
0.50	1.50	0.48	10.00	64.00	6.00	0.05	2	10	2	10.772	11.375	12.813	14.671	FBK0504307
0.60	1.50	-	-	64.00	6.00	0.05	2	6	1	2.890	3.157	3.878	5.036	FBK0504308
0.60	2.00	0.55	3.50	64.00	6.00	0.05	2	7	2	4.185	4.534	5.442	6.815	FBK0504309
0.60	2.00	0.55	7.00	64.00	6.00	0.05	2	8	2	7.864	8.405	9.750	11.614	FBK0504310
0.60	2.00	0.55	10.00	64.00	6.00	0.05	2	10	2	10.959	11.582	13.07	15.001	FBK0504311
0.80	2.00	-	-	64.00	6.00	0.05	2	6	1	3.435	3.760	4.642	6.078	FBK0504312
0.80	2.00	0.75	5.00	64.00	6.00	0.05	2	7	2	5.787	6.253	7.456	9.240	FBK0504313
0.80	2.00	0.75	7.50	64.00	6.00	0.05	2	8	2	8.402	8.987	10.447	12.478	FBK0504314
0.80	2.00	0.75	10.00	64.00	6.00	0.05	2	9	2	10.978	11.629	13.195	15.253	FBK0504315
0.80	2.00	0.75	15.00	64.00	6.00	0.05	2	13	2	16.043	16.674	18.099	19.794	FBK0504316
1.00	2.50	-	-	64.00	6.00	0.05	2	6	1	3.982	4.368	5.423	7.163	FBK0504317
1.00	3.00	0.95	5.00	64.00	6.00	0.05	2	7	2	5.805	6.294	7.572	9.512	FBK0504318
1.00	3.00	0.95	7.50	64.00	6.00	0.05	2	8	2	8.422	9.036	10.581	12.772	FBK0504319
1.00	3.00	0.95	10.00	64.00	6.00	0.05	2	9	2	10.999	11.680	13.333	15.537	FBK0504320
1.00	3.00	0.95	15.00	64.00	6.00	0.05	2	13	2	16.057	16.716	18.212	20.005	FBK0504321
1.00	3.00	0.95	20.00	64.00	6.00	0.05	2	18	2	21.124	21.741	23.091	24.621	FBK0504322
1.20	3.00	1.15	5.00	64.00	6.00	0.05	2	7	2	5.950	6.475	7.869	10.037	FBK0504323
1.20	3.00	1.15	10.00	64.00	6.00	0.05	2	9	2	11.183	11.907	13.683	16.087	FBK0504324
1.50	3.00	1.45	5.00	64.00	6.00	0.05	2	6	2	5.978	6.548	8.094	10.609	FBK0504325
1.50	3.00	1.45	7.50	64.00	6.00	0.05	2	7	2	8.618	9.326	11.166	13.921	FBK0504326
1.50	3.00	1.45	10.00	64.00	6.00	0.05	2	8	2	11.215	11.996	13.941	16.647	FBK0504327
1.50	3.00	1.45	15.00	64.00	6.00	0.05	2	12	2	16.319	17.069	18.798	20.921	FBK0504328
1.50	3.00	1.45	20.00	64.00	6.00	0.05	2	15	2	21.448	22.194	23.854	25.785	FBK0504329

Application data on page no 2.100

Cutting parameters

Center cutting high performance micro end mill with corner radius for graphite (Shoulder Milling) - 0.3 mm to 1.5 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling  ap 2D ae/D 10%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)															
							Diameter in mm															
							mm	0.3		0.4		0.5		0.6		0.8		1.0		1.2		1.5	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	DRY	500	<600	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048
		6			500	<600	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048
		7			350	500	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048

Center cutting high performance micro end mill with corner radius for graphite (Slot Milling) - 0.3 mm to 1.5 mm

Material Group			Cutting Speed (Vc) m/min for Slot Milling  ap 0.2D ae/D 100%	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)															
							Diameter in mm															
							mm	0.3		0.4		0.5		0.6		0.8		1.0		1.2		1.5	
					min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	5	550	DRY	500	<600	fz	0.006	0.012	0.008	0.015	0.010	0.020	0.012	0.022	0.015	0.025	0.018	0.030	0.020	0.035	0.025	0.040
		6			500	<600	fz	0.006	0.012	0.008	0.015	0.010	0.020	0.012	0.022	0.015	0.025	0.018	0.030	0.020	0.035	0.025	0.040
		7			350	500	fz	0.006	0.012	0.008	0.015	0.010	0.020	0.012	0.022	0.015	0.025	0.018	0.030	0.020	0.035	0.025	0.040

Advantages

- Excellent accuracy and tolerances
- Optimized surface finish on workpiece
- Leading diamond coating technology
- Superior toollife

Cutting speed Vc is based on max. 40,000 rpm.
Given conditions are based on micro short length endmills; when using endmills with longer L2-length, reduce fz according to the below table.

L2-Length	Reduction in Feed/Tooth (fz)
1-5 x D	0%
5-10 x D	30%
10 ~	50%

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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2 Flute

Centre cutting high performance micro ball nose for graphite

HPM HSM | 40° | FHC | 6535 HA | h5 | D

N5-N7

IMAGE 1

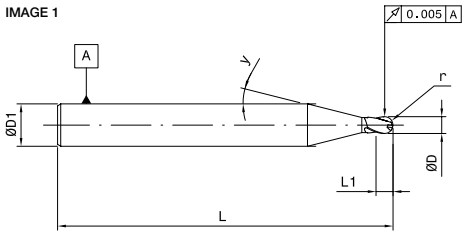
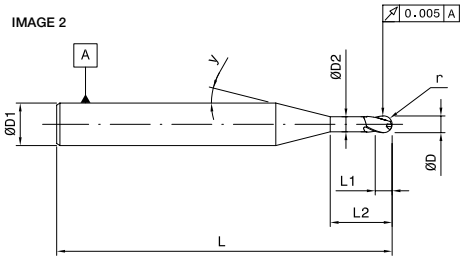


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
0.3	1.0	-	-	64	6	0.15	2	6	1	1.736	1.886	2.292	2.946	FBK0504330
0.3	1.5	0.28	2.5	64	6	0.15	2	7	2	2.901	3.131	3.731	4.635	FBK0504331
0.3	1.5	0.28	5.0	64	6	0.15	2	8	2	5.555	5.953	6.953	8.373	FBK0504332
0.4	1.5	-	-	64	6	0.20	2	6	1	1.731	1.880	2.283	2.942	FBK0504333
0.4	1.5	0.38	2.5	64	6	0.20	2	7	2	2.900	3.131	3.735	4.656	FBK0504334
0.4	1.5	0.38	5.0	64	6	0.20	2	8	2	5.557	5.959	6.976	8.432	FBK0504335
0.5	1.5	-	-	64	6	0.25	2	6	1	2.272	2.472	3.020	3.928	FBK0504336
0.5	1.5	0.48	3.5	64	6	0.25	2	7	2	3.968	4.277	5.078	6.280	FBK0504337
0.5	1.5	0.48	7.0	64	6	0.25	2	8	2	7.658	8.164	9.417	11.143	FBK0504338
0.5	1.5	0.48	10	64	6	0.25	2	10	2	10.761	11.353	12.762	14.584	FBK0504339
0.6	1.5	-	-	64	6	0.30	2	6	1	2.871	3.131	3.849	5.055	FBK0504340
0.6	2.0	0.55	3.5	64	6	0.30	2	7	2	4.166	4.492	5.341	6.624	FBK0504341
0.6	2.0	0.55	7.0	64	6	0.30	2	8	2	7.848	8.371	9.670	11.470	FBK0504342
0.6	2.0	0.55	10	64	6	0.30	2	10	2	10.946	11.554	13.006	14.890	FBK0504343
0.8	2.0	-	-	64	6	0.40	2	6	1	3.413	3.731	4.625	6.177	FBK0504344
0.8	2.0	0.75	5.0	64	6	0.40	2	7	2	5.761	6.196	7.320	8.987	FBK0504345
0.8	2.0	0.75	7.5	64	6	0.40	2	8	2	8.379	8.938	10.332	12.273	FBK0504346
0.8	2.0	0.75	10	64	6	0.40	2	9	2	10.958	11.587	13.100	15.089	FBK0504347
0.8	2.0	0.75	15	64	6	0.40	2	13	2	16.029	16.646	18.039	19.695	FBK0504348
1.0	2.5	-	-	64	6	0.50	2	5	1	3.958	4.341	5.437	7.410	FBK0504349
1.0	3.0	0.95	5.0	64	6	0.50	2	7	2	5.770	6.218	7.388	9.164	FBK0504350
1.0	3.0	0.95	7.5	64	6	0.50	2	8	2	8.392	8.970	10.427	12.491	FBK0504351
1.0	3.0	0.95	10	64	6	0.50	2	9	2	10.973	11.624	13.205	15.313	FBK0504352
1.0	3.0	0.95	15	64	6	0.50	2	13	2	16.040	16.679	18.131	19.872	FBK0504353
1.0	3.0	0.95	20	64	6	0.50	2	18	2	21.111	21.715	23.035	24.532	FBK0504354
1.2	3.0	1.15	5.0	64	6	0.60	2	7	2	5.905	6.378	7.630	9.579	FBK0504355
1.2	3.0	1.15	10	64	6	0.60	2	9	2	11.149	11.836	13.518	15.796	FBK0504356
1.5	3.0	1.45	5.0	64	6	0.75	2	6	2	5.917	6.413	7.761	9.953	FBK0504357
1.5	3.0	1.45	7.5	64	6	0.75	2	7	2	8.564	9.210	10.889	13.401	FBK0504358
1.5	3.0	1.45	10	64	6	0.75	2	8	2	11.169	11.898	13.713	16.238	FBK0504359
1.5	3.0	1.45	15	64	6	0.75	2	12	2	16.288	17.004	18.656	20.684	FBK0504360
1.5	3.0	1.45	20	64	6	0.75	2	15	2	21.425	22.145	23.749	25.615	FBK0504361

Application data on page no 2.102

Cutting parameters

Center cutting high performance micro end mill for graphite - 2.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Cutting Speed (Vc) m/min for Profile Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz) / for slot milling reduce fz by 20%								
								Diameter in mm								
								mm	2.0		3.0		4.0		5.0	
			ap 1D ae/D 10%	ap 0.1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	DRY	500	<600	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026
		6				500	<600	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026
		7				350	500	fz	0.007	0.014	0.010	0.018	0.012	0.024	0.014	0.026

Center cutting high performance micro end mill for graphite - 6.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Cutting Speed (Vc) m/min for Profile Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz) / for slot milling reduce fz by 20%								
								Diameter in mm								
								mm	6.0		8.0		10.0		12.0	
			ap 1D ae/D 10%	ap 0.1D ae/D 10%		min	max	Range	min	max	min	max	min	max	min	max
Non Ferrous	N	5	600	550	DRY	500	<600	fz	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048
		6				500	<600	fz	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048
		7				350	500	fz	0.018	0.030	0.022	0.036	0.024	0.042	0.030	0.048

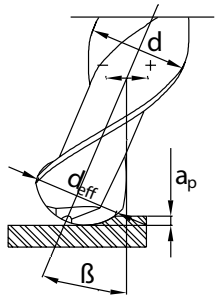
FBK0504349
Workpiece material: Poco Graphite
Hardness: 1700

	Competiton	Totem
Ø	1mm	1mm
Z	2 Flutes	2 Flutes
vc	126 m/min	126 m/min
n	40000 rpm	40000 rpm
Fz	0.010 mm/t	0.013 mm/t
vf	800 mm/min	1000 mm/min
ap	0.05 mm	0.05 mm
ae	0.10 mm	0.10 mm
Coolant	air	air
Q	4.0 mm^3/min	5.0 mm^3/min

Excellent surface finish

Cutting speed Vc is based on max. 40,000 rpm.
Given conditions are based on micro short length endmills; when using endmills with longer L2-length, reduce fz according table.

L2-Length	Reduction
1-5 x d	0%
5-10 x d	30%
10 ~	50%



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1
* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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Proton plus (45-62 HRc)

Features
- Superior nano grain structure raw material
- Wear resistant grade
- Ideal chip flow geometry
- Close tolerance end mills for finishing for higher accuracy

Functions
- Operates at high cutting speeds on hardened materials
- Polishing for hardened dies can be minimized
- No need of multiple setups, Job can be finished with single setup with high accuracy

Benefits
- Higher Tool Life and consistency

FBK0504268
Workpiece material: ISO 63

	Competitor	Totem
Ø	6mm	6mm
Z	2 Flutes	2 Flutes
Vc	226 m/min	226 m/min
n	12000 rpm	12000 rpm
fz	0.08 mm/tooth	0.08 mm/tooth
Vf	2000mm/min	2000mm/min
ap	0.15mm	0.15mm
ae	0.15mm	0.15mm
Coolant	Air	Air
Q	45mm3/min	45mm3/min
Tool Life	13 Hrs	21 Hrs

Higher productivity

4 Flute

Centre cutting proton plus end mill for 45-62 HRc steel

Carbide | REG | 30° | 6535 HA | 0.1X45° | Above 45 HRC | Proton Plus

IMAGE 1

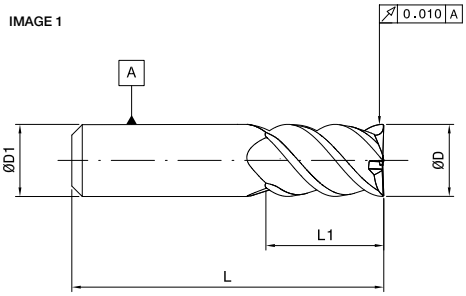
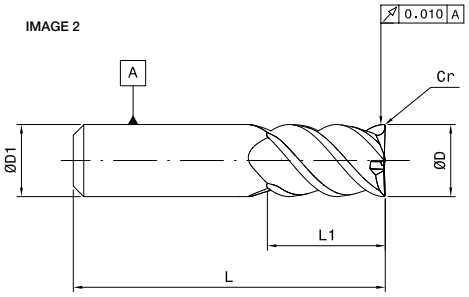


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	Ø D1 (mm)	Cr (mm)	z	Image	EDP No
3.00	12.00	38.00	3.00	-	4	1	FBK0503424
3.00	12.00	38.00	3.00	0.50	4	2	FBK0503425
3.00	12.00	38.00	3.00	1.00	4	2	FBK0503426
4.00	14.00	51.00	4.00	-	4	1	FBK0503427
4.00	14.00	51.00	4.00	0.50	4	2	FBK0503428
4.00	14.00	51.00	4.00	1.00	4	2	FBK0503429
5.00	15.00	60.00	5.00	-	4	1	FBK0503430
5.00	15.00	60.00	5.00	0.50	4	2	FBK0503431
5.00	15.00	60.00	5.00	1.00	4	2	FBK0503432
6.00	15.00	60.00	6.00	-	4	1	FBK0503433
6.00	15.00	60.00	6.00	0.50	4	2	FBK0503434
6.00	15.00	60.00	6.00	1.00	4	2	FBK0503435
8.00	19.00	60.00	8.00	-	4	1	FBK0503436
8.00	19.00	60.00	8.00	0.50	4	2	FBK0503437
8.00	19.00	60.00	8.00	1.00	4	2	FBK0503438
10.00	22.00	75.00	10.00	-	4	1	FBK0503439
10.00	22.00	75.00	10.00	0.50	4	2	FBK0503440
10.00	22.00	75.00	10.00	1.00	4	2	FBK0503441
12.00	22.00	76.00	12.00	-	4	1	FBK0503442
12.00	22.00	76.00	12.00	0.50	4	2	FBK0503443
12.00	22.00	76.00	12.00	1.00	4	2	FBK0503444
16.00	32.00	100.00	16.00	-	4	1	FBK0503445
16.00	32.00	100.00	16.00	0.50	4	2	FBK0503446
16.00	32.00	100.00	16.00	1.00	4	2	FBK0503447

Application data on page no 2.113

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4 Flute

Centre cutting proton plus end mill 45-62 HRc for steel

Carbide | LONG | 30° | 6535 HA | 0.1X45° | Above 45 HRC | Proton Plus

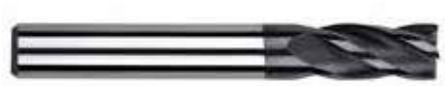


IMAGE 1

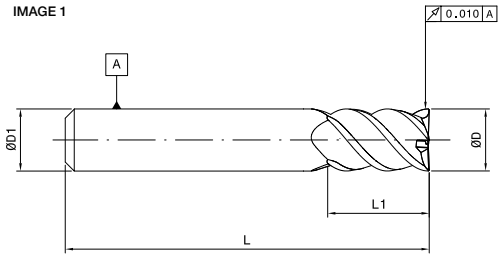
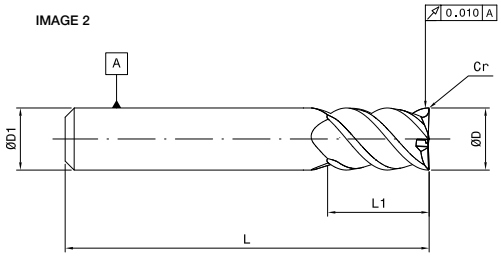


IMAGE 2



P5-P6
H1-H4

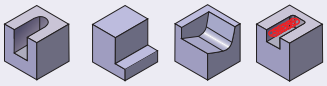
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	Ø D1 (mm)	Cr (mm)	z	Image	EDP No
3.00	12.00	60.00	3.00	-	4	1	FBK0503448
3.00	12.00	60.00	3.00	0.50	4	2	FBK0503449
3.00	12.00	60.00	3.00	1.00	4	2	FBK0503450
4.00	14.00	76.00	4.00	-	4	1	FBK0503451
4.00	14.00	76.00	4.00	0.50	4	2	FBK0503452
4.00	14.00	76.00	4.00	1.00	4	2	FBK0503453
5.00	15.00	76.00	5.00	-	4	1	FBK0503454
5.00	15.00	76.00	5.00	0.50	4	2	FBK0503455
5.00	15.00	76.00	5.00	1.00	4	2	FBK0503456
6.00	20.00	80.00	6.00	-	4	1	FBK0503457
6.00	20.00	80.00	6.00	0.50	4	2	FBK0503458
6.00	20.00	80.00	6.00	1.00	4	2	FBK0503459
8.00	25.00	80.00	8.00	-	4	1	FBK0503460
8.00	25.00	80.00	8.00	0.50	4	2	FBK0503461
8.00	25.00	80.00	8.00	1.00	4	2	FBK0503462
10.00	25.00	100.00	10.00	-	4	1	FBK0503463
10.00	25.00	100.00	10.00	0.50	4	2	FBK0503464
10.00	25.00	100.00	10.00	1.00	4	2	FBK0503465
12.00	30.00	102.00	12.00	-	4	1	FBK0503466
12.00	30.00	102.00	12.00	0.50	4	2	FBK0503467
12.00	30.00	102.00	12.00	1.00	4	2	FBK0503468
16.00	40.00	150.00	16.00	-	4	1	FBK0503469
16.00	40.00	150.00	16.00	0.50	4	2	FBK0503470
16.00	40.00	150.00	16.00	1.00	4	2	FBK0503471

Application data on page no 2.113

4 Flute

Centre cutting proton plus end mill for 45-62 HRc



Carbide | LONG REACH | 30° | 6535 HA | 0.1X45° | Above 45 HRC | Proton Plus

IMAGE 1

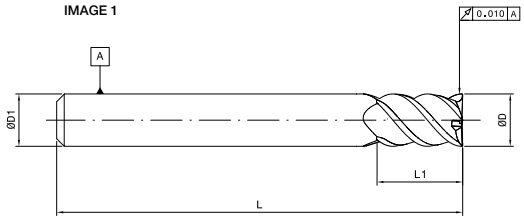
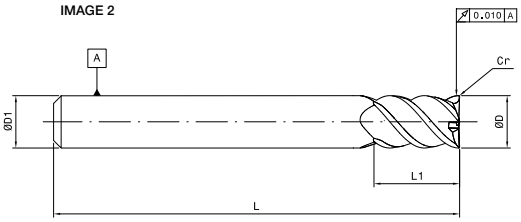


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	Image	EDP No
6.00	25.00	100.00	6.00	-	4	1	FBK0503472
6.00	25.00	100.00	6.00	0.50	4	2	FBK0503473
6.00	25.00	100.00	6.00	1.00	4	2	FBK0503474
8.00	25.00	100.00	8.00	-	4	1	FBK0503475
8.00	25.00	100.00	8.00	0.50	4	2	FBK0503476
8.00	25.00	100.00	8.00	1.00	4	2	FBK0503477
10.00	30.00	150.00	10.00	-	4	1	FBK0503478
10.00	30.00	150.00	10.00	0.50	4	2	FBK0503479
10.00	30.00	150.00	10.00	1.00	4	2	FBK0503480
12.00	30.00	150.00	12.00	-	4	1	FBK0503481
12.00	30.00	150.00	12.00	0.50	4	2	FBK0503482
12.00	30.00	150.00	12.00	1.00	4	2	FBK0503483

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4 Flute

Centre cutting proton plus end mill for 45-62 HRc with 50⁰ helix

Carbide | REG | 50⁰ | 6535 HA | 0.1X45⁰ | Above 45 HRC | Proton Plus

IMAGE 1

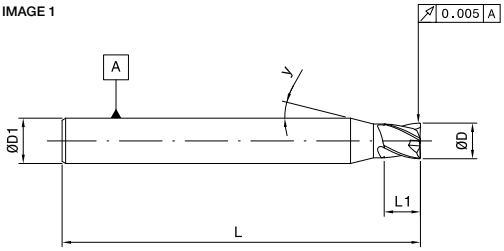
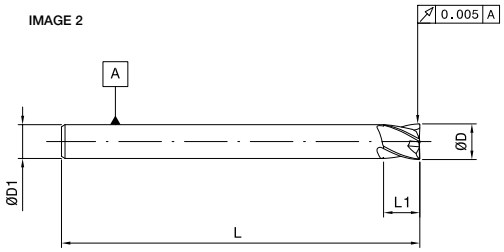


IMAGE 2



P5-P6

H1-H4

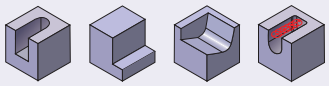
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
3.00	5.00	50.00	6.00	4	10	1	FBK0508765
4.00	6.00	50.00	6.00	4	10	1	FBK0508766
5.00	8.00	50.00	6.00	4	10	1	FBK0508767
6.00	9.00	50.00	6.00	4	-	2	FBK0508768
8.00	12.00	63.00	8.00	4	-	2	FBK0508769
10.00	15.00	76.00	10.00	4	-	2	FBK0508770
12.00	18.00	76.00	12.00	4	-	2	FBK0508771
16.00	24.00	89.00	16.00	4	-	2	FBK0508772
20.00	30.00	104.00	20.00	4	-	2	FBK0508773
25.00	38.00	121.00	25.00	5	-	2	FBK0508774

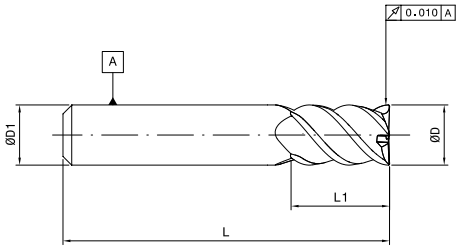
Application data on page no 2.113

4 Flute

Centre cutting proton plus end mill for 45-62 HRc with 50⁰ helix



Carbide | LONG | 50⁰ | 6535 HA | 0.1X45⁰ | Above 45 HRC | Proton Plus



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No
6.00	21.00	76.00	6.00	4	FBK0508775
8.00	28.00	100.00	8.00	4	FBK0508776
10.00	35.00	100.00	10.00	5	FBK0508777
12.00	42.00	125.00	12.00	6	FBK0508778
16.00	56.00	125.00	16.00	6	FBK0508779
20.00	70.00	150.00	20.00	6	FBK0508780
25.00	88.00	150.00	25.00	6	FBK0508781

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4 Flute

Centre cutting proton plus end mill for 45-62 HRc with 50⁰ helix

Carbide | REG | 50⁰ | 6535 HA | Above 45 HRC | Proton Plus

IMAGE 1

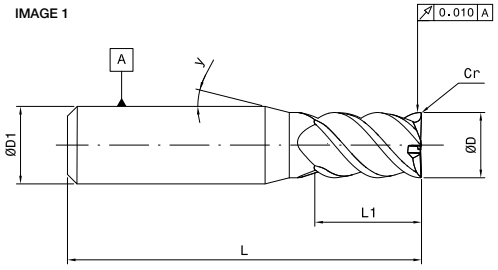
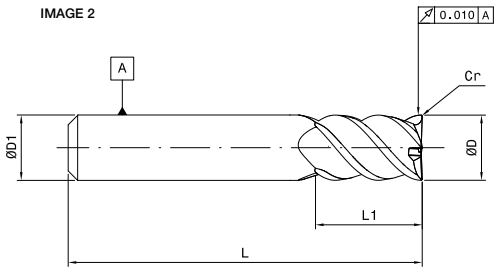


IMAGE 2



P5-P6
H1-H4

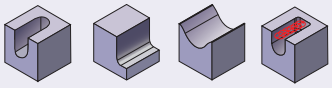
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	EDP No
3.00	4.50	50.00	6.00	0.25	4	10	1	FBK0508851
3.00	4.50	50.00	6.00	0.50	4	10	1	FBK0508852
4.00	6.00	50.00	6.00	0.25	4	10	1	FBK0508853
4.00	6.00	50.00	6.00	0.50	4	10	1	FBK0508854
5.00	8.00	50.00	6.00	0.25	4	10	1	FBK0508855
5.00	8.00	50.00	6.00	0.50	4	10	1	FBK0508856
6.00	6.00	50.00	6.00	0.25	4	-	2	FBK0508857
6.00	6.00	50.00	6.00	0.50	4	-	2	FBK0508858
6.00	6.00	50.00	6.00	0.75	4	-	2	FBK0508859
6.00	6.00	50.00	6.00	1.00	4	-	2	FBK0508860
8.00	12.00	63.00	8.00	0.50	4	-	2	FBK0508861
8.00	12.00	63.00	8.00	0.75	4	-	2	FBK0508862
8.00	12.00	63.00	8.00	1.00	4	-	2	FBK0508863
8.00	12.00	63.00	8.00	1.50	4	-	2	FBK0508864
10.00	15.00	76.00	10.00	0.50	4	-	2	FBK0508865
10.00	15.00	76.00	10.00	1.00	4	-	2	FBK0508866
10.00	15.00	76.00	10.00	1.50	4	-	2	FBK0508867
10.00	15.00	76.00	10.00	2.00	4	-	2	FBK0508868
12.00	18.00	76.00	12.00	0.50	4	-	2	FBK0508869
12.00	18.00	76.00	12.00	1.00	4	-	2	FBK0508870
12.00	18.00	76.00	12.00	1.50	4	-	2	FBK0508871
12.00	18.00	76.00	12.00	2.00	4	-	2	FBK0508872
16.00	24.00	89.00	16.00	0.50	4	-	2	FBK0508873
16.00	24.00	89.00	16.00	1.50	4	-	2	FBK0508874
16.00	24.00	89.00	16.00	2.00	4	-	2	FBK0508875
20.00	30.00	104.00	20.00	0.50	4	-	2	FBK0508876
20.00	30.00	104.00	20.00	1.00	4	-	2	FBK0508877
20.00	30.00	104.00	20.00	2.00	4	-	2	FBK0508878

Application data on page no 2.113

2 Flute

Centre cutting proton plus ball nose end mill for 45-62 HRc Steel



Carbide | REG | 30° | 6535 HA | Above 45 HRC | Proton Plus

IMAGE 1

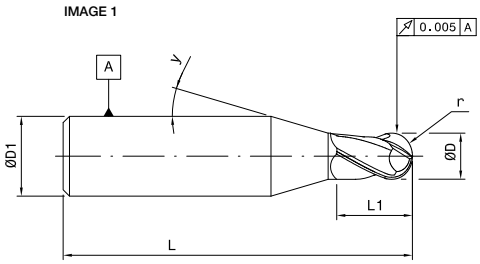
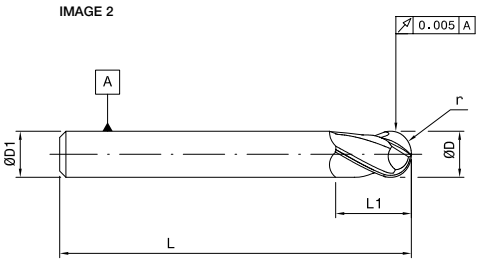


IMAGE 2



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r	z	γ (°)	Image	EDP No
1.00	2.00	60.00	4.00	0.50	2	10	1	FBK0501561
1.50	3.00	60.00	4.00	0.75	2	10	1	FBK0501562
2.00	4.00	60.00	4.00	1.00	2	10	1	FBK0501563
2.50	4.00	60.00	4.00	1.25	2	10	1	FBK0501564
3.00	5.00	60.00	6.00	1.50	2	10	1	FBK0501565
4.00	6.00	60.00	6.00	2.00	2	10	1	FBK0501566
5.00	4.00	80.00	6.00	2.50	2	10	1	FBK0501571
6.00	10.00	60.00	6.00	3.00	2	-	2	FBK0501553
8.00	16.00	60.00	8.00	4.00	2	-	2	FBK0501554
10.00	19.00	75.00	10.00	5.00	2	-	2	FBK0501555
12.00	22.00	80.00	12.00	6.00	2	-	2	FBK0501556

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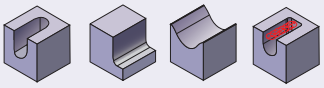
2 Flute

Centre cutting proton plus ball nose end mill for 45-62 HRc



Carbide | LONG | 30° | 6535 HA | Above 45 HRC | Proton Plus

IMAGE 1

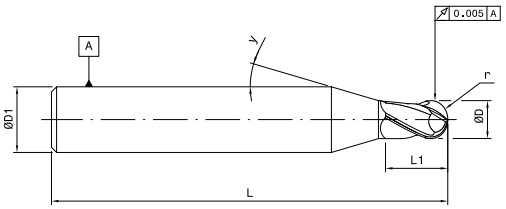
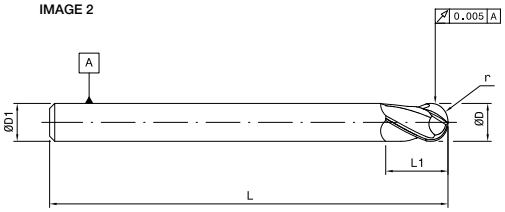


IMAGE 2



P5-P6
H1-H4

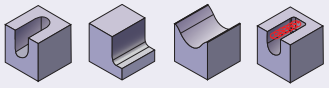
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r	z	γ (°)	Image	EDP No
1.00	2.00	80.00	4.00	0.50	2	10	1	FBK0501567
2.00	3.00	80.00	4.00	1.00	2	10	1	FBK0501568
3.00	4.00	80.00	6.00	1.50	2	10	1	FBK0501569
4.00	4.00	80.00	6.00	2.00	2	10	1	FBK0501570
6.00	10.00	80.00	6.00	3.00	2	-	2	FBK0501557
8.00	16.00	80.00	8.00	4.00	2	-	2	FBK0503390
10.00	19.00	100.00	10.00	5.00	2	-	2	FBK0501559
10.00	25.00	102.00	10.00	5.00	2	-	2	FBK0503513
12.00	22.00	100.00	12.00	6.00	2	-	2	FBK0501560

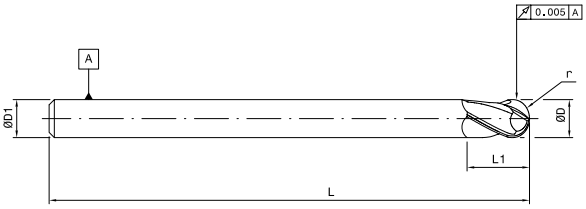
Application data on page no 2.113

2 Flute

Centre cutting proton plus ball nose end mill for 45-62 HRc



Carbide | LONG REACH | 30° | 6535 HA | Above 45 HRC | Proton Plus



P5-P6
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r	z	EDP No
6.00	12.00	102.00	6.00	3.00	2	FBK0503367
8.00	16.00	100.00	8.00	4.00	2	FBK0501558
10.00	32.00	152.00	10.00	5.00	2	FBK0503912
12.00	32.00	152.00	12.00	6.00	2	FBK0503913

Application data on page no 2.113

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Cutting parameters

Centre cutting proton plus ball nose end mill for 45-62 HRc - 1.0 mm to 12.0 mm

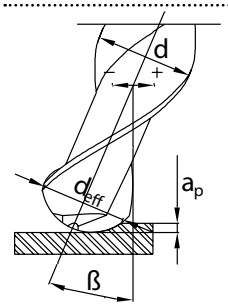
Material Group			Cutting Speed (Vc) m/min for Profile Milling	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																			
						Diameter in mm																			
						mm	1.0		1.5		2.0		3.0		4.0		5.0		6.0		8.0		10.0		12.0	
			ap 0.02D ae/D 5%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	157	157	262	fz	0.011	0.013	0.012	0.015	0.013	0.016	0.020	0.025	0.026	0.033	0.034	0.043	0.038	0.048	0.042	0.052	0.044	0.055	0.047	0.059
		6	157	157	252	fz	0.009	0.012	0.011	0.013	0.011	0.014	0.019	0.023	0.025	0.031	0.031	0.039	0.034	0.043	0.037	0.046	0.039	0.049	0.042	0.052
Hardened Steel	H	1	141	141	211	fz	0.009	0.012	0.010	0.013	0.011	0.014	0.017	0.021	0.022	0.028	0.028	0.035	0.032	0.039	0.034	0.042	0.036	0.045	0.038	0.048
		2	126	126	189	fz	0.008	0.011	0.009	0.012	0.010	0.013	0.015	0.019	0.020	0.025	0.025	0.032	0.028	0.035	0.030	0.038	0.032	0.040	0.035	0.043
		3	110	110	166	fz	0.008	0.010	0.009	0.011	0.010	0.012	0.015	0.019	0.020	0.025	0.025	0.031	0.027	0.034	0.030	0.037	0.032	0.040	0.032	0.040
		4	110	110	151	fz	0.007	0.009	0.009	0.011	0.009	0.011	0.014	0.017	0.018	0.022	0.022	0.028	0.025	0.031	0.027	0.033	0.029	0.036	0.029	0.037

Centre cutting Proton Plus 4 Flute and corner radius end mill for 45-62 HRc - 1.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
						Diameter in mm											
						mm	1.0		1.5		2.0		3.0		4.0		5.0	
			ap 0.1D ae/D 5%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	151	151	245	fz	0.003	0.003	0.004	0.005	0.005	0.006	0.007	0.009	0.009	0.012	0.011	0.014
		6	119	119	195	fz	0.002	0.003	0.003	0.004	0.004	0.005	0.006	0.008	0.009	0.011	0.010	0.013
Hardened Steel	H	1	80	80	129	fz	0.002	0.003	0.003	0.004	0.004	0.005	0.006	0.008	0.009	0.011	0.010	0.013
		2	64	64	101	fz	0.002	0.002	0.002	0.003	0.003	0.004	0.005	0.006	0.007	0.008	0.008	0.010
		3	50	50	82	fz	0.001	0.002	0.002	0.002	0.003	0.003	0.004	0.005	0.005	0.007	0.006	0.008
		4	39	39	70	fz	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.007

Centre cutting Proton Plus 4 Flute and corner radius end mill for 45-62 HRc - 6.0mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
						Diameter in mm											
						mm	6.0		8.0		10.0		12.0		16.0		20.0	
			ap 0.1D ae/D 5%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	5	151	151	245	fz	0.013	0.016	0.017	0.021	0.020	0.024	0.023	0.029	0.027	0.033	0.029	0.036
		6	119	119	195	fz	0.012	0.015	0.015	0.019	0.018	0.022	0.021	0.026	0.025	0.031	0.027	0.034
Hardened Steel	H	1	80	80	129	fz	0.012	0.015	0.015	0.019	0.018	0.022	0.021	0.026	0.024	0.031	0.028	0.034
		2	64	64	101	fz	0.009	0.011	0.011	0.014	0.013	0.016	0.016	0.020	0.018	0.023	0.021	0.026
		3	50	50	82	fz	0.007	0.009	0.009	0.011	0.011	0.013	0.012	0.016	0.015	0.018	0.017	0.021
		4	39	39	70	fz	0.006	0.008	0.007	0.009	0.009	0.011	0.010	0.013	0.012	0.016	0.014	0.018



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D\text{-}ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D\text{-}2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

HSM series (32-45 HRc)

Features
- Superior micro grain structure raw material
- Wear resistant grade
- Same tool for Roughing and Finishing for Mould Machining
- Ideal to machine upto 42 HRc

Functions
- Operates at high cutting speeds on Moulds

Benefits
- Higher Tool Life and consistency

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4 Flute

Centre cutting HSM end mill for 32-45 HRc steel

Carbide | REG | 30° | 6535 HA | 30-45 HRC | TiAlN

P3-P4

M1

IMAGE 1

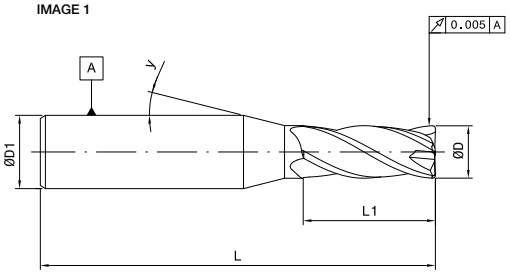
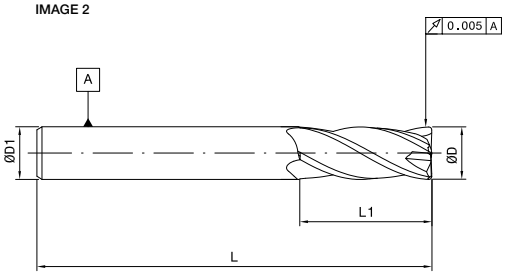


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
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1.50	6.00	38.00	3.00	4	10	1	FBK0501971
2.00	9.00	38.00	3.00	4	10	1	FBK0501972
2.50	12.00	38.00	3.00	4	10	1	FBK0501973
3.00	12.00	38.00	3.00	4	-	2	FBK0501200
4.00	14.00	51.00	4.00	4	-	2	FBK0501974
5.00	20.00	51.00	5.00	4	-	2	FBK0501326
6.00	20.00	64.00	6.00	4	-	2	FBK0501366
8.00	20.00	64.00	8.00	4	-	2	FBK0501975
10.00	25.00	70.00	10.00	4	-	2	FBK0500846
12.00	25.00	76.00	12.00	4	-	2	FBK0500942
14.00	30.00	89.00	14.00	4	-	2	FBK0501017
16.00	30.00	89.00	16.00	4	-	2	FBK0501048
20.00	38.00	102.00	20.00	4	-	2	FBK0501125

Application data on page no 2.119

2 Flute

Centre cutting HSM end mill for 32-45 HRc Steel

Carbide | REG | 30° | 6535 HA | 30 - 45 HRC | TiAlN

P3-P4
M1

IMAGE 1

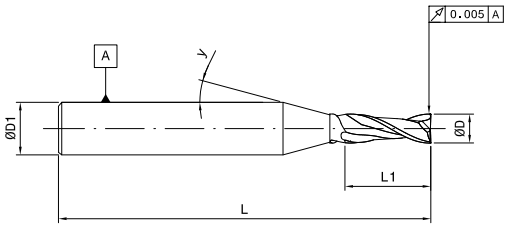
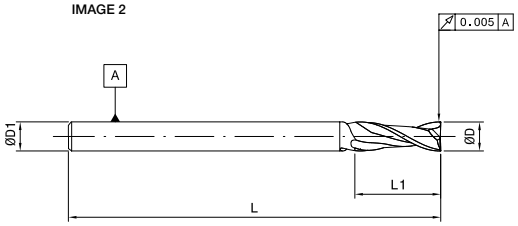


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
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1.50	6.00	38.00	3.00	2	10	1	FBK0501983
2.00	9.00	38.00	3.00	2	10	1	FBK0501984
2.50	12.00	38.00	3.00	2	10	1	FBK0501985
3.00	12.00	38.00	3.00	2	-	2	FBK0501196
4.00	14.00	51.00	4.00	2	-	2	FBK0501986
5.00	20.00	51.00	5.00	2	-	2	FBK0501318
6.00	20.00	64.00	6.00	2	-	2	FBK0501987
8.00	20.00	64.00	8.00	2	-	2	FBK0501441
10.00	25.00	70.00	10.00	2	-	2	FBK0500834
12.00	25.00	76.00	12.00	2	-	2	FBK0500932
14.00	30.00	89.00	14.00	2	-	2	FBK0501015
16.00	30.00	89.00	16.00	2	-	2	FBK0501046
20.00	38.00	102.00	20.00	2	-	2	FBK0501122

Application data on page no 2.119

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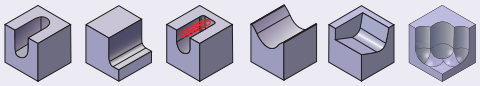
4 Flute

Centre cutting HSM ball nose end mill for 32-45 HRc Steel



Carbide | REG | 30° | 6535 HA | 30 - 45 HRC | TiAlN

IMAGE 1

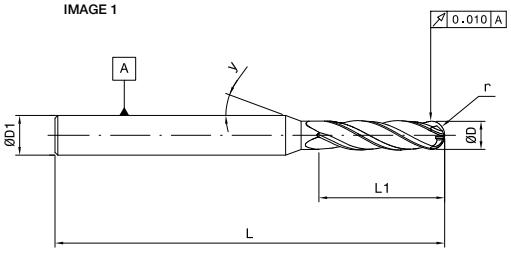
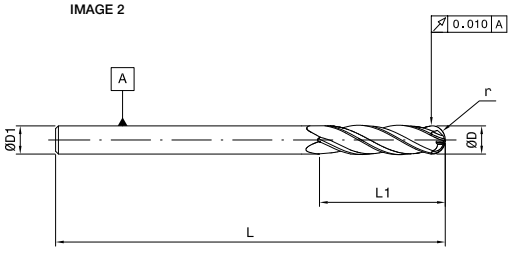


IMAGE 2



P3-P4

M1

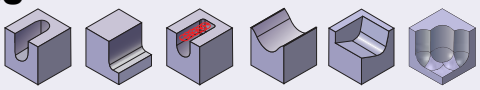
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
1.00	3.00	38.00	3.00	0.50	4	10	1	FBK0501976
1.50	6.00	38.00	3.00	0.75	4	10	1	FBK0501977
2.00	9.00	38.00	3.00	1.00	4	10	1	FBK0501978
2.50	12.00	38.00	3.00	1.25	4	10	1	FBK0501979
3.00	12.00	38.00	3.00	1.50	4	-	2	FBK0501198
4.00	14.00	51.00	4.00	2.00	4	-	2	FBK0501980
5.00	20.00	51.00	5.00	2.50	4	-	2	FBK0501322
6.00	20.00	64.00	6.00	3.00	4	-	2	FBK0501361
8.00	20.00	64.00	8.00	4.00	4	-	2	FBK0501448
10.00	25.00	70.00	10.00	5.00	4	-	2	FBK0500838
12.00	25.00	76.00	12.00	6.00	4	-	2	FBK0500937
16.00	30.00	89.00	16.00	8.00	4	-	2	FBK0501047
20.00	38.00	102.00	20.00	10.00	4	-	2	FBK0501981

Application data on page no 2.119

2 Flute

Centre cutting HSM ball nose end mill for 32-45 HRc



Carbide | REG | 30° | 6535 HA | 30 - 45 HRC | TiAlN

P2-P4

IMAGE 1

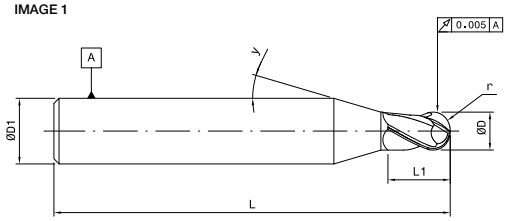
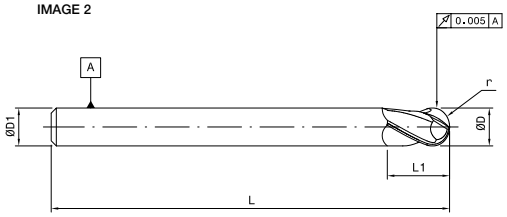


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
1.00	3.00	38.00	3.00	0.50	2	10	1	FBK0501988
1.50	6.00	38.00	3.00	0.75	2	10	1	FBK0501989
2.00	9.00	38.00	3.00	1.00	2	10	1	FBK0501990
2.50	12.00	38.00	3.00	1.25	2	10	1	FBK0501991
3.00	12.00	38.00	3.00	1.50	2	-	2	FBK0501195
4.00	14.00	51.00	4.00	2.00	2	-	2	FBK0501241
5.00	20.00	51.00	5.00	2.50	2	-	2	FBK0501320
6.00	20.00	64.00	6.00	3.00	2	-	2	FBK0501992
8.00	20.00	64.00	8.00	4.00	2	-	2	FBK0501437
10.00	25.00	70.00	10.00	5.00	2	-	2	FBK0501993
12.00	25.00	76.00	12.00	6.00	2	-	2	FBK0501994
16.00	30.00	89.00	16.00	8.00	2	-	2	FBK0501045
20.00	38.00	102.00	20.00	10.00	2	-	2	FBK0501995

Application data on page no 2.119

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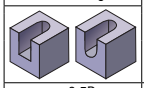
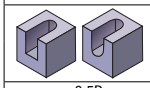
Cutting parameters

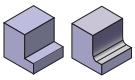
Centre cutting HSM end mill for 32-45 HRc steel - 2 Flute Flat / 4 Flute Flat & Ball - 1.0 mm to 6.0 mm

Material Group			Cutting Speed (Vc) m/min for Slot Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)														
						Diameter in mm														
						mm	1.0		1.5		2.0		3.0		4.0		5.0		6.0	
			ap 0.5D ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	45	45	72	fz	0.004	0.005	0.006	0.008	0.008	0.010	0.012	0.015	0.016	0.020	0.020	0.025	0.029	0.036
		4	40	40	68	fz	0.003	0.004	0.005	0.006	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.024	0.030
Stainless Steel	M	1	27	27	45	fz	0.002	0.003	0.004	0.005	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.019	0.024

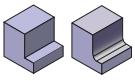
Centre cutting HSM end mill for 32-45 HRc steel - 2 Flute Flat / 4 Flute Flat & Ball - 8.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Slot Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
						Diameter in mm											
						mm	8.0		10.0		12.0		14.0		16.0		20.0	
			ap 0.5D ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	45	45	72	fz	0.038	0.048	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		4	40	40	68	fz	0.032	0.040	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100
Stainless Steel	M	1	27	27	45	fz	0.026	0.032	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080

Centre cutting HSM end mill for 32-45 HRc - 4 Flute Flat/Ball - 1.0 mm to 6.0 mm

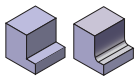
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)														
						Diameter in mm														
						mm	1.0		1.5		2.0		3.0		4.0		5.0		6.0	
			ap 1D ae/D 10%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	90	90	120	fz	0.004	0.005	0.006	0.008	0.008	0.010	0.012	0.015	0.016	0.020	0.020	0.025	0.029	0.036
		4	75	75	90	fz	0.003	0.004	0.005	0.006	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.024	0.030
Stainless Steel	M	1	60	60	75	fz	0.002	0.003	0.004	0.005	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.019	0.024

Centre cutting HSM end mill for 32-45 HRc - 4 Flute Flat/Ball - 8.0 mm to 20.0 mm

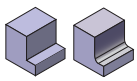
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)											
						Diameter in mm											
						mm	8.0		10.0		12.0		14.0		16.0		20.0	
			ap 1D ae/D 10%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	90	90	120	fz	0.038	0.048	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		4	75	75	90	fz	0.032	0.040	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100
Stainless Steel	M	1	60	60	75	fz	0.026	0.032	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080

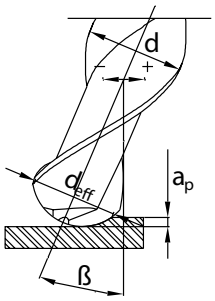
Cutting parameters

Centre cutting HSM end mill for 32-45 HRc - 2 Flute Ball - 1.0 mm to 6.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)															
						Diameter in mm															
						mm	1.0		1.5		2.0		3.0		4.0		5.0		6.0		
			ap 0.2D ae/D 30%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	90	90	120	fz	0.009	0.011	0.013	0.017	0.018	0.022	0.026	0.033	0.035	0.044	0.044	0.055	0.058	0.072
		4	75	75	90	fz	0.007	0.009	0.011	0.014	0.014	0.018	0.022	0.027	0.029	0.036	0.036	0.045	0.048	0.060
Hardened Steel	M	1	60	60	75	fz	0.007	0.009	0.011	0.014	0.014	0.018	0.022	0.027	0.029	0.036	0.036	0.045	0.048	0.060

Centre cutting HSM end mill for 32-45 HRc - 2 Flute Ball - 8.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling 	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)													
						Diameter in mm													
						mm	8.0		10.0		12.0		14.0		16.0		20.0		
			ap 0.2D ae/D 30%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	90	90	120	fz	0.077	0.096	0.096	0.120	0.115	0.144	0.134	0.168	0.154	0.192	0.192	0.240
		4	75	75	90	fz	0.064	0.080	0.080	0.100	0.096	0.120	0.112	0.140	0.128	0.160	0.160	0.200
Hardened Steel	M	1	60	60	75	fz	0.064	0.080	0.080	0.100	0.096	0.120	0.112	0.140	0.128	0.160	0.160	0.200



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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TOTEM®

High Performance Cutting Tools

END MILLING SOLUTIONS FOR AEROSPACE INDUSTRY & DIFFICULT TO MACHINE MATERIALS

FEATURES

- Variable helix angle and variable flute spacing
- Stable core geometry
- Optimized centre cutting geometry
- New generation coating
- Available in 4 flutes, 5 flutes, 6 flutes and 7 flutes
- Available in neck options

FUNCTIONS & BENEFITS

- Higher productivity
- Reinforced core geometry for higher rigidity at elevated parameters
- Superior tool life
- Excellent surface finish
- High MRR

PRODUCT RANGE

- Turbo End Mill Range (F177TR/ NF177TR/ F178TR GOLD/ F178TR BLACK/ F179TR/ F179TRL/ F180TR/ NF180TR)for Stainless Steel/ Titanium/ Super Alloys/ Steel /Cast Iron)
- VR End Mill Range(5VR/6VR) for Trochoidal Milling for Structural parts for Titanium/ Stainless Steel/ PH/ Super Alloys/ Steel)
- Roughing Chip Breaker End Mill Range (F192CB/ F193CB/NF193CB/F193CBL/F194CB) for Steel/ Stainless Steel/ Titanium/ Super Alloys)

DIAMETER RANGE

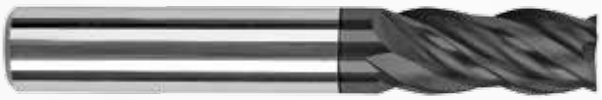
- F177TR 3mm-20mm
- NF177TR with neck- 6mm-20mm
- F179TR – Ball nose -4mm-20mm
- F179TRL – Ball nose -6mm-20mm
- F178TR BLACK 4mm-20mm
- F178TR GOLD 4mm-20mm
- F180TR 10mm-16mm
- NF180TR 10mm-16mm
- NF180TR with neck 10mm-16mm
- 5VR- 6mm-20mm
- 6VR- 6mm-20mm

* Special as per Drawing on request

CASE STUDIES

12MM END MILL FOR MACHINING A STRUCTURAL SUPPORT FOR BOEING AND AIRBUS

CHALLENGE : Reduction in CPC
COMPONENT : Side Plate (ASGRCS-1082)
COMPETITON : Global Competitor
SOLUTION : EM 8.00MMX19X63 SH8 4FLT CR0.8 TR ALT- FBK0510611
CUTTING DATA : Machine : Makino Slim twin
Spindle VMC, Shrink-fit- BT40-Regofix, Coolant – Emulsion
RPM = 3183, Feed = 1300mm/min
Ap = 12mm, Ae = 2-3mm
Existing Tool Life – 32 Parts
Achieved Tool Life – 104 Parts
RESULT : Tool Life Benefit
BENEFIT : Reduction in CPC by 66%



Material – 15-5 PH – 40 HRC

TROCHOIDAL MILLING 16MM END MILL FOR A VENDOR OF BOEING

CHALLENGE : Reduction in CPC
COMPONENT : Boeing Floor to Frame Fitting
COMPETITON : Global Competitor
SOLUTION : EM 16.00MMX34X48X100SH16 6F CR3 5FLTALT
CUTTING DATA : Machine : Mitsubishi DH80 HMC
Holder BT50 Side-lock
Totem , Coolant – Soluble Oil
RPM = 1200 Feed = 420
Ap = 30mm, Ae = 4mm
Existing Tool Life – 240 minutes
Achieved Tool Life – 344 minutes
RESULT : Tool Life Benefit
BENEFIT : Reduction in CPC by 30%

Material – Ti6Al4V

Turbo - TR

Features

- Variable pitch and Variable helix
- Stable core geometry
- Optimized centre cutting geometry
- New generation coating
- Available in 4 flutes,5 flutes, 6 flutes and 7 flutes
- Available with neck options

Functions & Benefits

- Higher productivity
- Reinforced core gives the ability to work at higher parameters
- Superior tool life
- Excellent surface finish
- High MRR

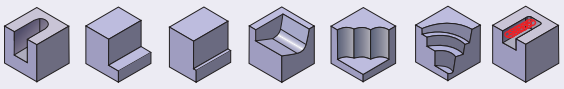
TOTEM

Solid Carbide End Mills

F177TR Series

4 Flute

Centre cutting high performance end mill for roughing & finishing



Carbide | REG | 35/38° | 6535 HA | Cr Base

IMAGE 1

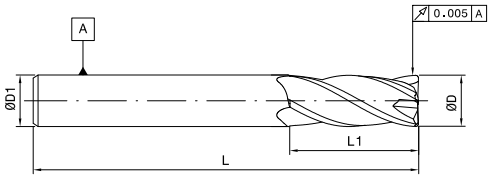


IMAGE 2

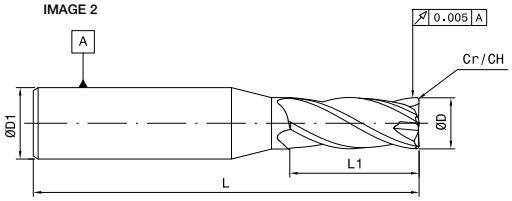


IMAGE 3

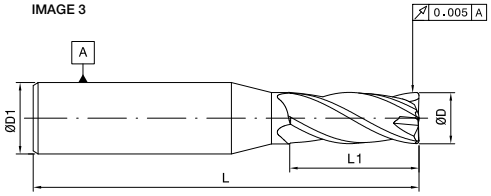
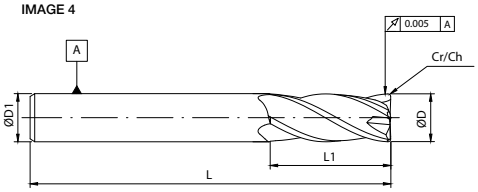


IMAGE 4



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	CH (mm)	z	γ (°)	Image	EDP No
3.00	6.00	38.00	3.00			4	-	1	FBK0503876
4.00	11.00	55.00	6.00	0.20		4	10	2	FBK0508737
4.00	11.00	55.00	6.00		0.40	4	10	2	FBK0508921
4.00	11.00	55.00	6.00			4	10	3	FBK0508738
4.00	14.00	51.00	4.00			4	-	1	FBK0503954
4.00	20.00	51.00	4.00			4	-	1	FBK0503955
5.00	20.00	51.00	5.00			4	-	1	FBK0503956
6.00	13.00	57.00	6.00	0.20		4	-	4	FBK0508739
6.00	13.00	57.00	6.00		0.40	4	-	4	FBK0508922
6.00	13.00	57.00	6.00			4	-	1	FBK0508740
6.00	20.00	64.00	6.00			4	-	1	FBK0503484
8.00	19.00	63.00	8.00	0.20		4	-	4	FBK0508741
8.00	19.00	63.00	8.00		0.40	4	-	4	FBK0508923
8.00	19.00	63.00	8.00			4	-	1	FBK0508742
8.00	20.00	64.00	8.00			4	-	1	FBK0503485
10.00	22.00	72.00	10.00	0.30		4	-	4	FBK0508743

Application data on page no 2.129

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4 Flute

Centre cutting high performance end mill for roughing & finishing

Carbide | REG | 35/38° | 6535 HA | Cr Base

P1-P6
K1-K3
S1-S4
M1-M3
H1

IMAGE 1

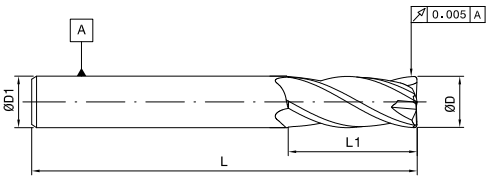
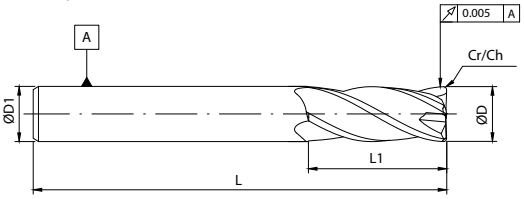


IMAGE 2



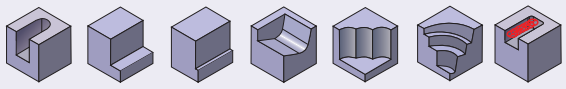
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	CH (mm)	z	γ (°)	Image	EDP No
10.00	22.00	72.00	10.00		0.50	4	-	2	FBK0508924
10.00	22.00	72.00	10.00			4	-	1	FBK0508744
10.00	25.00	70.00	10.00			4	-	1	FBK0503486
12.00	26.00	83.00	12.00	0.30		4	-	2	FBK0508745
12.00	26.00	83.00	12.00		0.50	4	-	2	FBK0508925
12.00	26.00	83.00	12.00			4	-	1	FBK0508746
12.00	25.00	76.00	12.00			4	-	1	FBK0503487
14.00	30.00	89.00	14.00			4	-	1	FBK0503488
16.00	32.00	92.00	16.00	0.30		4	-	2	FBK0508747
16.00	32.00	92.00	16.00		0.50	4	-	2	FBK0508926
16.00	32.00	92.00	16.00			4	-	1	FBK0508748
16.00	30.00	89.00	16.00			4	-	1	FBK0503489
20.00	38.00	104.00	20.00	0.30		4	-	2	FBK0508749
20.00	38.00	104.00	20.00		0.50	4	-	2	FBK0508927
20.00	38.00	104.00	20.00			4	-	1	FBK0508750
20.00	35.00	102.00	20.00			4	-	1	FBK0503490

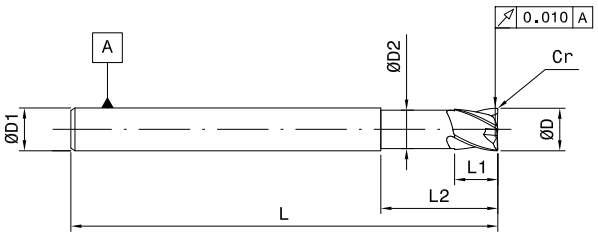
Application data on page no 2.129

4 Flute

Centre cutting high performance end mill for roughing & finishing



Carbide | LONG | 35/38° | 6535 HA | Cr Base



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	EDP No
6.00	12.00	5.50	42.00	100.00	6.00	0.40	4	FBK0508731
8.00	16.00	7.30	62.00	100.00	8.00	0.40	4	FBK0508732
10.00	20.00	9.10	60.00	100.00	10.00	0.50	4	FBK0508733
12.00	24.00	11.00	73.00	125.00	12.00	0.50	4	FBK0508734
16.00	32.00	14.56	100.00	150.00	16.00	0.50	4	FBK0508735
20.00	40.00	18.20	100.00	175.00	20.00	0.50	4	FBK0508736

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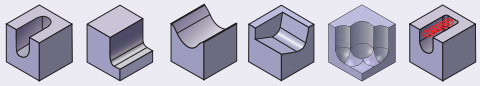
4 Flute

Centre cutting high performance ball nose end mill for roughing & finishing



Carbide | REG | 35/38° | 6535 HA | Cr Base

IMAGE 1

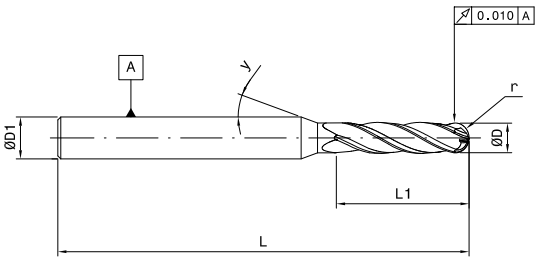
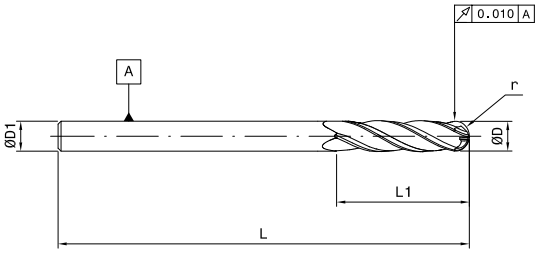


IMAGE 2



P1-P6
K1-K3
S1-S4
M1-M3
H1

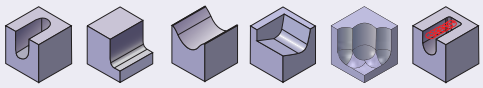
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No
3.00	6.00	38.00	6.00	1.50	4	10	1	FBK0503958
4.00	15.00	64.00	6.00	2.00	4	10	1	FBK0503888
6.00	16.00	64.00	6.00	3.00	4	-	2	FBK0503889
8.00	20.00	64.00	8.00	4.00	4	-	2	FBK0503890
10.00	20.00	70.00	10.00	5.00	4	-	2	FBK0503891
12.00	25.00	76.00	12.00	6.00	4	-	2	FBK0503892
16.00	30.00	89.00	16.00	8.00	4	-	2	FBK0503893
18.00	35.00	102.00	18.00	9.00	4	-	2	FBK0503894

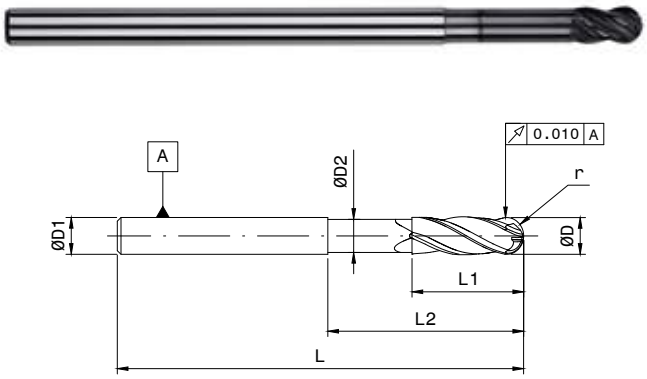
Application data on page no 2.129

4 Flute

Centre cutting high performance ball nose end mill for roughing & finishing



Carbide | LONG | 35/38° | 6535 HA | Cr Base



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No
6.00	9.00	5.80	32.00	101.00	6.00	3.00	4	FBK0510487
8.00	12.00	7.60	42.00	101.00	8.00	4.00	4	FBK0510625
10.00	15.00	9.60	52.00	127.00	10.00	5.00	4	FBK0510626
12.00	18.00	11.40	62.00	152.00	12.00	6.00	4	FBK0510627
16.00	24.00	15.20	82.00	152.00	16.00	8.00	4	FBK0510628

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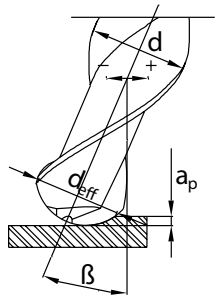
Cutting parameters

Centre cutting high performance end mill / ball nose for roughing & finishing - F177 TR/ NF177 TR / F179 TR / F179 TRL - 4.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling							Cutting Speed (Vc) m/min for Slot Milling		Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1	1		Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.													
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT		Cutting Speed (Vc) m/min		mm	Diameter in mm											
			ap max	ap max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling				4.0		6.0		8.0		10.0		12.0		16.0		20.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	1	315	248	225	210	203	195	188	1XD	175	150	315	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	294	231	210	196	189	182	175	1XD	165	140	294	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		3	252	198	180	168	162	156	150	1XD	140	120	252	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		4	189	149	135	126	122	117	113	0.75XD	120	90	189	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088
		5	126	99	90	84	81	78	75	1XD	80	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		6	105	83	75	70	68	65	63	0.75XD	62.5	50	105	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Stainless Steel	M	1	189	149	135	126	122	117	113	1XD	102.5	90	189	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	126	99	90	84	81	78	75	1XD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		3	126	99	90	84	81	78	75	1XD	65	60	126	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Cast Iron	K	1	252	198	180	168	162	156	150	1XD	135	120	252	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	231	182	165	154	149	143	138	1XD	120	110	231	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		3	210	165	150	140	135	130	125	1XD	115	100	210	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
Super Alloys	S	1	105	83	75	70	68	65		0.3XD	70	50	105	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	53	41	38	35	34	33		0.3XD	32.5	25	53	fz	0.010	0.013	0.015	0.019	0.021	0.026	0.026	0.032	0.030	0.037	0.037	0.046	0.043	0.054
		3	126	99	90	84	81	78	75	1XD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		4	105	83	75	70	68	65	63	1XD	55	50	105	fz	0.013	0.016	0.021	0.026	0.030	0.037	0.036	0.045	0.042	0.052	0.051	0.064	0.059	0.074
Hard Materials	H	1	168	132	120	112	108	104	100	0.75XD	110	80	168	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088

		4 Flute Flat	4 Flute Flat/ Neck	4 Flute Ball
CT	Standard	**F177TR**	**NF177TR**	**F179TR**
NCT	Long	**NF179TR**		

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1
* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D\text{-}ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D\text{-}2 \times ADOC}{D}\right)\right]$$

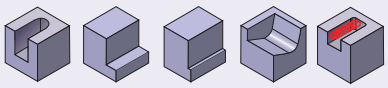
Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

5 Flute

Centre cutting high performance end mill for roughing & finishing



Carbide | REG | 35/38° | 6535 HA | Cr Base

IMAGE 1

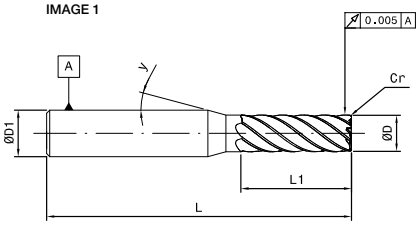


IMAGE 2

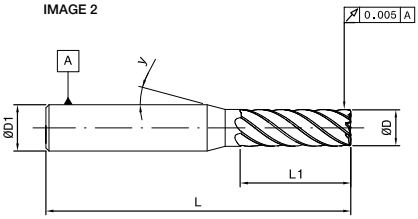


IMAGE 3

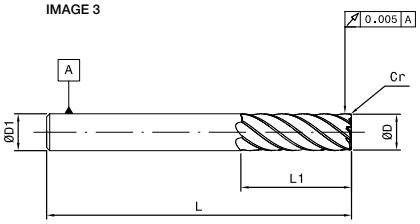
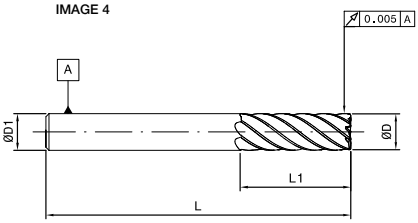


IMAGE 4



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	γ (°)	Image	EDP No BLACK	EDP No GOLD
4.00	11.00	55.00	6.00	0.25	5	10	1	FBK0508717	FBK0510616
4.00	11.00	55.00	6.00		5	10	2	FBK0508718	FBK0510617
6.00	13.00	57.00	6.00	0.40	5	-	3	FBK0508719	FBK0510414
6.00	13.00	57.00	6.00		5	-	4	FBK0508720	FBK0510618
6.00	20.00	64.00	6.00		5	-	4	FBK0503491	-
8.00	19.00	63.00	8.00	0.50	5	-	3	FBK0508721	FBK0510338
8.00	19.00	63.00	8.00		5	-	4	FBK0508722	FBK0510619
8.00	20.00	64.00	8.00		5	-	4	FBK0503492	-
10.00	22.00	72.00	10.00	0.50	5	-	3	FBK0508723	FBK0510339
10.00	22.00	72.00	10.00		5	-	4	FBK0508724	FBK0510620
10.00	25.00	70.00	10.00		5	-	4	FBK0503493	-
12.00	26.00	83.00	12.00	0.75	5	-	3	FBK0508725	FBK0510340
12.00	26.00	83.00	12.00		5	-	4	FBK0508726	FBK0510621
12.00	25.00	76.00	12.00		5	-	4	FBK0503494	-
14.00	30.00	89.00	14.00		5	-	4	FBK0503495	-
16.00	32.00	92.00	16.00	0.75	5	-	3	FBK0508727	FBK0510341
16.00	32.00	92.00	16.00		5	-	4	FBK0508728	FBK0510622
16.00	30.00	89.00	16.00		5	-	4	FBK0503496	-
20.00	38.00	104.00	20.00	0.75	5	-	3	FBK0508729	FBK0510623
20.00	38.00	104.00	20.00		5	-	4	FBK0508730	FBK0510624
20.00	35.00	102.00	20.00		5	-	4	FBK0503497	-

Application data on page no 2.131

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Cutting parameters

Centre cutting high performance 5 flute end mill for roughing & finishing - F178 TR Black/Gold - 4.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling for Rough and Semi Finish							Cutting Speed (Vc) m/min for Slot Milling				Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1					Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling	Cutting Speed (Vc) m/min		mm	Diameter in mm												
															4.0		6.0		8.0		10.0		12.0		16.0		20.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	1	315	248	225	210	203	195	188	1xD	175	150	315	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	294	231	210	196	189	182	175	1xD	165	140	294	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		3	252	198	180	168	162	156	150	1xD	140	120	252	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		4	189	149	135	126	122	117	113	0.75XD	120	90	189	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088
		5	126	99	90	84	81	78	75	1xD	80	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		6	105	83	75	70	68	65	63	0.75XD	62.5	50	105	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Stainless Steel	M	1	189	149	135	126	122	117	113	1xD	102.5	90	189	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	126	99	90	84	81	78	75	1xD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		3	126	99	90	84	81	78	75	1xD	65	60	126	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Cast Iron	K	1	252	198	180	168	162	156	150	1xD	135	120	252	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	231	182	165	154	149	143	138	1xD	120	110	231	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		3	210	165	150	140	135	130	125	1xD	115	100	210	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
Super Alloys	S	1	105	83	75	70	68	65		0.3XD	70	50	105	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	53	41	38	35	34	33		0.3XD	32.5	25	53	fz	0.010	0.013	0.015	0.019	0.021	0.026	0.026	0.032	0.030	0.037	0.037	0.046	0.043	0.054
		3	126	99	90	84	81	78	75	1xD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		4	105	83	75	70	68	65	63	1xD	55	50	105	fz	0.013	0.016	0.021	0.026	0.030	0.037	0.036	0.045	0.042	0.052	0.051	0.064	0.059	0.074
Hard Materials	H	1	168	132	120	112	108	104	100	0.75XD	110	80	168	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088

F178TR Gold to be used on Stainless Steel and Steel as first preferance/ SuperAlloys, Cast Iron and Hard Steel as a second preferance
F178TR Black to be used on Titanium and Super Alloys as a frist preferance/ Stainless Steel/ Steel/ Cast Iron and Hard Steel as the second preferance

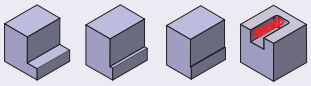
Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

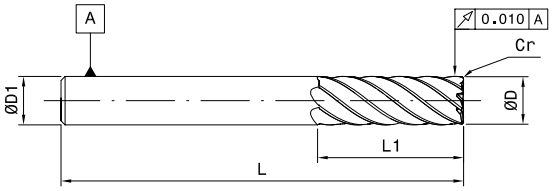
Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

7 Flute

Centre cutting high performance end mill for roughing & finishing



Carbide | 7 | REG | 35/38° | 6535 HA | Cr Base

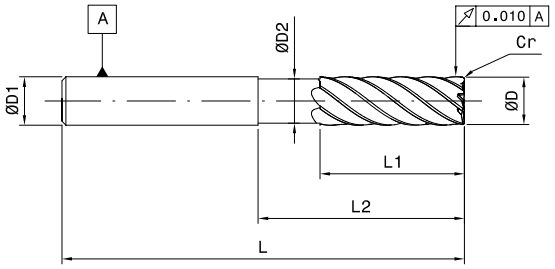


P1-P6
S1-S4
M1-M3
H1-H2

F180TR

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	EDP No
10.00	30.00	76.00	10.00	0.50	7	FBK0508808
12.00	36.00	100.00	12.00	0.50	7	FBK0508809
16.00	48.00	110.00	16.00	0.50	7	FBK0508810

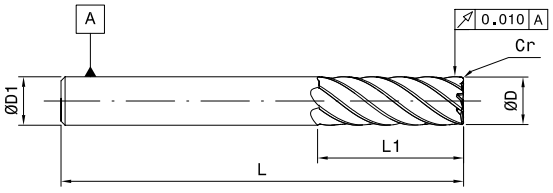


P1-P6
S1-S4
M1-M3
H1-H2

NF180TR

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Corner Radius Ø Cr	z	EDP No
10.00	22.00	9.40	30.00	76.00	10.00	0.50	7	FBK0508811
12.00	26.00	11.28	36.00	100.00	12.00	0.50	7	FBK0508812
16.00	32.00	15.04	48.00	110.00	16.00	0.50	7	FBK0508813



P1-P6
S1-S4
M1-M3
H1-H2

F180TRL

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD2 (mm)	Corner Radius ØCr	z	EDP No
10.00	50.00	100.00	10.00	0.50	7	FBK0511263
12.00	60.00	125.00	12.00	0.50	7	FBK0511264
16.00	80.00	141.00	16.00	0.50	7	FBK0511265

Application data on page no 2.133

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Cutting parameters

Centre cutting high performance 7 flute end mill for roughing & finishing - F180TR/NF 180TR Semi Finishing - 10.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling							Recommended Feed/Tooth (fz)						
			5	2.3	1.6	1.4	1.2				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.					
			ap Max	ap 2.5D	ap 2.5D	ap 2D	ap 2D	Cutting Speed (Vc) m/min			Diameter in mm					
										mm	10.0		12.0		16.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	min	max	Range	min	max	min	max	min	max
Steel	P	1	500	393	750	333	298	238	500	fz	0.048	0.060	0.052	0.065	0.064	0.080
		2	240	189	360	160	143	115	240	fz	0.048	0.060	0.052	0.065	0.064	0.080
		3	150	118	225	100	89	72	150	fz	0.043	0.054	0.050	0.062	0.062	0.077
		4	150	118	225	100	89	72	150	fz	0.043	0.054	0.050	0.062	0.062	0.077
		5	100	78	150	67	59	48	100	fz	0.038	0.048	0.045	0.056	0.056	0.070
Stainless Steel	M	1	115	90	173	77	69	55	115	fz	0.049	0.061	0.056	0.070	0.070	0.087
		2	80	63	120	53	48	38	80	fz	0.038	0.048	0.045	0.056	0.056	0.070
		3	70	55	105	47	42	34	70	fz	0.032	0.040	0.038	0.047	0.046	0.057
Super Alloys	S	1	90	71	135	60	54	43	90	fz	0.049	0.061	0.056	0.070	0.070	0.087
		2	40	31	60	27	24	19	40	fz	0.026	0.032	0.030	0.037	0.037	0.046
		3	80	63	120	53	48	38	80	fz	0.038	0.048	0.045	0.056	0.056	0.070
		4	60	47	90	40	36	29	60	fz	0.036	0.045	0.042	0.052	0.051	0.064
Hard Materials	H	1	140	110	210	93	83	67	140	fz	0.043	0.054	0.050	0.062	0.062	0.077
		2	120	94	180	80	71	57	120	fz	0.032	0.040	0.038	0.047	0.046	0.057

Centre cutting high performance 7 flute end mill for roughing & finishing - F180TR/NF 180TR Finishing - 10.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min for Milling/Finishing			Recommended Feed/Tooth (fz)					
			Cutting Speed (Vc) m/min			Diameter in mm					
			ap Max	ap Max	mm	10.0		12.0		16.0	
			ae/D 1%	ae/D 6%	Range	min	max	min	max	min	max
Steel	P	1	500	238	fz	0.048	0.060	0.052	0.065	0.064	0.080
		2	240	115	fz	0.048	0.060	0.052	0.065	0.064	0.080
		3	150	72	fz	0.043	0.054	0.050	0.062	0.062	0.077
		4	150	72	fz	0.043	0.054	0.050	0.062	0.062	0.077
		5	100	48	fz	0.038	0.048	0.045	0.056	0.056	0.070
Stainless Steel	M	1	115	55	fz	0.049	0.061	0.056	0.070	0.070	0.087
		2	80	38	fz	0.038	0.048	0.045	0.056	0.056	0.070
		3	70	34	fz	0.032	0.040	0.038	0.047	0.046	0.057
Super Alloys	S	1	90	43	fz	0.049	0.061	0.056	0.070	0.070	0.087
		2	40	19	fz	0.026	0.032	0.030	0.037	0.037	0.046
		3	80	38	fz	0.038	0.048	0.045	0.056	0.056	0.070
		4	60	29	fz	0.036	0.045	0.042	0.052	0.051	0.064
Hard Materials	H	1	140	67	fz	0.043	0.054	0.050	0.062	0.062	0.077
		2	120	57	fz	0.032	0.040	0.038	0.047	0.046	0.057

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Trochoidal milling

Features
- Robust Core Design
- Multiflutes for High Productivity
- Available with alternate coating

Functions
- Operates at high cutting speeds
- Geometry programmed to suit adequate material removal at various enagemnet angles

Benefits
- Highest dynamic speed rates
- Highest material removal rate
- Least cutting forces
- Prolonged tool life due to reduced shock
- High savings in cycle time when compared to the conventional milling strategy

5 Flute

Centre cutting end mill for roughing and finishing steel and super alloys

Carbide | VARI | 6535 HA | TiAlN

IMAGE 1

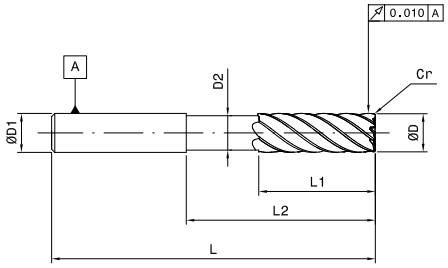
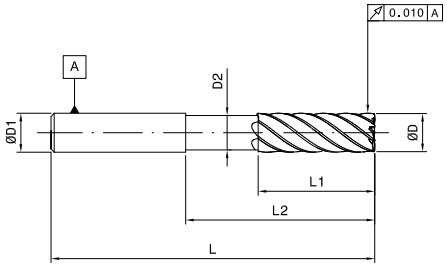


IMAGE 2



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	Image	EDP No
6.00	13.00	5.64	18.00	64.00	6.00	0.50	5	1	FBK0508649
6.00	13.00	5.64	18.00	64.00	6.00	1.00	5	1	FBK0508650
6.00	13.00	5.64	18.00	64.00	6.00	1.50	5	1	FBK0508651
6.00	14.00	5.64	18.00	64.00	6.00	–	5	2	FBK0508652
8.00	19.00	7.52	24.00	76.00	8.00	0.50	5	1	FBK0508653
8.00	19.00	7.52	24.00	76.00	8.00	1.00	5	1	FBK0508654
8.00	18.00	7.52	24.00	76.00	8.00	–	5	2	FBK0508655
10.00	22.00	9.40	30.00	76.00	10.00	0.50	5	1	FBK0508656
10.00	22.00	9.40	30.00	76.00	10.00	1.00	5	1	FBK0508657
10.00	22.00	9.40	30.00	76.00	10.00	2.00	5	1	FBK0508658
10.00	22.00	9.40	30.00	76.00	10.00	3.00	5	1	FBK0510260
10.00	22.00	9.40	30.00	76.00	10.00	–	5	2	FBK0508659
12.00	26.00	11.28	36.00	84.00	12.00	0.50	5	1	FBK0508660
12.00	26.00	11.28	36.00	84.00	12.00	1.00	5	1	FBK0510270
12.00	26.00	11.28	36.00	84.00	12.00	2.00	5	1	FBK0510271
12.00	26.00	11.28	36.00	84.00	12.00	3.00	5	1	FBK0510259
12.00	26.00	11.28	36.00	84.00	12.00	–	5	2	FBK0508663
16.00	32.00	15.04	48.00	100.00	16.00	0.50	5	1	FBK0508664
16.00	32.00	15.04	48.00	100.00	16.00	1.00	5	1	FBK0508665
16.00	32.00	15.04	48.00	100.00	16.00	2.00	5	1	FBK0508666
16.00	32.00	15.04	48.00	100.00	16.00	3.00	5	1	FBK0510261
16.00	32.00	15.04	48.00	100.00	16.00	5.00	5	1	FBK0510269
16.00	32.00	15.04	48.00	100.00	16.00	–	5	2	FBK0508668

Features

- 5 Flutes
- Variable helix
- Variable pitch
- Effective for machining steel/ stainless (wet) / super alloys (wet)
- Also available with more flutes/ neck and through coolant as a special option

Functions

- Effective for trochoidal milling and I-machining
- High MRR
- Optimal flutes as per diameter of tool

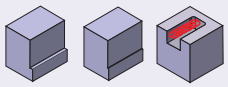
Benefits

- Stable cutting edge at elevated cutting conditions
- Superior tool life

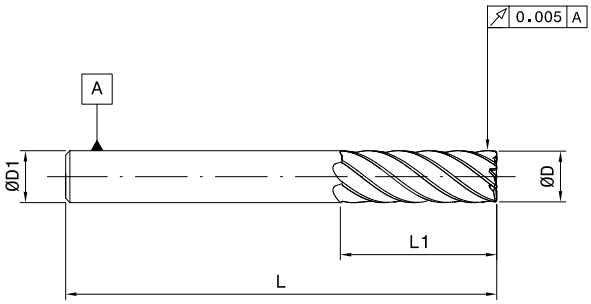
Application data on page no 2.137

6 Flute

Centre cutting high performance 6 flute end mill for trochoidal milling



Carbide | 45° | 6535 HA | TiAlN



P1-P6
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No
6.00	13.00	57.00	6.00	6	FBK0508789
8.00	19.00	63.00	8.00	6	FBK0508790
10.00	22.00	72.00	10.00	6	FBK0508791
12.00	26.00	83.00	12.00	6	FBK0508792
16.00	32.00	92.00	16.00	6	FBK0508793
20.00	38.00	104.00	20.00	6	FBK0508794

Features
- 6 Flutes
- 45^0 Helix
- Good geometry for finishing
- Effective for machining steel/ stainless (wet) / super alloys (wet)
- Also available with more flutes/ neck and through coolant as a special option

Functions
- Effective for trochoidal milling and I-machining
- High MRR
- Optimal flutes as per diameter of tool

Benefits
- Stable cutting edge at elevated cutting conditions
- Superior tool life

Application data on page no 2.137

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Cutting parameters

Centre cutting 5 flute end mill for finishing steel and super alloys for Trochoidal milling - 5VR- 4.0 mm to 20.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling for Rough and Semi Finish							Cutting Speed (Vc) m/min for Slot Milling				Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1					Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling	Cutting Speed (Vc) m/min		mm	Diameter in mm												
															4.0		6.0		8.0		10.0		12.0		16.0		20.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	1	315	248	225	210	203	195	188	1xD	175	150	315	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	294	231	210	196	189	182	175	1xD	165	140	294	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		3	252	198	180	168	162	156	150	1xD	140	120	252	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		4	189	149	135	126	122	117	113	0.75XD	120	90	189	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088
		5	126	99	90	84	81	78	75	1xD	80	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		6	105	83	75	70	68	65	63	0.75XD	62.5	50	105	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Stainless Steel	M	1	189	149	135	126	122	117	113	1xD	102.5	90	189	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	126	99	90	84	81	78	75	1xD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		3	126	99	90	84	81	78	75	1xD	65	60	126	fz	0.013	0.016	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065
Cast Iron	K	1	252	198	180	168	162	156	150	1xD	135	120	252	fz	0.022	0.028	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114
		2	231	182	165	154	149	143	138	1xD	120	110	231	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		3	210	165	150	140	135	130	125	1xD	115	100	210	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
Super Alloys	S	1	105	83	75	70	68	65		0.3XD	70	50	105	fz	0.018	0.023	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101
		2	53	41	38	35	34	33		0.3XD	32.5	25	53	fz	0.010	0.013	0.015	0.019	0.021	0.026	0.026	0.032	0.030	0.037	0.037	0.046	0.043	0.054
		3	126	99	90	84	81	78	75	1xD	70	60	126	fz	0.015	0.019	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081
		4	105	83	75	70	68	65	63	1xD	55	50	105	fz	0.013	0.016	0.021	0.026	0.030	0.037	0.036	0.045	0.042	0.052	0.051	0.064	0.059	0.074
Hard Materials	H	1	168	132	120	112	108	104	100	0.75XD	110	80	168	fz	0.017	0.021	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088

Centre cutting high performance 6 flute end mill for Trochoidal milling - 6VR - 6.0 mm to 20.0 mm

Material			Cutting Speed (Vc) m/min for Shoulder Milling				Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			5	2.3			Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finish													
			ap max	ap 1.5D	Cutting Speed (Vc) m/min		mm	Diameter in mm												
								6.0		8.0		10.0		12.0		16.0		20.0		
			ae/D 1%	ae/D 5%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	1	315	248	150	315	fz	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114	
		2	294	231	140	294	fz	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114	
		3	252	198	120	252	fz	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101	
		4	189	149	90	189	fz	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088	
		5	126	99	60	126	fz	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081	
		6	105	83	50	105	fz	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065	
Stain-less Steel	M	1	168	132	80	168	fz	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101	
		2	126	99	60	126	fz	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081	
		3	126	99	60	126	fz	0.020	0.025	0.027	0.034	0.032	0.040	0.038	0.047	0.046	0.057	0.052	0.065	
Cast Iron	K	1	252	198	120	252	fz	0.035	0.044	0.048	0.060	0.058	0.072	0.066	0.083	0.081	0.101	0.091	0.114	
		2	231	182	110	231	fz	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101	
		3	210	165	100	210	fz	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081	
Special Alloys	S	1	105	83	50	105	fz	0.029	0.036	0.040	0.050	0.049	0.061	0.056	0.070	0.070	0.087	0.081	0.101	
		2	42	33	20	42	fz	0.015	0.019	0.021	0.026	0.026	0.032	0.030	0.037	0.037	0.046	0.043	0.054	
		3	105	83	50	105	fz	0.023	0.029	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070	0.065	0.081	
		4	95	74	45	95	fz	0.021	0.026	0.030	0.037	0.036	0.045	0.042	0.052	0.051	0.064	0.059	0.074	
Hard-ened Steel	H	1	168	132	80	168	fz	0.026	0.033	0.036	0.045	0.043	0.054	0.050	0.062	0.062	0.077	0.070	0.088	

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

3 Flute

Centre cutting finisher for steel, stainless steel and super alloys

Carbide | REG | 60° | 6535 HA | TiAlN

IMAGE 1

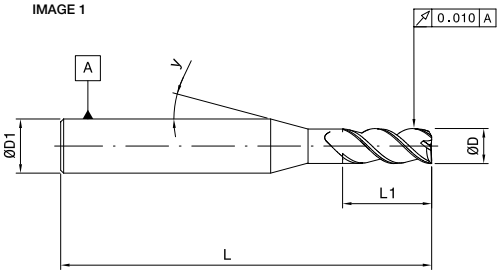
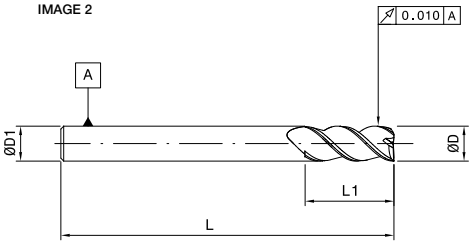


IMAGE 2



P1-P4
K1-K3
S1-S4
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
3.00	8.00	57.00	6.00	3	10	1	FBK0508814
4.00	11.00	57.00	6.00	3	10	1	FBK0508815
5.00	13.00	57.00	6.00	3	10	1	FBK0508816
6.00	13.00	57.00	6.00	3	-	2	FBK0508817
8.00	19.00	63.00	8.00	3	-	2	FBK0508818
10.00	22.00	72.00	10.00	3	-	2	FBK0508819
12.00	26.00	83.00	12.00	3	-	2	FBK0508820
16.00	32.00	92.00	16.00	3	-	2	FBK0508821
20.00	38.00	104.00	20.00	3	-	2	FBK0508822

Function

- High helix design for good wall finish

Benefits

- Superior tool life
- Excellent surface finish

Good Geometry for Finishing for Steel/ Stainless (Wet) / SuperAlloys (Wet)
Also Available with Neck as a special option

Application data on page no 2.139

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Cutting parameters for swift

Centre cutting 3 flute finisher for steel, stainless steel and super alloys - SWIFT - 3.0 mm to 6.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling							Slot Milling		Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%							
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.							
			ap Max	ap Max	ap 1.5D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap as per chart	Cutting Speed (Vc) m/min for Slot Milling				Diameter in mm							
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		Cutting Speed (Vc) m/min		mm	3.0		4.0		5.0		6.0	
												min	max	Range	min	max	min	max	min	max	min	max
Steel	P	1	252	198	180	168	162	156	150	0.5XD	140	120	252	fz	0.012	0.015	0.015	0.019	0.019	0.024	0.023	0.029
		2	189	149	135	126	122	117	113	0.3XD	120	90	189	fz	0.012	0.015	0.014	0.017	0.018	0.022	0.021	0.026
		3	126	99	90	84	81	78	75	0.5XD	80	60	126	fz	0.010	0.012	0.012	0.015	0.015	0.019	0.019	0.024
		4	105	83	75	70	68	65	63	0.3XD	62.5	50	105	fz	0.007	0.009	0.010	0.013	0.013	0.016	0.016	0.02
Stainless Steel	M	1	168	132	120	112	108	104	100	0.5XD	90	80	168	fz	0.012	0.015	0.015	0.019	0.019	0.024	0.023	0.029
		2	126	99	90	84	81	78	75	0.5XD	70	60	126	fz	0.010	0.012	0.012	0.015	0.015	0.019	0.019	0.024
		3	126	99	90	84	81	78	75	0.5XD	70	60	126	fz	0.007	0.009	0.010	0.013	0.013	0.016	0.016	0.02
Cast Iron	K	1	252	198	180	168	162	156	150	0.5XD	140	120	252	fz	0.014	0.018	0.018	0.023	0.023	0.029	0.028	0.035
		2	231	182	165	154	149	143	138	0.5XD	125	110	231	fz	0.012	0.015	0.015	0.019	0.019	0.024	0.023	0.029
		3	210	165	150	140	135	130	125	0.5XD	115	100	210	fz	0.010	0.012	0.012	0.015	0.015	0.019	0.019	0.024
Super Alloys	S	1	105	83	75	70	68	65	63	0.3XD	70	50	105	fz	0.012	0.015	0.015	0.019	0.019	0.024	0.023	0.029
		2	42	33	30	28	27	26	25	0.3XD	30	20	42	fz	0.007	0.009	0.008	0.010	0.010	0.013	0.013	0.016
		3	105	83	75	70	68	65	63	0.5XD	65	50	105	fz	0.010	0.012	0.012	0.015	0.015	0.019	0.019	0.024
		4	95	74	68	63	61	59	56	0.3XD	55	45	95	fz	0.010	0.012	0.010	0.013	0.014	0.017	0.017	0.021
Hard Materials	H	1	168	132	120	112	108	104	100	0.5XD	110	80	168	fz	0.012	0.015	0.014	0.017	0.018	0.022	0.021	0.026

Centre cutting 3 flute finisher for steel, stainless steel and super alloys - SWIFT - 8.0 mm to 16.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling							Slot Milling		Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%							
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.							
			ap Max	ap Max	ap 1.5D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap as per chart	Cutting Speed (Vc) m/min for Slot Milling				Diameter in mm							
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		Cutting Speed (Vc) m/min		mm	8.0		10.0		12.0		16.0	
												min	max	Range	min	max	min	max	min	max	min	max
Steel	P	1	252	198	180	168	162	156	150	0.5XD	140	120	252	Fz	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070
		2	189	149	135	126	122	117	113	0.3XD	120	90	189	Fz	0.029	0.036	0.034	0.043	0.04	0.05	0.049	0.061
		3	126	99	90	84	81	78	75	0.5XD	80	60	126	Fz	0.026	0.032	0.031	0.039	0.036	0.045	0.045	0.056
		4	105	83	75	70	68	65	63	0.3XD	62.5	50	105	Fz	0.022	0.027	0.026	0.032	0.030	0.037	0.037	0.046
Stainless Steel	M	1	168	132	120	112	108	104	100	0.5XD	90	80	168	Fz	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070
		2	126	99	90	84	81	78	75	0.5XD	70	60	126	Fz	0.026	0.032	0.031	0.039	0.036	0.045	0.045	0.056
		3	126	99	90	84	81	78	75	0.5XD	70	60	126	Fz	0.022	0.027	0.026	0.032	0.030	0.037	0.037	0.046
Cast Iron	K	1	252	198	180	168	162	156	150	0.5XD	140	120	252	Fz	0.038	0.048	0.046	0.058	0.053	0.066	0.065	0.081
		2	231	182	165	154	149	143	138	0.5XD	125	110	231	Fz	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070
		3	210	165	150	140	135	130	125	0.5XD	115	100	210	Fz	0.026	0.032	0.031	0.039	0.036	0.045	0.045	0.056
Super Alloys	S	1	105	83	75	70	68	65	63	0.3XD	70	50	105	Fz	0.032	0.040	0.038	0.048	0.045	0.056	0.056	0.070
		2	42	33	30	28	27	26	25	0.3XD	30	20	42	Fz	0.017	0.021	0.021	0.026	0.024	0.030	0.030	0.037
		3	105	83	75	70	68	65	63	0.5XD	65	50	105	Fz	0.026	0.032	0.031	0.039	0.036	0.045	0.045	0.056
		4	95	74	68	63	61	59	56	0.3XD	55	45	95	Fz	0.023	0.029	0.029	0.036	0.033	0.041	0.041	0.051
Hard Materials	H	1	168	132	120	112	108	104	100	0.5XD	110	80	168	Fz	0.029	0.036	0.034	0.043	0.040	0.050	0.049	0.061

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

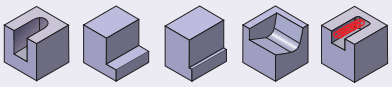
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

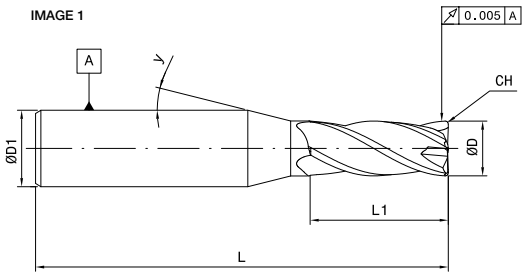
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

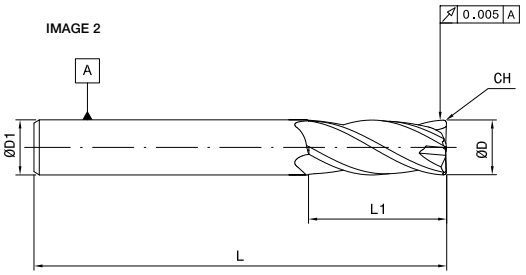
4 Flute

Centre cutting stub length high performance end mill for better economics



Carbide | STUB | 35/38° | 6535 HA | TiAlN





P1-P4
K1-K3
M1-M2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	CH (mm)	z	γ (°)	Image	EDP No
4.00	7.00	38.00	6.00	0.40	4	15	1	FBK0508782
5.00	7.00	38.00	6.00	0.40	4	10	1	FBK0508783
6.00	8.00	38.00	6.00	0.40	4	-	2	FBK0508784
8.00	11.00	43.00	8.00	0.40	4	-	2	FBK0508785
10.00	13.00	50.00	10.00	0.50	4	-	2	FBK0508786
12.00	15.00	55.00	12.00	0.50	4	-	2	FBK0508787
16.00	15.00	76.00	16.00	CR0.50	6	-	2	FBK0508788

Nano is an economic choice for high quality and performance when regrinding is not an option. Designed to minimise tool costs for applications when short lengths-of-cut are required. Nano has a short, compact design with minimised vibration and soft cut to support mill-turn machines. A good substrate and coating offers high tool life and stable manufacturing on a wide range of workpiece materials. This can be produced with different corner styles, Nano covers a wide range of applications. Roughing and finishing with one tool reduces tool inventory and tool changes providing increased productivity and value.

- One tool for roughing and finishing operations.
- Milling at a value price when re-grinding is not justified.
- Stable, low-vibration solution with soft cut for mill-turn machines.
- Stable, low-vibration solution with soft cut for mill-turn machines.
- Ask your local sales representatives about the options with corner radius

Features
- 4 Flutes
- Center cutting
- Short length better economics

Functions
- High MRR
- Stable cutting at high cutting speeds

Benefits
- Superior tool life
- Low operating cost

Application data on page no 2.141

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Cutting parameters

Centre cutting stub length high performance end mill - NANO - 4.0 mm to 12.0 mm

Material Group			Cutting Speed (Vc) m/min for Shoulder Milling / Rough and Semi Finish							Cutting Speed (Vc) m/min for Slot Milling			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%						
																			
			5	2.3	1.6	1.4	1.2	1.1	1	←			Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.						
			ap Max	ap Max	ap 1.5D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min		mm	Diameter in mm					
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	min	max	Range	4.0	6.0	8.0	10.0	12.0	12.0
Steel	P	1	378	297	270	252	243	234	225	200	180	378	fz	0.030	0.050	0.060	0.070	0.075	0.080
		2	336	264	240	224	216	208	200	180	160	336	fz	0.030	0.050	0.060	0.070	0.075	0.080
		3	336	264	240	224	216	208	200	170	160	336	fz	0.025	0.040	0.050	0.060	0.070	0.075
		4	294	231	210	196	189	182	175	150	140	294	fz	0.023	0.036	0.045	0.054	0.063	0.070
Stain-less Steel	M	1	189	149	135	126	122	117	113	103	90	189	fz	0.025	0.040	0.050	0.060	0.065	0.070
		2	126	99	90	84	81	78	75	70	60	126	fz	0.020	0.030	0.040	0.050	0.060	0.070
Cast Iron	K	1	252	198	180	168	162	156	150	135	120	252	fz	0.030	0.050	0.060	0.070	0.080	0.090
		2	231	182	165	154	149	143	138	120	110	231	fz	0.025	0.040	0.050	0.060	0.070	0.080
		3	210	165	150	140	135	130	125	115	100	210	fz	0.020	0.030	0.040	0.050	0.060	0.070

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TOTEM®

High Performance Cutting Tools

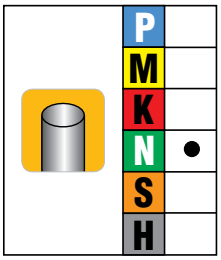
RAZORCUT™

SOLID CARBIDE END MILLING SOLUTIONS FOR MACHINING NON FERROUS MATERIALS FOR AEROSPACE & AUTOMOBILE INDUSTRY

ROUGHER SERIES
CBC/ CBCH/ NCBCH

FINISHER SERIES
2FWF/3FWF/3FWFXL/3FWFCR/3F

ROUTER SERIES
1F



FEATURES, FUNCTIONS AND BENEFITS

- Designed for Aluminium Alloys (Works excellent on Al6061 & Al7075)
- Designed to maximize metal removal rates and deliver superior wall and floor finishes on the part.
- Designed to be used in roughing, semi-finishing, finishing and super finishing applications
- Designed with a strong core geometry and flute form to tackle corners at elevated cutting conditions without chattering.
- 3FWF incorporates unequal flute spacing which helps to eliminate chatter while running at elevated parameters
- 3FWF tools come with a Wiper Flat Geometry with a wide gash which helps in ensuring excellent floor finish during the finish cycle.
- 3FWF tools are excellent in profiling operations up to 0.5D radial x 1.5D axial depth of cut
- The 3 Flute Razorcut™ generates less vibration and less deflection, enabling higher metal removal rates
- The 3 Flute Razorcut™ 3FWFXL/3FWFCR are available with neck for deep pocketing operations
- The 3 Flute Razorcut™ 3FWF Excellent performance in thin wall applications as the geometry exerts very less radial force
- The 3 Flute Razorcut™ CBCH incorporates a 40 degree helix which will ensure a better surface finish with its chamfered chip breaker and be used directly for semi finishing Aluminium
- The 3 Flute Razorcut™ 3FWF and the Razorcut™ CBCH and Razorcut™ CBC can be used in trochoidal milling with and Ae/D ratio of 30% with at least 35% improvement in cycle time over conventional strategy with improved parameters
- The Razorcut™ 1F tool is a first choice for Routing Aluminium, Organic Materials, Thermo-plastics, Thermosets, Delerine, Nylon. These tools can be offered with HardCarbon™ coating for atleast 30% higher productivity.
- Razorcut™ is an excellent program for slotting operations up to a 1 x D axial depth of cut
- Razorcut™ is available in 1,2 and 3 Flute Styles
- Effective throughout the full range of machine speeds, from 3000 to 50000 RPM
- The entire Razorcut™ family of tools can be offered with a TiCN coating for machining Cast Aluminium
- The entire program is available with various corner radii and alternate lengths as a special

TARGET MARKET SEGMENTS

- Especially useful in airframe machining and other aerospace applications (Al2024, 6061 & Al7075).
- Can be used in general engineering, machine tool, and automotive casting (AlSi9, ADC6, ADC12)
- Designed for customers machining a large volume of aluminium products.
- Effective in high-speed machining, conventional milling, and MQL applications.

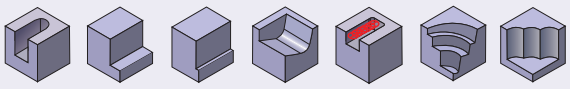
TOTEM

Solid Carbide End Mills

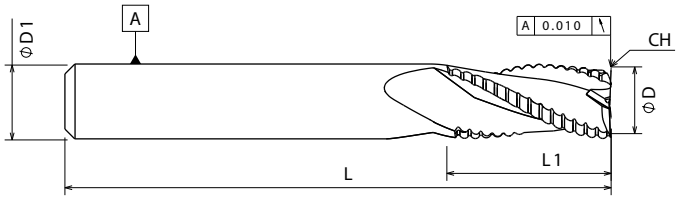
Razor cut - CBC Series

3 Flute

Centre cutting high performance chip breaker end mill with corner chamfer for roughing of aluminium



Carbide | REG | 30° | 6535 HA | BF



N1-N2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	CH (mm)	z	EDP Code
6.00	13.00	57.00	6.00	0.5	3	FBK0508672
8.00	16.00	63.00	8.00	1	3	FBK0508673
10.00	22.00	72.00	10.00	1	3	FBK0508674
12.00	26.00	83.00	12.00	1	3	FBK0508675
16.00	32.00	92.00	16.00	1	3	FBK0508676
20.00	38.00	104.00	20.00	1	3	FBK0508677
25.00	45.00	121.00	25.00	1	3	FBK0508678

Features
- 3 Flutes
- Center cutting
- Coarse pitch
- Roughing for aluminium
- Uncoated

Functions
- High MRR
- Excellent for roughing and finishing of alumnium

Benefits
- Superior tool life

Application data on page no 2.151

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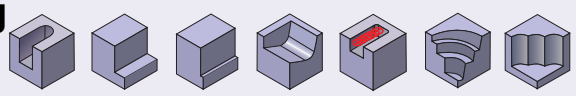
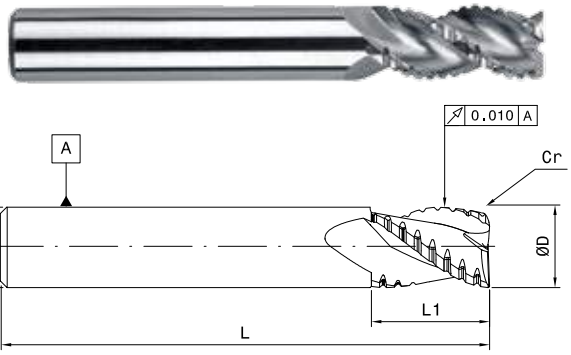
3 Flute

Centre cutting high performance chip breaker end mill with corner radius for roughing of aluminium



Carbide | REG | 40° | 6535 HA | BF

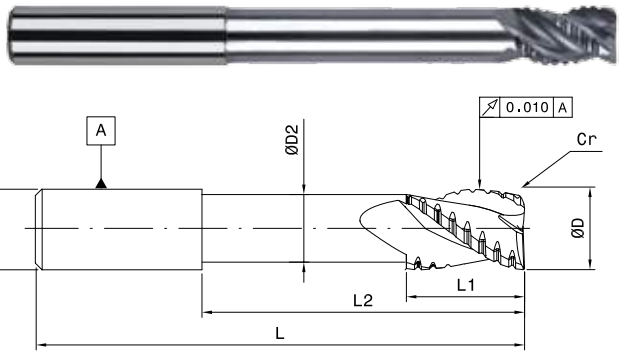


N1-N5

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	EDP Code
6.00	13.00	57.00	6.00	0.25	3	FBK0508701
8.00	16.00	63.00	8.00	0.25	3	FBK0508702
10.00	22.00	72.00	10.00	0.50	3	FBK0508703
12.00	26.00	83.00	12.00	0.50	3	FBK0508704
16.00	32.00	110.00	16.00	1.00	3	FBK0508705
20.00	38.00	104.00	20.00	1.00	3	FBK0508706
25.00	45.00	121.00	25.00	1.50	3	FBK0508707

REG | 40° | 6535 HA | BF



N1-N5

Razor cut - NCBCH

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	EDP Code
6.00	8.00	5.00	18.00	57.00	6.00	0.25	3	FBK0509069
8.00	10.00	7.00	24.00	63.00	8.00	0.25	3	FBK0509070
10.00	12.00	9.00	30.00	72.00	10.00	0.50	3	FBK0509071
12.00	15.00	11.00	36.00	83.00	12.00	0.50	3	FBK0509072
16.00	20.00	15.00	48.00	110.00	16.00	1.00	3	FBK0509073
20.00	24.00	19.00	60.00	104.00	20.00	1.00	3	FBK0509074

Application data on page no 2.151

TOTEM

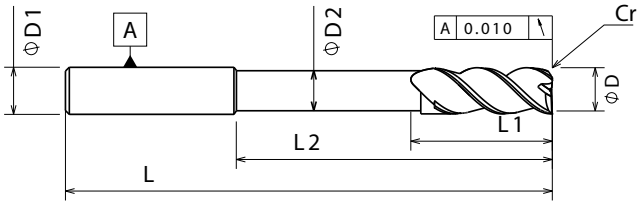
Solid Carbide End Mills

Razor cut - 3FWFXL Series

3 Flute

Centre cutting high performance end mill with wiper technology for non ferrous materials

Carbide | LONG REACH | 38° | 6535 HA | BF



N1-N2

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	EDP Code
6.00	10.00	5.50	42.00	100.00	6.00	0.20	3	FBK0508679
8.00	13.00	7.30	48.00	100.00	8.00	0.20	3	FBK0508680
10.00	16.00	9.10	60.00	125.00	10.00	0.20	3	FBK0508681
12.00	20.00	11.00	73.00	125.00	12.00	0.20	3	FBK0508682
16.00	26.00	14.56	100.00	150.00	16.00	0.20	3	FBK0508683
20.00	32.00	18.20	100.00	150.00	20.00	0.20	3	FBK0508684

Features
- 3 Flutes
- Unequal flute design
- Center cutting
- Wiper technology for excellent floor finish
- Uncoated

Functions
- High MRR
- Excellent for finishing of alumnium

Benefits
- Superior tool life
- Excellent floor finish

Application data on page no 2.151

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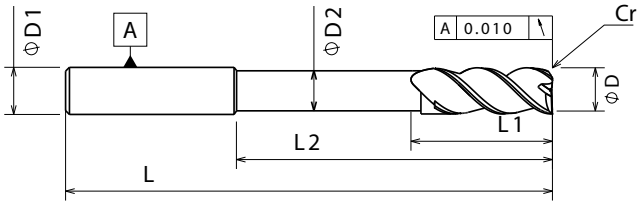
3 Flute

Centre cutting high performance end mill with wiper technology for non ferrous materials

Carbide | REG | 38° | 6535 HA | BF



N1-N2

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	ØCr (mm)	z	EDP Code
6.00	9.00	5.40	18.00	63.00	6.00	0.20	3	FBK0508685
6.00	9.00	5.40	18.00	63.00	6.00	0.50	3	FBK0508686
6.00	9.00	5.40	18.00	63.00	6.00	1.00	3	FBK0508687
8.00	12.00	7.20	24.00	76.00	8.00	0.20	3	FBK0508688
8.00	12.00	7.20	24.00	76.00	8.00	0.50	3	FBK0508689
8.00	12.00	7.20	24.00	76.00	8.00	1.00	3	FBK0508690
10.00	15.00	9.00	30.00	89.00	10.00	0.20	3	FBK0508691
10.00	15.00	9.00	30.00	89.00	10.00	0.50	3	FBK0508692
10.00	15.00	9.00	30.00	89.00	10.00	1.00	3	FBK0508693
12.00	18.00	10.80	36.00	100.00	12.00	0.20	3	FBK0508694
12.00	18.00	10.80	36.00	100.00	12.00	0.50	3	FBK0508695
12.00	18.00	10.80	36.00	100.00	12.00	1.00	3	FBK0508696
16.00	24.00	14.40	48.00	110.00	16.00	0.20	3	FBK0508697
16.00	24.00	14.40	48.00	110.00	16.00	0.50	3	FBK0508698
16.00	24.00	14.40	48.00	110.00	16.00	1.00	3	FBK0508699
16.00	24.00	14.40	48.00	110.00	16.00	2.00	3	FBK0508700

Features
- 3 Flutes
- Unequal flute design
- Center cutting
- Wiper technology for excellent floor finish
- Uncoated

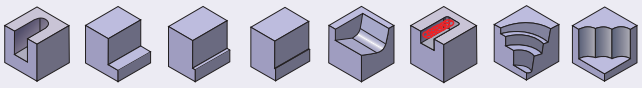
Functions
- High MRR
- Excellent for finishing of alumnium

Benefits
- Superior tool life
- Excellent floor finish

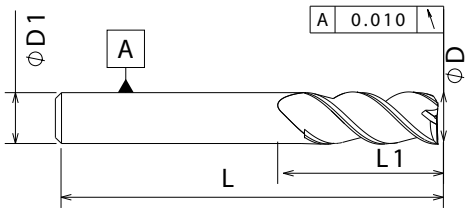
Application data on page no 2.151

3 Flute

Centre cutting high performance end mill with wiper technology for non ferrous materials



Carbide | REG | 38° | 6535 HA | BF



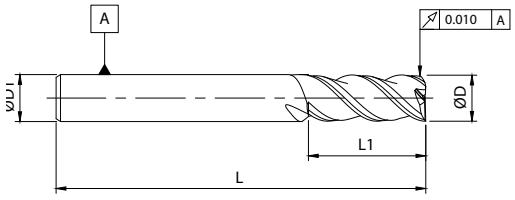
Razor cut - 3FWF
With Wiper Technology

N1-N2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP Code
3.00	12.00	38.00	3.00	3	FBK0508708
4.00	12.00	51.00	4.00	3	FBK0508709
5.00	14.00	51.00	5.00	3	FBK0508710
6.00	16.00	50.00	6.00	3	FBK0508711
8.00	20.00	63.00	8.00	3	FBK0508712
10.00	22.00	76.00	10.00	3	FBK0508713
12.00	25.00	76.00	12.00	3	FBK0508714
16.00	32.00	89.00	16.00	3	FBK0508715
20.00	38.00	104.00	20.00	3	FBK0508716

Carbide | REG | 45° | 6535 HA | BF



Razor cut - 3F
Without Wiper Technology

N1-N2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP Code
3.00	12.00	38.00	3.00	3	FBK0509996
4.00	12.00	50.00	4.00	3	FBK0509997
5.00	14.00	50.00	5.00	3	FBK0509998
6.00	16.00	50.00	6.00	3	FBK0509999
8.00	20.00	63.00	8.00	3	FBK0510000
10.00	22.00	76.00	10.00	3	FBK0510001
12.00	25.00	76.00	12.00	3	FBK0510002
16.00	32.00	89.00	16.00	3	FBK0510003
20.00	38.00	104.00	20.00	3	FBK0510004

Application data on page no 2.151

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2 Flute

Centre cutting high performance end mill with wiper technology for non ferrous materials

Carbide | REG | 45° | 6535 HA | BF

IMAGE 1

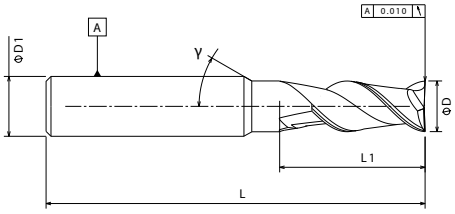
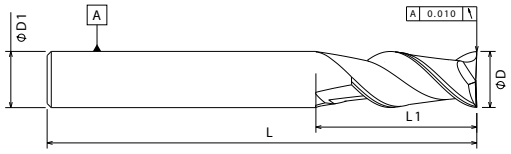


IMAGE 2



N1-N2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP Code
1.50	6.00	38.00	3.00	2		1	FBK0508795
2.00	8.00	38.00	3.00	2		1	FBK0508796
2.50	9.00	38.00	3.00	2		1	FBK0508797
3.00	12.00	38.00	3.00	2	-	2	FBK0508798
4.00	12.00	50.00	4.00	2	-	2	FBK0508799
5.00	14.00	50.00	5.00	2	-	2	FBK0508800
5.00	14.00	50.00	6.00	2		1	FBK0508801
6.00	16.00	50.00	6.00	2	-	2	FBK0508802
8.00	20.00	63.00	8.00	2	-	2	FBK0508803
10.00	22.00	76.00	10.00	2	-	2	FBK0508804
12.00	25.00	76.00	12.00	2	-	2	FBK0508805
16.00	32.00	89.00	16.00	2	-	2	FBK0508806
20.00	38.00	104.00	20.00	2	-	2	FBK0508807

Features
- 2 Flutes
- 45 degree helix
- Center cutting
- Wiper technology for excellent floor finish
- Uncoated

Functions
- High MRR
- Stable cutting at high cutting speeds

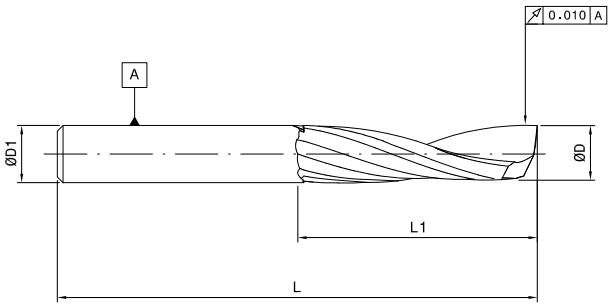
Benefits
- Superior tool life

Application data on page no 2.151

1 Flute

Razor cut 1F for machining alumnium and plastics

Carbide | REG | 30° | 6535 HA | BF



N1-N2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP Code
3.00	12.00	50.00	3.00	1	FBK0509238
4.00	15.00	60.00	4.00	1	FBK0509239
5.00	17.00	60.00	5.00	1	FBK0509240
6.00	20.00	65.00	6.00	1	FBK0509241
8.00	25.00	65.00	8.00	1	FBK0509242
10.00	25.00	75.00	10.00	1	FBK0509243

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Cutting parameters for razor cut

Centre cutting high performance 3 flute chip breaker end mill for roughing of aluminium with corner chamfer - Razorcut CBC - 6.0 mm to 25.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this multiplication factor based on ae. For excellant floor finish, use the standard fz per chart below. Only add chip thinning multiplication factor when roughing or semi-finishing.													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm													
															6.0		8.0		10.0		12.0		16.0		20.0		25.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	0.75XD	1xD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.053	0.066	0.070	0.088	0.088	0.110	0.106	0.132	0.141	0.176	0.176	0.220	0.220	0.275
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.047	0.059	0.063	0.079	0.079	0.099	0.095	0.119	0.126	0.158	0.158	0.198	0.198	0.248

If you are using Trochoidal Strategy with the Razorcut CBC. Program the helix as 30 degrees, use the starting hm value as given in the catalogue section, Use an engagement angle starting value of 53.13 degrees to get good results.

Centre cutting high performance 3 flute chip breaker end mill for roughing of aluminium with corner radius - Razorcut CBCH/NCBCH - 6.0 mm to 25.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this multiplication factor based on ae. For excellant floor finish, use the standard fz per chart below. Only add chip thinning multiplication factor when roughing or semi-finishing.													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm													
															6.0		8.0		10.0		12.0		16.0		20.0		25.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	0.75XD	1xD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.058	0.072	0.077	0.096	0.096	0.120	0.115	0.144	0.154	0.192	0.192	0.240	0.208	0.260
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.052	0.065	0.069	0.086	0.086	0.108	0.104	0.130	0.138	0.173	0.173	0.216	0.192	0.240
		3	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.040	0.050	0.054	0.067	0.067	0.084	0.081	0.101	0.107	0.134	0.134	0.168	0.144	0.180
		4	840	660	600	560	540	520	500	460	575	400	750	fz	0.046	0.058	0.062	0.077	0.077	0.096	0.092	0.115	0.123	0.154	0.154	0.192	0.164	0.205
		5	525	413	375	350	338	325	313	500	625	250	1000	fz	0.052	0.065	0.069	0.086	0.086	0.108	0.104	0.130	0.138	0.173	0.173	0.216	0.187	0.234

If you are using Trochoidal Strategy with the Razorcut CBCH/NCBCH. Program the helix as 40 degrees, use the starting hm value as given in the catalogue section, Use an engagement angle starting value of 53.13 degrees to get good results.

Razor Cut 1F for machining alumnium and plastics - 3.0 mm to 10.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			ap Max	ap Max	ap 1.2D	ap 1.2D	ap 1.1D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm											
															3.0		4.0		5.0		6.0		8.0		10.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	1XD	0.5XD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.017	0.021	0.022	0.028	0.028	0.035	0.034	0.042	0.045	0.056	0.056	0.070
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.014	0.017	0.018	0.022	0.022	0.028	0.027	0.034	0.036	0.045	0.045	0.056

For better finish reduce the feed rate.

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Cutting parameters for razor cut

Centre cutting high performance end mill for non ferrous materials with wiper technology - Razorcut 2FWF - 1.5 mm to 20.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%															
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this multiplication factor based on ae. For excellant floor finish, use the standard fz per chart below. Only add chip thinning multiplication factor when roughing or semi-finishing.																	
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm															
															1.5		2.0		4.0		6.0		8.0		10.0		12.0		16.0		20.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	1XD	0.5XD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.011	0.014	0.014	0.018	0.029	0.036	0.043	0.054	0.058	0.072	0.072	0.090	0.086	0.108	0.115	0.144	0.144	0.180
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.010	0.012	0.013	0.016	0.026	0.032	0.039	0.049	0.052	0.065	0.065	0.081	0.078	0.097	0.104	0.130	0.130	0.162

Centre cutting high performance 3 flute end mill for non ferrous materials with wiper technology - Razorcut 3FWF/3F - 3.0 mm to 20.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this multiplication factor based on ae. For excellant floor finish, use the standard fz per chart below. Only add chip thinning multiplication factor when roughing or semi-finishing.													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm													
															3.0		6.0		8.0		10.0		12.0		16.0		20.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	0.75XD	1xD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.022	0.027	0.043	0.054	0.058	0.072	0.072	0.090	0.086	0.108	0.115	0.144	0.144	0.180
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.019	0.024	0.039	0.049	0.052	0.065	0.065	0.081	0.078	0.097	0.104	0.130	0.130	0.162

If you are using Trochoidal Strategy with the Razorcut 3FWF. Program the helix as 38 degrees, use the starting hm value as given in the catalogue section, Use an engagement angle starting value of 53.13 degrees to get good results.

Centre cutting high performance 3 flute end mill for non ferrous materials with wiper technology - Razorcut 3FWFXL/3FWFCR - 6.0 mm to 20.0 mm

Material			Cutting speed (Vc) m/min for Shoulder Milling (rough and semi finish). If high power spindle is available, you can increase Vc upto 2 times							Cutting speed (Vc) m/min for slot milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			5	2.3	1.6	1.4	1.2	1.1	1						Multiply fz by this multiplication factor based on ae. For excellant floor finish, use the standard fz per chart below. Only add chip thinning multiplication factor when roughing or semi-finishing.											
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap	ap	Cutting Speed (Vc) m/min		mm	Diameter in mm											
															6.0		8.0		10.0		12.0		16.0		20.0	
			ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	0.75XD	1xD	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Non Ferrous	N	1	1050	825	750	700	675	650	625	1000	1250	500	2000	fz	0.048	0.060	0.064	0.080	0.080	0.100	0.096	0.120	0.128	0.160	0.160	0.200
		2	1050	825	750	700	675	650	625	800	1000	500	1500	fz	0.043	0.054	0.058	0.072	0.072	0.090	0.086	0.108	0.115	0.144	0.144	0.180

If you are using Trochoidal Strategy with the Razorcut 3FWFCR. Program the helix as 38 degrees, use the starting hm value as given in the catalogue section, Use an engagement angle starting value of 66.42 degrees to get good results.

Note

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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TOTEM®

High Performance Cutting Tools

ROUGHER END MILLS (CHIP BREAKER)

TOTEM®
High Performance Cutting Tools

ROUGHER END MILLS (CHIP BREAKER)

FEATURES

- 3-4 Flutes
- Center cutting
- Sinosoidal pitch / hot chip breaker
- Superior coating

FUNCTIONS & BENEFITS

- High MRR
- Stable cutting at high cutting speeds
- Superior tool life

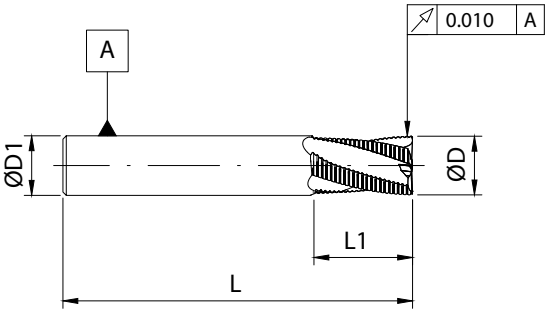
RANGE

- Standard 6mm - 25mm available in standard
- Specials 6mm - 25.4mm available in standard

3/4 Flute

Sinusoidal regular length chip breaker end mill

Carbide | 3-4 | STUB | 20° | 0.1X45° | TiAlN



P0-P6
K1-K3
S1-S4
M1-M3
H1-H2

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No
8.00	8.00	51.00	8.00	3	FBK0504087
10.00	10.00	51.00	10.00	4	FBK0504088
12.00	12.00	64.00	12.00	4	FBK0504090
16.00	16.00	76.00	16.00	4	FBK0504092
20.00	20.00	76.00	20.00	4	FBK0504093

Application data on page no 2.161

3/4 Flute Sinusoidal regular length chip breaker end mill

Carbide | 3-4 | REG | 20° | 0.1X45° | TiAlN

IMAGE 1

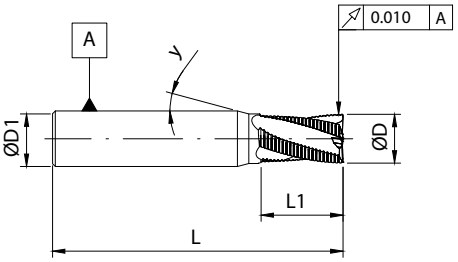
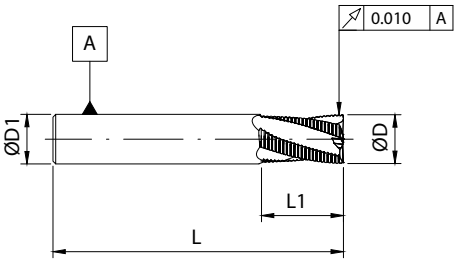


IMAGE 2



P1-P5
K1-K3
S1
S3
M1-M3
H1

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No
4.00	11.00	55.00	6.00	3	10	1	FBK0511189
5.00	13.00	57.00	6.00	3	10	1	FBK0511266
6.00	13.00	57.00	6.00	3	-	2	FBK0508669
8.00	16.00	64.00	8.00	3	-	2	FBK0504029
10.00	20.00	70.00	10.00	4	-	2	FBK0504089
12.00	25.00	76.00	12.00	4	-	2	FBK0504091
12.00	26.00	83.00	12.00	4	-	2	FBK0508670
16.00	32.00	89.00	16.00	4	-	2	FBK0508671
16.00	35.00	89.00	16.00	4	-	2	FBK0503359
20.00	38.00	102.00	20.00	4	-	2	FBK0504094

Application data on page no 2.161

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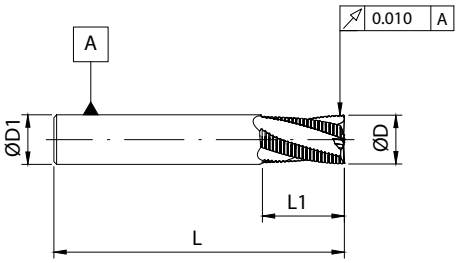
3/4 Flute

Sinusoidal regular length chip breaker end mill

Carbide | 3-4 | LONG | 20° | 0.1X45° | TiAlN



P1-P5
K1-K3
S1
S3
M1-M3
H1

Unit : mm

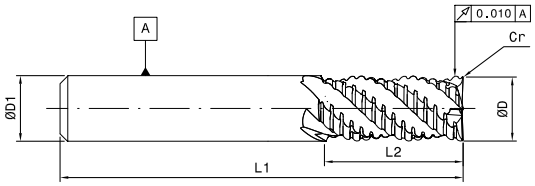
ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	Image	EDP No
6.00	40.00	100.00	6.00	3	2	FBK0509263
8.00	40.00	100.00	8.00	3	2	FBK0509264
10.00	45.00	100.00	10.00	4	2	FBK0509266
12.00	50.00	100.00	12.00	4	2	FBK0509268

Application data on page no 2.161

4/6 Flute

Flat pitch regular length chip breaker end mill with corner radius

Carbide | 4-6 | REG | 45° | TiAlN



P3-P6
K1-K3
S1-S4
M1-M3
H1-H3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	Cr (mm)	EDP No
6.00	8.00	57.00	6.00	4	0.75	FBK0510347
8.00	10.00	63.00	8.00	4	0.75	FBK0510348
10.00	12.00	72.00	10.00	4	0.75	FBK0510349
12.00	14.00	83.00	12.00	4	1.00	FBK0510350
16.00	18.00	92.00	16.00	6	1.00	FBK0510351
20.00	22.00	104.00	20.00	6	1.25	FBK0511267
25.00	27.00	121.00	25.00	6	1.25	FBK0511268

Application data on page no 2.162

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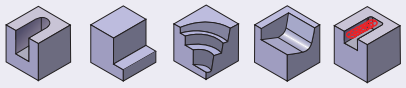
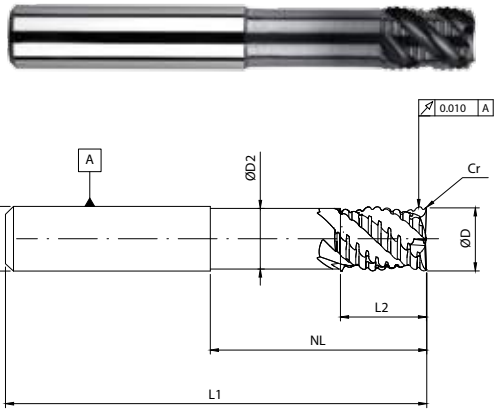
4/6 Flute

Flat pitch regular length chip breaker end mill with corner radius



Carbide | 4-6 | REG | 45° | TiAlN

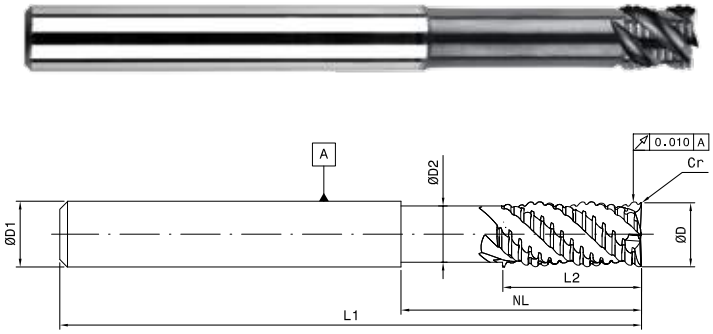


NF193CB

P3-P6
K1-K3
S1-S4
M1-M3
H1-H3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	L2 (mm)	ØD2 (mm)	ØD1 (mm)	z	Cr (mm)	EDP No
6.00	8.00	57.00	21.00	5.50	6.00	4	0.75	FBK0510352
8.00	10.00	63.00	28.00	7.30	8.00	4	0.75	FBK0510353
10.00	12.00	72.00	35.00	9.10	10.00	4	0.75	FBK0510354
12.00	14.00	83.00	42.00	11.00	12.00	4	1.00	FBK0510355
16.00	18.00	92.00	56.00	14.50	16.00	6	1.00	FBK0510356
20.00	22.00	104.00	70.00	18.20	20.00	6	1.25	FBK0511269
25.00	27.00	121.00	80.00	23.20	25.00	6	1.25	FBK0511270



NF193CBL

P3-P6
K1-K3
S1-S4
M1-M3
H1-H3

Unit : mm

ØD (mm)	L2 (mm)	L1 (mm)	NL (mm)	ØD2 (mm)	ØD1 (mm)	z	Cr (mm)	EDP No
6.00	8.00	100	42.00	5.50	6.00	4	0.75	FBK0510555
8.00	10.00	100	42.00	7.30	8.00	4	0.75	FBK0510556
10.00	12.00	100	42.00	9.10	10.00	4	0.75	FBK0510557
12.00	14.00	125	42.00	11.00	12.00	4	1.00	FBK0510558
16.00	18.00	125	56.00	14.56	16.00	6	1.00	FBK0510559

Application data on page no 2.162

TOTEM

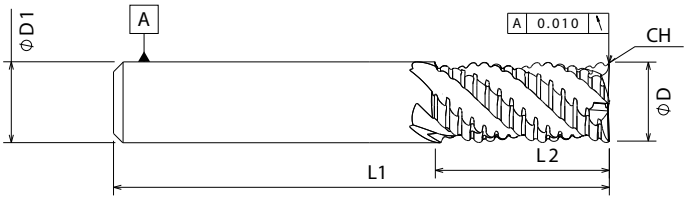
Solid Carbide End Mills

F194CB

4/6 Flute

Flat pitch regular length chip breaker end mill with corner chamfer

Carbide | 4-6 | REG | 45° | TiAlN



P3-P6
K1-K3
S1-S4
M1-M3
H1-H3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	CH (mm)	EDP No
6.00	13.00	57.00	6.00	4	0.25	FBK0510342
8.00	16.00	63.00	8.00	4	0.25	FBK0510343
10.00	22.00	72.00	10.00	4	0.25	FBK0510344
12.00	26.00	83.00	12.00	4	0.35	FBK0510345
16.00	32.00	92.00	16.00	6	0.35	FBK0510346
20.00	38.00	104.00	20.00	6	0.35	FBK0511271
25.00	45.00	121.00	25.00	6	0.50	FBK0511272

Features
- 4-6 Flutes
- Center cutting
- Flat pitch
- Superior coating
- 45HX

Functions
- High MRR
- Stable cutting at high cutting speeds

Benefits
- Superior tool life

Application data on page no 2.162

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Cutting parameters

Sinusoidal regular length 3/4 flute chip breaker end mill - F192CB/NF192CB/F192CBL - 6.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling				Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%													
			5	2.3	1.6	1.4	1.2	1.1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.													
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT	CT				Diameter in mm													
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling	Cutting Speed (Vc) m/min		mm	6.0		8.0		10.0		12.0		16.0		20.0		25.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	1	315	248	225	210	203	195	188	1 x D	175	150	315	fz	0.033	0.041	0.039	0.049	0.047	0.059	0.058	0.072	0.070	0.087	0.074	0.093	0.078	0.098
		2	294	231	210	196	189	182	175	1 x D	165	140	294	fz	0.033	0.041	0.039	0.049	0.047	0.059	0.058	0.072	0.070	0.087	0.074	0.093	0.078	0.098
		3	252	198	180	168	162	156		0.75 D	140	120	252	fz	0.026	0.033	0.033	0.041	0.039	0.049	0.049	0.061	0.060	0.075	0.066	0.082	0.070	0.087
		4	189	149	135	126	122	117		0.5 x D	120	90	189	fz	0.023	0.029	0.030	0.037	0.035	0.044	0.043	0.054	0.053	0.066	0.058	0.072	0.061	0.076
		5	126	99	90	84	81	78		0.75 XD	80	60	126	fz	0.020	0.025	0.026	0.033	0.031	0.039	0.039	0.049	0.048	0.06	0.052	0.065	0.056	0.07
Stainless Steel	M	1	168	132	120	112	108	104		0.75 x D	90	80	168	fz	0.026	0.033	0.033	0.041	0.039	0.049	0.049	0.061	0.060	0.075	0.066	0.082	0.070	0.087
		2	126	99	90	84	81	78		0.75 x D	70	60	126	fz	0.020	0.025	0.026	0.033	0.031	0.039	0.039	0.049	0.048	0.06	0.052	0.065	0.056	0.07
		3	126	99	90	84	81	78		0.75 x D	70	60	126	fz	0.014	0.018	0.021	0.026	0.026	0.032	0.031	0.039	0.038	0.048	0.042	0.052	0.045	0.056
Cast Iron	K	1	252	198	180	168	162	156	150	1 x D	140	120	252	fz	0.033	0.041	0.039	0.049	0.047	0.059	0.058	0.072	0.070	0.087	0.074	0.093	0.078	0.098
		2	231	182	165	154	149	143		1 x D	125	110	231	fz	0.026	0.033	0.033	0.041	0.039	0.049	0.049	0.061	0.060	0.075	0.066	0.082	0.070	0.087
		3	210	165	150	140	135	130		1 x D	115	100	210	fz	0.020	0.025	0.026	0.033	0.031	0.039	0.039	0.049	0.048	0.06	0.052	0.065	0.056	0.07
Super Alloys	S	1	105	83	75	70	68	65		0.75 xD	70	50	105	fz	0.026	0.033	0.033	0.041	0.039	0.049	0.049	0.061	0.060	0.075	0.066	0.082	0.070	0.087
		3	105	83	75	70	68	65		0.75 xD	65	50	105	fz	0.020	0.025	0.026	0.033	0.031	0.039	0.039	0.049	0.048	0.06	0.052	0.065	0.056	0.07
Hard Materials	H	1	168	132	120	112	108	104		0.75 xD	110	80	168	fz	0.023	0.029	0.030	0.037	0.035	0.044	0.043	0.054	0.053	0.066	0.058	0.072	0.061	0.076

		3 Flute 4 Flute
CT	Stub	**F192CBS**
CT	Standard	**F192CB**
NCT	Long	**F192CBL**

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Cutting parameters

Flat pitch regular length 4/6 flute chip breaker end mill with corner radius - F193CB/NF 193CB/F193CBL - 6.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling		Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%											
			5	2.3	1.6	1.4	1.2	1.1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT	CT				Diameter in mm											
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling	Cutting Speed (Vc) m/min		mm	6.0		8.0		10.0		12.0		16.0		20.0		25.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	252	198	180	168	162	156	150	0.75xD	140	120	252	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		4	189	149	135	126	122	117		0.5xD	120	90	189	fz	0.022	0.028	0.030	0.038	0.037	0.046	0.045	0.056	0.055	0.069	0.070	0.088	0.078	0.098
		5	126	99	90	84	81	78	75	0.75xD	80	60	126	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		6	105	83	75	70	68	65		0.5xD	63	50	105	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
Stainless Steel	M	1	168	132	120	112	108	104	100	0.75xD	90	80	168	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		2	126	99	90	84	81	78		0.75xD	70	60	126	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		3	126	99	90	84	81	78		0.75xD	70	60	126	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
Cast Iron	K	1	252	198	180	168	162	156	150	0.75xD	140	120	252	fz	0.030	0.037	0.041	0.051	0.049	0.061	0.060	0.075	0.073	0.091	0.091	0.114	0.099	0.124
		2	231	182	165	154	149	143	138	0.75xD	125	110	231	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		3	210	165	150	140	135	130		0.75xD	115	100	210	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
Super Alloys	S	1	105	83	75	70	68	65		0.75xD	70	50	105	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		2	42	33	30	28	27	26		0.3xD	30	20	42	fz	0.014	0.017	0.018	0.022	0.022	0.027	0.026	0.033	0.034	0.042	0.043	0.054	0.049	0.061
		3	105	83	75	70	68	65		0.75xD	65	50	105	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		4	95	74	68	63	61	59		0.5xD	55	45	95	fz	0.018	0.022	0.025	0.031	0.030	0.038	0.037	0.046	0.046	0.058	0.059	0.074	0.067	0.084
Hard Materials	H	1	168	132	120	112	108	104	100	0.5xD	110	80	168	fz	0.022	0.028	0.030	0.038	0.037	0.046	0.045	0.056	0.055	0.069	0.070	0.088	0.078	0.098
		2	147	116	105	98	95			0.3xD	95	70	147	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
		3	126	99	90	84	81			0.2xD	75	60	126	fz	0.014	0.017	0.018	0.023	0.022	0.027	0.027	0.034	0.033	0.041	0.042	0.052	0.046	0.057

Note: For endmills with 6 flutes use ap 60% of table values

Flat pitch regular length 4/6 flute chip breaker end mill with corner chamfer - F194CB - 6.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling		Cutting Speed (Vc) m/min			Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%											
			5	2.3	1.6	1.4	1.2	1.1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			ap Max	ap Max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 1D	Cutting Speed (Vc) m/min for Slot Milling	Cutting Speed (Vc) m/min		mm	Diameter in mm											
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%		min	max	Range	6.0		8.0		10.0		12.0		16.0		20.0		25.0	
															min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	3	252	198	180	168	162	156	150	0.75xD	140	120	252	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		4	189	149	135	126	122	117	113	0.4xD	120	90	189	fz	0.022	0.028	0.030	0.038	0.037	0.046	0.045	0.056	0.055	0.069	0.070	0.088	0.078	0.098
		5	126	99	90	84	81	78	75	0.5xD	80	60	126	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		6	105	83	75	70	68	65		0.4xD	63	50	105	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
Stainless Steel	M	1	168	132	120	112	108	104	100	0.5xD	90	80	168	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		2	126	99	90	84	81	78	75	0.5xD	70	60	126	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		3	126	99	90	84	81	78	75	0.5xD	70	60	126	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
Cast Iron	K	1	252	198	180	168	162	156	150	0.5xD	140	120	252	fz	0.030	0.037	0.041	0.051	0.049	0.061	0.060	0.075	0.073	0.091	0.091	0.114	0.099	0.124
		2	231	182	165	154	149	143	138	0.5xD	125	110	231	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		3	210	165	150	140	135	130	125	0.5xD	115	100	210	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
Super Alloys	S	1	105	83	75	70	68	65		0.3xD	70	50	105	fz	0.025	0.031	0.034	0.043	0.041	0.051	0.050	0.063	0.062	0.078	0.081	0.101	0.091	0.114
		2	42	33	30	28	27	26		0.3xD	30	20	42	fz	0.014	0.017	0.018	0.022	0.022	0.027	0.026	0.033	0.034	0.042	0.043	0.054	0.049	0.061
		3	105	83	75	70	68	65	63	0.4xD	65	50	105	fz	0.020	0.025	0.027	0.034	0.033	0.041	0.041	0.051	0.050	0.063	0.065	0.081	0.073	0.091
		4	95	74	68	63	61	59	56	0.4xD	55	45	95	fz	0.018	0.022	0.025	0.031	0.030	0.038	0.037	0.046	0.046	0.058	0.059	0.074	0.067	0.084
Hard Materials	H	1	168	132	120	112	108	104		0.3xD	110	80	168	fz	0.022	0.028	0.030	0.038	0.037	0.046	0.045	0.056	0.055	0.069	0.070	0.088	0.078	0.098
		2	147	116	105	98	95			0.2xD	95	70	147	fz	0.017	0.021	0.023	0.029	0.027	0.034	0.034	0.042	0.041	0.051	0.052	0.065	0.057	0.071
		3	126	99	90	84	81			0.2xD	75	60	126	fz	0.014	0.017	0.018	0.023	0.022	0.027	0.027	0.034	0.033	0.041	0.042	0.052	0.046	0.057

		4 Flute/ 6 Flute	
		Flat/ Cr	Flat/ CH
CT	Standard	**F193CB**	**F194CB**
CT	Standard	**NF193CB**	
NCT	Long	**NF193CBL**	

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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High Performance Cutting Tools

GENERAL PURPOSE & ECONOMY SERIES END MILLS

CONTENTS

GENERAL PURPOSE END MILLS

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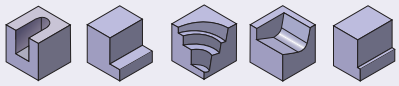
ECONOMY RANGE END MILLS

4 Flute Centre cutting regular length end mill



Carbide | REG | 30° | 6535 HA | TiAlN

IMAGE 1

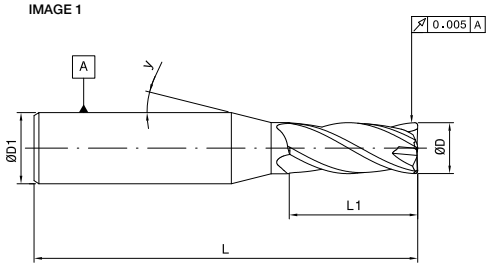
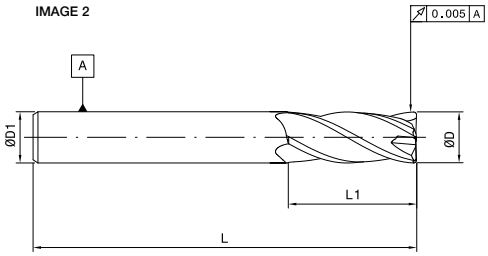


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
1.00	3.00	38.00	3.00	4	10	1	FBK0500001	FBK0500002	FBK0500003
1.50	6.00	38.00	3.00	4	10	1	FBK0500004	FBK0500005	FBK0500006
2.00	9.00	38.00	3.00	4	10	1	FBK0500007	FBK0500008	FBK0500009
2.50	12.00	38.00	3.00	4	10	1	FBK0500010	FBK0500011	FBK0500012
3.00	12.00	38.00	3.00	4	-	2	FBK0500013	FBK0500014	FBK0500015
3.50	12.00	51.00	4.00	4	10	1	FBK0500016		FBK0500017
4.00	14.00	51.00	4.00	4	-	2	FBK0500018	FBK0500019	FBK0500020
4.50	14.00	51.00	5.00	4	10	1	FBK0500021	FBK0500022	FBK0500023
5.00	20.00	51.00	5.00	4	-	2	FBK0500024	FBK0500025	FBK0500026
5.50	20.00	64.00	6.00	4	10	1	FBK0500027	FBK0500028	FBK0500029
6.00	20.00	64.00	6.00	4	-	2	FBK0500030	FBK0500031	FBK0500032
6.50	20.00	64.00	8.00	4	10	1	FBK0500033	FBK0500034	FBK0500035
7.00	20.00	64.00	8.00	4	10	1	FBK0500036		FBK0500037
8.00	20.00	64.00	8.00	4	-	2	FBK0500038	FBK0500039	FBK0500040
9.00	20.00	64.00	9.00	4	-	2	FBK0500041	FBK0500042	FBK0500043
10.00	25.00	70.00	10.00	4	-	2	FBK0500044	FBK0500045	FBK0500046
11.00	25.00	70.00	11.00	4	-	2	FBK0500047		FBK0500048
12.00	25.00	76.00	12.00	4	-	2	FBK0500049	FBK0500050	FBK0500051
13.00	30.00	89.00	13.00	4	-	2	FBK0500052		FBK0500053
14.00	30.00	89.00	14.00	4	-	2	FBK0500054	FBK0500055	FBK0500056
15.00	30.00	89.00	15.00	4	-	2	FBK0500057	FBK0500058	FBK0500059
16.00	30.00	89.00	16.00	4	-	2	FBK0500060	FBK0500061	FBK0500062
18.00	35.00	102.00	18.00	4	-	2	FBK0500063	FBK0500064	FBK0500065
20.00	35.00	102.00	20.00	4	-	2	FBK0500066	FBK0500067	FBK0500068
22.00	40.00	102.00	22.00	4	-	2	FBK0500069		FBK0500070
25.00	40.00	102.00	25.00	4	-	2	FBK0500071		FBK0500072

Application data on page no 2.185

Also available in uncoated & TiN

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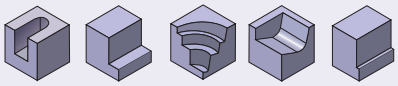
4 Flute

Centre cutting stub length end mill



Carbide | STUB | 30° | 6535 HA | TiAlN

IMAGE 1

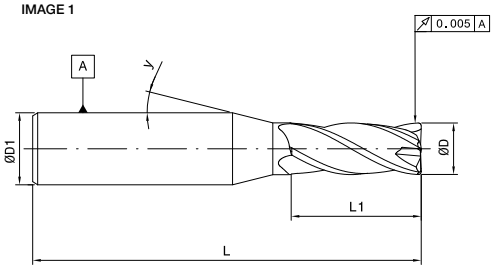
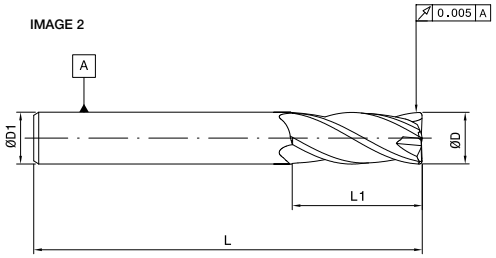


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

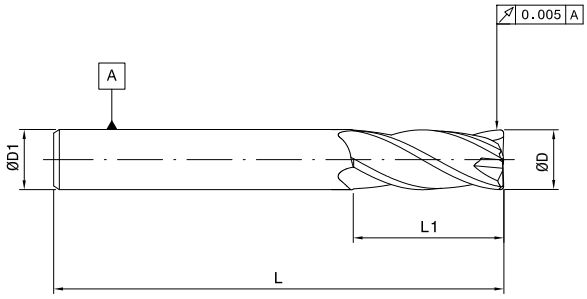
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No Coated
1.00	2.00	38.00	3.00	4	10	1	FBK0502013	FBK0502014
1.50	3.00	38.00	3.00	4	10	1	FBK0500532	FBK0500533
2.00	4.00	38.00	3.00	4	10	1	FBK0500534	FBK0500535
2.50	5.00	38.00	3.00	4	10	1	FBK0500536	FBK0500537
3.00	6.00	38.00	3.00	4	-	2	FBK0500538	FBK0500539
4.00	8.00	51.00	4.00	4	-	2	FBK0500540	FBK0500541
5.00	11.00	51.00	5.00	4	-	2	FBK0500542	FBK0500543
6.00	13.00	51.00	6.00	4	-	2	FBK0500544	FBK0500545
8.00	13.00	51.00	8.00	4	-	2	FBK0500546	FBK0500547
10.00	14.00	51.00	10.00	4	-	2	FBK0500548	FBK0500549
12.00	16.00	64.00	12.00	4	-	2	FBK0500550	FBK0500551
14.00	18.00	70.00	14.00	4	-	2	FBK0500552	FBK0500553
16.00	20.00	76.00	16.00	4	-	2	FBK0500554	FBK0500555
20.00	25.00	76.00	25.00	4	-	2	FBK0500556	FBK0500557

Application data on page no 2.185

4 Flute Centre cutting long length end mill

Carbide | LONG | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No Uncoated	EDP No TiN Coated	EDP No TiAIN Coated
3.00	25.00	64.00	3.00	4	FBK0500334	FBK0500335	FBK0500336
4.00	25.00	64.00	4.00	4	FBK0500337	FBK0500338	FBK0500339
5.00	25.00	64.00	5.00	4	FBK0500340	FBK0500341	FBK0500342
6.00	30.00	76.00	6.00	4	FBK0500343	FBK0500344	FBK0500345
7.00	30.00	83.00	8.00	4	FBK0500346		FBK0500347
8.00	35.00	83.00	8.00	4	FBK0500348	FBK0500349	FBK0500350
9.00	35.00	89.00	10.00	4	FBK0500351		FBK0500352
10.00	40.00	89.00	10.00	4	FBK0500353	FBK0500354	FBK0500355
11.00	40.00	102.00	12.00	4	FBK0500356		FBK0500357
12.00	50.00	102.00	12.00	4	FBK0500358	FBK0500359	FBK0500360
14.00	65.00	117.00	14.00	4	FBK0500361		FBK0500362
16.00	65.00	117.00	16.00	4	FBK0500363	FBK0500364	FBK0500365
20.00	80.00	152.00	20.00	4	FBK0500366	FBK0500367	FBK0500368
25.00	80.00	152.00	25.00	4	FBK0500369		FBK0500370

Application data on page no 2.185

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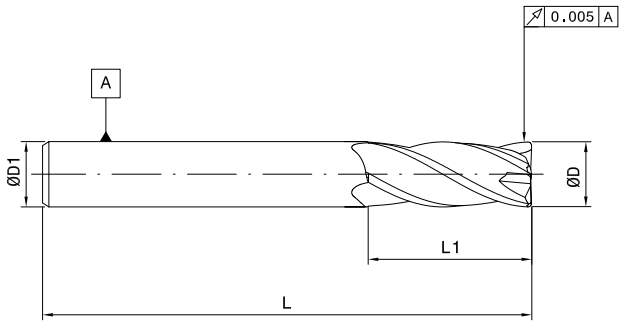
4 Flute

Centre cutting extra long end mill

Carbide | EXTRA LONG | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

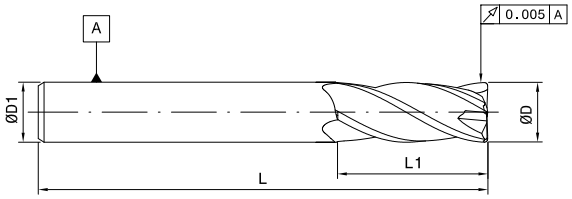
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No TiAIN Coated
3.00	40.00	100.00	3.00	4	FBK0502681
4.00	40.00	100.00	4.00	4	FBK0502682
5.00	40.00	100.00	5.00	4	FBK0502683
6.00	40.00	100.00	6.00	4	FBK0502684
8.00	50.00	100.00	8.00	4	FBK0502685
8.00	75.00	150.00	8.00	4	FBK0501481
10.00	40.00	100.00	10.00	4	FBK0500888
10.00	75.00	152.00	10.00	4	FBK0502686
12.00	75.00	152.00	12.00	4	FBK0502687
16.00	75.00	152.00	16.00	4	FBK0502688
20.00	75.00	152.00	20.00	4	FBK0502689

Application data on page no 2.185

4 Flute Centre cutting long reach end mill

Carbide | LONG REACH | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No Uncoated	EDP No TiAIN Coated
3.00	6.00	60.00	3.00	4	FBK0500454	FBK0500455
4.00	9.00	76.00	4.00	4	FBK0500456	FBK0500457
5.00	15.00	76.00	5.00	4	FBK0500458	FBK0500459
6.00	15.00	76.00	6.00	4	FBK0500460	FBK0500461
8.00	20.00	101.00	8.00	4	FBK0500462	FBK0500463
10.00	25.00	101.00	10.00	4	FBK0500464	FBK0500465
12.00	25.00	152.00	12.00	4	FBK0500466	FBK0500467
16.00	30.00	152.00	16.00	4	FBK0500468	FBK0500469
18.00	40.00	152.00	18.00	4	FBK0500470	FBK0500471
20.00	40.00	152.00	20.00	4	FBK0500472	FBK0500473

Application data on page no 2.185

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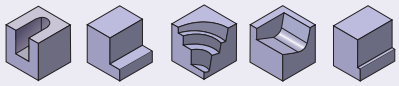
3 Flute

Centre cutting regular length end mill



Carbide | REG | 30° | 6535 HA | TiAIN

IMAGE 1

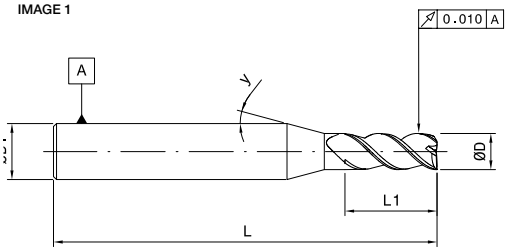
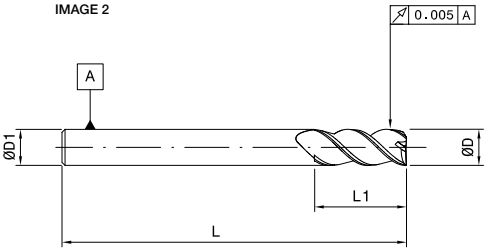


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L2 (mm)	L1 (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAIN Coated
1.00	3.00	38.00	3.00	3	10	1	FBK0500138	FBK0500139	FBK0500140
1.50	6.00	38.00	3.00	3	10	1	FBK0500141	FBK0500142	FBK0500143
2.00	9.00	38.00	3.00	3	10	1	FBK0500144	FBK0500145	FBK0500146
2.50	12.00	38.00	3.00	3	10	1	FBK0500147	FBK0500148	FBK0500149
3.00	12.00	38.00	3.00	3	-	2	FBK0500150	FBK0500151	FBK0500152
3.50	12.00	51.00	4.00	3	10	1	FBK0500153		FBK0500154
4.00	14.00	51.00	4.00	3	-	2	FBK0500155	FBK0500156	FBK0500157
4.50	20.00	51.00	5.00	3	10	1	FBK0500158		FBK0500159
5.00	20.00	51.00	5.00	3	-	2	FBK0500160	FBK0500161	FBK0500162
6.00	20.00	63.00	6.00	3	-	2	FBK0500163	FBK0500164	FBK0500165
6.50	20.00	64.00	8.00	3	10	1	FBK0500166	FBK0500167	FBK0500168
8.00	20.00	63.00	8.00	3	-	2	FBK0500169	FBK0500170	FBK0500171
9.00	20.00	64.00	9.00	3	-	2	FBK0500172		FBK0500173
10.00	25.00	70.00	10.00	3	-	2	FBK0500174	FBK0500175	FBK0500176
11.00	25.00	70.00	11.00	3	-	2	FBK0500177		FBK0500178
12.00	25.00	76.00	12.00	3	-	2	FBK0500179	FBK0500180	FBK0500181
14.00	30.00	89.00	14.00	3	-	2	FBK0500182	FBK0500183	FBK0500184
15.00	30.00	89.00	15.00	3	-	2	FBK0500185		FBK0500186
16.00	30.00	89.00	16.00	3	-	2	FBK0500187	FBK0500188	FBK0500189
18.00	35.00	102.00	18.00	3	-	2	FBK0500190	FBK0500191	FBK0500192
20.00	38.00	102.00	20.00	3	-	2	FBK0500193	FBK0500194	FBK0500195
25.00	40.00	102.00	25.00	3	-	2	FBK0500196	FBK0500197	FBK0500198

Application data on page no 2.185

2 Flute

Centre cutting stub length end mill

Carbide | STUB | 30° | 6535 HA | TiAlN

IMAGE 1

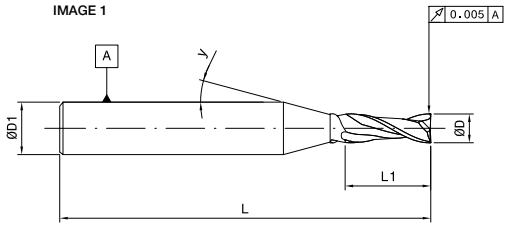
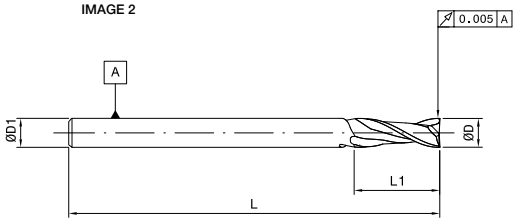


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiAlN Coated
1.00	2.00	38.00	3.00	2	10	1	FBK0502015	FBK0502016
1.50	3.00	38.00	3.00	2	10	1	FBK0500558	FBK0500559
2.00	4.00	38.00	3.00	2	10	1	FBK0500560	FBK0500561
2.50	5.00	38.00	3.00	2	10	1	FBK0500562	FBK0500563
3.00	6.00	38.00	3.00	2	-	2	FBK0500564	FBK0500565
4.00	8.00	51.00	4.00	2	-	2	FBK0500566	FBK0500567
5.00	11.00	51.00	5.00	2	-	2	FBK0500568	FBK0500569
6.00	13.00	51.00	6.00	2	-	2	FBK0500570	FBK0500571
8.00	13.00	51.00	8.00	2	-	2	FBK0500572	FBK0500573
10.00	14.00	51.00	10.00	2	-	2	FBK0500574	FBK0500575
12.00	16.00	64.00	12.00	2	-	2	FBK0500576	FBK0500577
14.00	18.00	70.00	14.00	2	-	2	FBK0500578	FBK0500579
16.00	20.00	76.00	16.00	2	-	2	FBK0500580	FBK0500581
20.00	25.00	76.00	25.00	2	-	2	FBK0500582	FBK0500583

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2 Flute

Centre cutting regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN

IMAGE 1

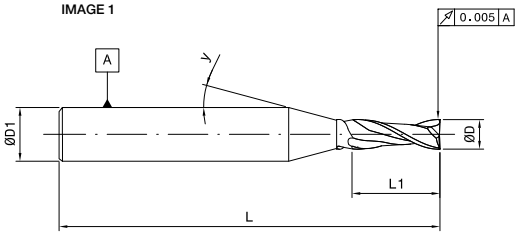
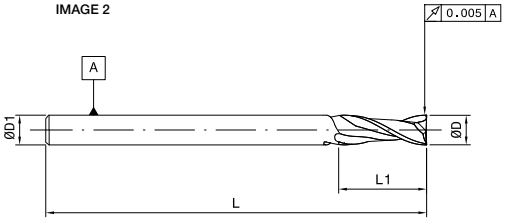


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
1.00	3.00	38.00	3.00	2	10	1	FBK0500073	FBK0500074	FBK0500075
1.50	6.00	38.00	3.00	2	10	1	FBK0500076	FBK0500077	FBK0500078
2.00	9.00	38.00	3.00	2	10	1	FBK0500079	FBK0500080	FBK0500081
2.50	12.00	38.00	3.00	2	10	1	FBK0500082	FBK0500083	FBK0500084
3.00	12.00	38.00	3.00	2	-	2	FBK0500085	FBK0500086	FBK0500087
3.50	12.00	51.00	4.00	2	10	1	FBK0500088		FBK0500089
4.00	14.00	51.00	4.00	2	-	2	FBK0500090	FBK0500091	FBK0500092
4.50	20.00	51.00	5.00	2	10	1	FBK0500093		FBK0500094
5.00	20.00	51.00	5.00	2	-	2	FBK0500095	FBK0500096	FBK0500097
5.50	20.00	64.00	6.00	2	10	1	FBK0500098		FBK0500099
6.00	20.00	64.00	6.00	2	-	2	FBK0500100	FBK0500101	FBK0500102
6.50	20.00	64.00	8.00	2	10	1	FBK0500103		FBK0500104
7.00	20.00	64.00	8.00	2	10	1	FBK0500105		FBK0500106
8.00	20.00	64.00	8.00	2	-	2	FBK0500107	FBK0500108	FBK0500109
9.00	20.00	64.00	9.00	2	-	2	FBK0500110		FBK0500111
10.00	25.00	70.00	10.00	2	-	2	FBK0500112	FBK0500113	FBK0500114
11.00	25.00	70.00	11.00	2	-	2	FBK0500115		FBK0500116
12.00	25.00	76.00	12.00	2	-	2	FBK0500117	FBK0500118	FBK0500119
14.00	30.00	89.00	14.00	2	-	2	FBK0500120	FBK0500121	FBK0500122
15.00	30.00	89.00	15.00	2	-	2	FBK0500123		FBK0500124
16.00	30.00	89.00	16.00	2	-	2	FBK0500125	FBK0500126	FBK0500127
18.00	35.00	102.00	18.00	2	-	2	FBK0500128	FBK0500129	FBK0500130
20.00	35.00	102.00	20.00	2	-	2	FBK0500131	FBK0500132	FBK0500133
22.00	35.00	102.00	22.00	2	-	2	FBK0500134		FBK0500135
25.00	35.00	102.00	25.00	2	-	2	FBK0500136		FBK0500137

Application data on page no 2.185

2 Flute

Centre cutting long length end mill

Carbide | LONG | 30° | 6535 HA | TiAlN

IMAGE 1

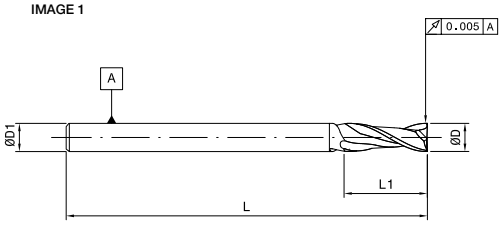
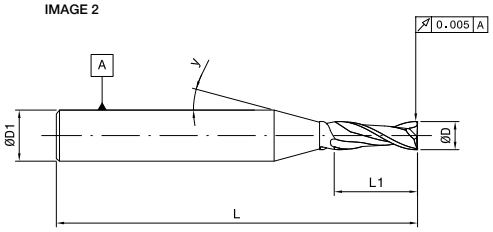


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
3.00	25.00	64.00	3.00	2	-	1	FBK0500371		FBK0500372
4.00	25.00	64.00	4.00	2	-	1	FBK0500373	FBK0500374	FBK0500375
5.00	25.00	64.00	5.00	2	-	1	FBK0500376	FBK0500377	FBK0500378
6.00	30.00	76.00	6.00	2	-	1	FBK0500379		FBK0500380
7.00	30.00	83.00	8.00	2	10	2	FBK0500381		FBK0500382
8.00	35.00	83.00	8.00	2	-	1	FBK0500383	FBK0500384	FBK0500385
9.00	35.00	89.00	10.00	2	10	2	FBK0500386		FBK0500387
10.00	40.00	89.00	10.00	2	-	1	FBK0500388	FBK0500389	FBK0500390
12.00	50.00	102.00	12.00	2	-	1	FBK0500391	FBK0500392	FBK0500393
16.00	65.00	117.00	16.00	2	-	1	FBK0500394	FBK0500395	FBK0500396
20.00	80.00	152.00	20.00	2	-	1	FBK0500397		FBK0500398

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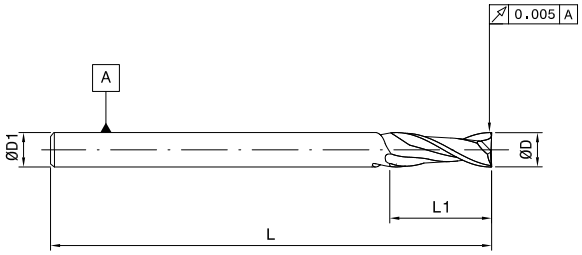
2 Flute

Centre cutting long reach end mill

Carbide | LONG REACH | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No Uncoated	EDP No TiAIN Coated
3.00	6.00	64.00	3.00	2	FBK0500474	FBK0500475
4.00	9.00	76.00	4.00	2	FBK0500476	FBK0500477
5.00	15.00	76.00	5.00	2	FBK0500478	FBK0500479
6.00	15.00	76.00	6.00	2	FBK0500480	FBK0500481
8.00	20.00	101.00	8.00	2	FBK0500482	FBK0500483
10.00	25.00	101.00	10.00	2	FBK0500484	FBK0500485
12.00	25.00	152.00	12.00	2	FBK0500486	FBK0500487
16.00	30.00	152.00	16.00	2	FBK0500488	FBK0500489
20.00	40.00	152.00	20.00	2	FBK0500490	FBK0500491

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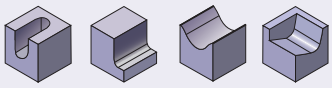
4 Flute

Centre cutting ball nose stub length end mill



Carbide | STUB | 30° | 6535 HA | TiAIN

IMAGE 1

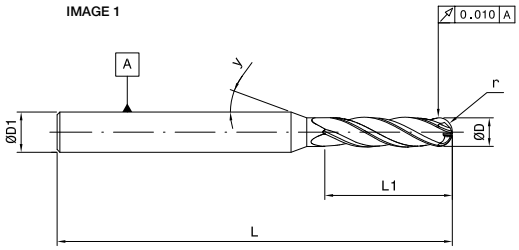
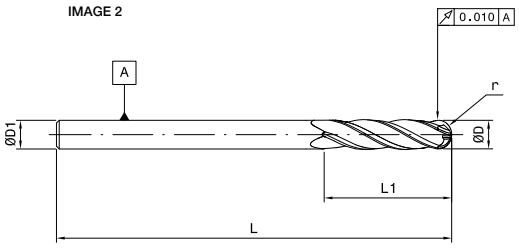


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiAIN Coated
1.00	2.00	38.00	3.00	0.50	4	10	1	FBK0502017	FBK0502018
1.50	3.00	38.00	3.00	0.75	4	10	1	FBK0500584	FBK0500585
2.00	4.00	38.00	3.00	1.00	4	10	1	FBK0500586	FBK0500587
2.50	5.00	38.00	3.00	1.25	4	10	1	FBK0500588	FBK0500589
3.00	6.00	38.00	3.00	1.50	4	-	2	FBK0500590	FBK0500591
4.00	8.00	51.00	4.00	2.00	4	-	2	FBK0500592	FBK0500593
5.00	11.00	51.00	5.00	2.50	4	-	2	FBK0500594	FBK0500595
6.00	13.00	51.00	6.00	3.00	4	-	2	FBK0500596	FBK0500597
8.00	13.00	51.00	8.00	4.00	4	-	2	FBK0500598	FBK0500599
10.00	14.00	51.00	10.00	5.00	4	-	2	FBK0500600	FBK0500601
12.00	16.00	64.00	12.00	6.00	4	-	2	FBK0500602	FBK0500603
14.00	18.00	70.00	14.00	7.00	4	-	2	FBK0500604	FBK0500605
16.00	20.00	76.00	16.00	8.00	4	-	2	FBK0500606	FBK0500607
20.00	25.00	76.00	25.00	10.00	4	-	2	FBK0500608	FBK0500609

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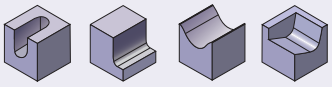
4 Flute

Centre cutting ball nose regular length end mill



Carbide | REG | 30° | 6535 HA | TiAlN

IMAGE 1

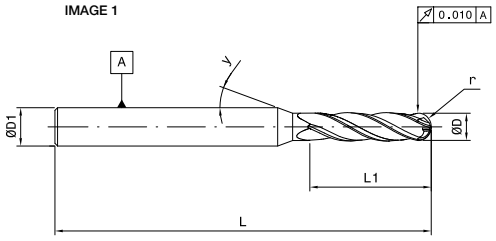
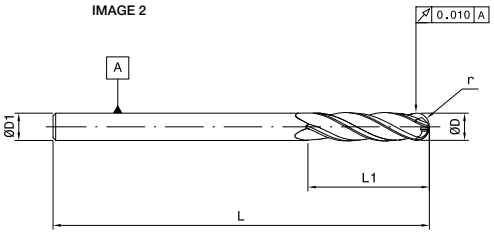


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
1.00	3.00	38.00	3.00	0.50	4	10	1	FBK0500199	FBK0500200	FBK0500201
1.50	6.00	38.00	3.00	0.75	4	10	1	FBK0500202	FBK0500203	FBK0500204
2.00	9.00	38.00	3.00	1.00	4	10	1	FBK0500205	FBK0500206	FBK0500207
2.50	12.00	38.00	3.00	1.25	4	10	1	FBK0500208	FBK0500209	FBK0500210
3.00	12.00	38.00	3.00	1.50	4	-	2	FBK0500211	FBK0500212	FBK0500213
3.50	12.00	51.00	4.00	1.75	4	10	1	FBK0500214	FBK0500215	FBK0500216
4.00	14.00	51.00	4.00	2.00	4	-	2	FBK0500217	FBK0500218	FBK0500219
4.50	20.00	51.00	5.00	2.25	4	10	1	FBK0500220	FBK0500221	FBK0500222
5.00	20.00	51.00	5.00	2.50	4	-	2	FBK0500223	FBK0500224	FBK0500225
5.50	20.00	64.00	6.00	2.75	4	10	1	FBK0500226	FBK0500227	FBK0500228
6.00	20.00	64.00	6.00	3.00	4	-	2	FBK0500229	FBK0500230	FBK0500231
6.50	20.00	64.00	8.00	3.25	4	10	1	FBK0500232	FBK0500233	FBK0500234
7.00	20.00	64.00	8.00	3.50	4	10	1	FBK0500235	FBK0500236	FBK0500237
8.00	20.00	64.00	8.00	4.00	4	-	2	FBK0500238	FBK0500239	FBK0500240
9.00	20.00	64.00	9.00	4.50	4	-	2	FBK0500241		FBK0500242
10.00	25.00	70.00	10.00	5.00	4	-	2	FBK0500243	FBK0500244	FBK0500245
11.00	25.00	70.00	11.00	5.50	4	-	2	FBK0500246		FBK0500247
12.00	25.00	76.00	12.00	6.00	4	-	2	FBK0500248	FBK0500249	FBK0500250
13.00	30.00	89.00	13.00	6.50	4	-	2	FBK0500251		FBK0500252
14.00	30.00	89.00	14.00	7.00	4	-	2	FBK0500253	FBK0500254	FBK0500255
15.00	30.00	89.00	15.00	7.50	4	-	2	FBK0500256		FBK0500257
16.00	30.00	89.00	16.00	8.00	4	-	2	FBK0500258	FBK0500259	FBK0500260
18.00	35.00	102.00	18.00	9.00	4	-	2	FBK0500261	FBK0500262	FBK0500263
20.00	35.00	102.00	20.00	10.00	4	-	2	FBK0500264	FBK0500265	FBK0500266
22.00	35.00	102.00	22.00	11.00	4	-	2	FBK0500267		FBK0500268
25.00	35.00	102.00	25.00	12.50	4	-	2	FBK0500269		FBK0500270

Application data on page no 2.185

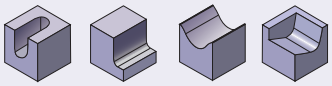
TOTEM

Solid Carbide End Mills

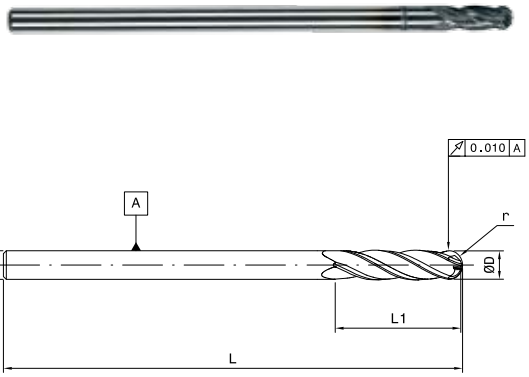
F184 GP Series

4 Flute

Centre cutting ball nose long reach end mill



Carbide | LONG REACH | 30° | 6535 HA | TiAlN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No Uncoated	EDP No TiAlN Coated
3.00	6.00	64.00	3.00	1.50	4	FBK0500492	FBK0500493
4.00	9.00	76.00	4.00	2.00	4	FBK0500494	FBK0500495
5.00	15.00	76.00	5.00	2.50	4	FBK0500496	FBK0500497
6.00	15.00	76.00	6.00	3.00	4	FBK0500498	FBK0500499
8.00	20.00	101.00	8.00	4.00	4	FBK0500500	FBK0500501
10.00	25.00	101.00	10.00	5.00	4	FBK0500502	FBK0500503
12.00	25.00	152.00	12.00	6.00	4	FBK0500504	FBK0500505
16.00	30.00	152.00	16.00	8.00	4	FBK0500506	FBK0500507
18.00	40.00	152.00	18.00	9.00	4	FBK0500508	FBK0500509
20.00	40.00	152.00	20.00	10.00	4	FBK0500510	FBK0500511

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2 Flute

Centre cutting ball nose regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN

IMAGE 1

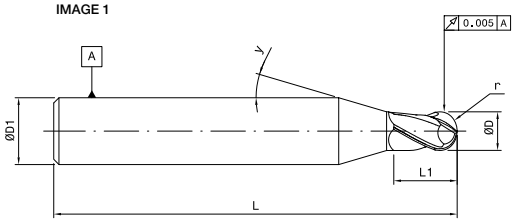
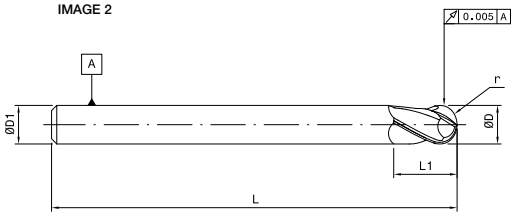


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

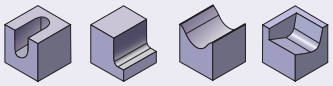
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
1.00	3.00	38.00	3.00	0.50	2	10	1	FBK0500271	FBK0500272	FBK0500273
1.50	6.00	38.00	3.00	0.75	2	10	1	FBK0500274	FBK0500275	FBK0500276
2.00	9.00	38.00	3.00	1.00	2	10	1	FBK0500277	FBK0500278	FBK0500279
2.50	12.00	38.00	3.00	1.25	2	10	1	FBK0500280	FBK0500281	FBK0500282
3.00	12.00	38.00	3.00	1.50	2	-	2	FBK0500283	FBK0500284	FBK0500285
3.50	12.00	51.00	4.00	1.75	2	10	1	FBK0500286		FBK0500287
4.00	14.00	51.00	4.00	2.00	2	-	2	FBK0500288	FBK0500289	FBK0500290
4.50	20.00	51.00	5.00	2.25	2	10	1	FBK0500291		FBK0500292
5.00	20.00	51.00	5.00	2.50	2	-	2	FBK0500293	FBK0500294	FBK0500295
5.50	20.00	64.00	6.00	2.75	2	10	1	FBK0500296		FBK0500297
6.00	20.00	64.00	6.00	3.00	2	-	2	FBK0500298	FBK0500299	FBK0500300
6.50	20.00	64.00	8.00	3.25	2	10	1	FBK0500301		FBK0500302
7.00	20.00	64.00	8.00	3.50	2	10	1	FBK0500303		FBK0500304
8.00	20.00	64.00	8.00	4.00	2	-	2	FBK0500305	FBK0500306	FBK0500307
9.00	20.00	64.00	9.00	4.50	2	-	2	FBK0500308		FBK0500309
10.00	25.00	70.00	10.00	5.00	2	-	2	FBK0500310	FBK0500311	FBK0500312
11.00	25.00	70.00	11.00	5.50	2	-	2	FBK0500313		FBK0500314
12.00	25.00	76.00	12.00	6.00	2	-	2	FBK0500315	FBK0500316	FBK0500317
14.00	30.00	89.00	14.00	7.00	2	-	2	FBK0500318	FBK0500319	FBK0500320
16.00	30.00	89.00	16.00	8.00	2	-	2	FBK0500321	FBK0500322	FBK0500323
18.00	35.00	102.00	18.00	9.00	2	-	2	FBK0500324	FBK0500325	FBK0500326
20.00	35.00	102.00	20.00	10.00	2	-	2	FBK0500327	FBK0500328	FBK0500329
22.00	35.00	102.00	22.00	11.00	2	-	2	FBK0500330		FBK0500331
25.00	35.00	102.00	25.00	12.50	2	-	2	FBK0500332		FBK0500333

Application data on page no 2.185

2 Flute

Centre cutting ball nose stub length end mill



Carbide | STUB | 30° | 6535 HA | TiAIN

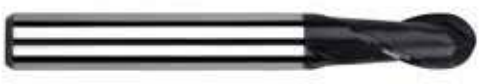


IMAGE 1

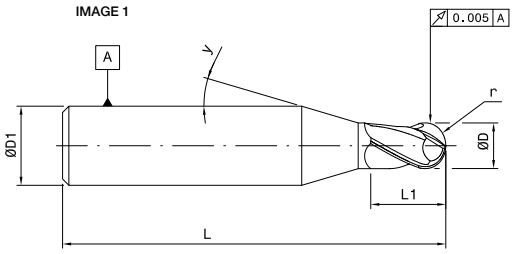
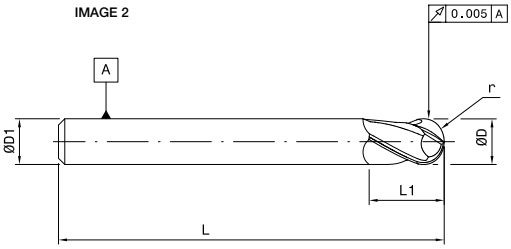


IMAGE 2



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No Uncoated	EDP No TiAIN Coated
1.00	2.00	38.00	3.00	0.50	2	10	1	FBK0502019	FBK0502020
1.50	3.00	38.00	3.00	0.75	2	10	1	FBK0500610	FBK0500611
2.00	4.00	38.00	3.00	1.00	2	10	1	FBK0500612	FBK0500613
2.50	5.00	38.00	3.00	1.25	2	10	1	FBK0500614	FBK0500615
3.00	6.00	38.00	3.00	1.50	2	-	2	FBK0500616	FBK0500617
4.00	8.00	51.00	4.00	2.00	2	-	2	FBK0500618	FBK0500619
5.00	11.00	51.00	5.00	2.50	2	-	2	FBK0500620	FBK0500621
6.00	13.00	51.00	6.00	3.00	2	-	2	FBK0500622	FBK0500623
8.00	13.00	51.00	8.00	4.00	2	-	2	FBK0500624	FBK0500625
10.00	14.00	51.00	10.00	5.00	2	-	2	FBK0500626	FBK0500627
12.00	16.00	64.00	12.00	6.00	2	-	2	FBK0500628	FBK0500629
14.00	18.00	70.00	14.00	7.00	2	-	2	FBK0500630	FBK0500631
16.00	20.00	76.00	16.00	8.00	2	-	2	FBK0500632	FBK0500633
20.00	25.00	76.00	25.00	10.00	2	-	2	FBK0500634	FBK0500635

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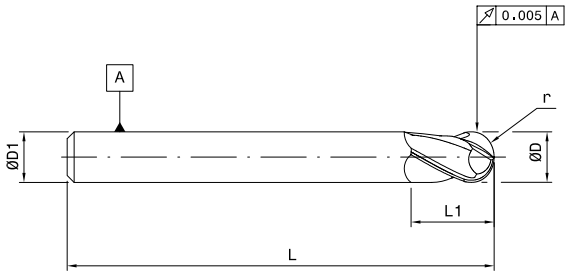
2 Flute

Centre cutting ball nose long reach end mill

Carbide | LONG REACH | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

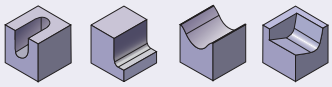
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No Uncoated	EDP No TiAIN Coated
3.00	6.00	64.00	3.00	1.50	2	FBK0500512	FBK0500513
4.00	9.00	76.00	4.00	2.00	2	FBK0500514	FBK0500515
5.00	15.00	76.00	5.00	2.50	2	FBK0500516	FBK0500517
6.00	15.00	76.00	6.00	3.00	2	FBK0500518	FBK0500519
8.00	20.00	101.00	8.00	4.00	2	FBK0500520	FBK0500521
10.00	25.00	101.00	10.00	5.00	2	FBK0500522	FBK0500523
12.00	25.00	152.00	12.00	6.00	2	FBK0500524	FBK0500525
16.00	30.00	152.00	16.00	8.00	2	FBK0500526	FBK0500527
18.00	40.00	152.00	18.00	9.00	2	FBK0500528	FBK0500529
20.00	40.00	152.00	20.00	10.00	2	FBK0500530	FBK0500531

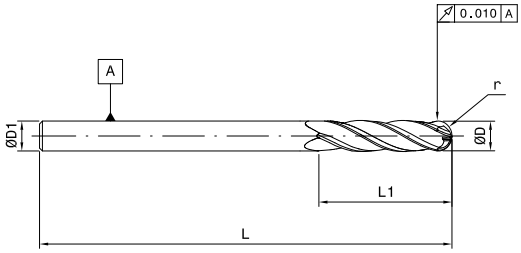
Application data on page no 2.185

4 Flute

Centre cutting ball nose long length end mill



Carbide | LONG LENGTH | 30° | 6535 HA | TiAlN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No Uncoated	EDP No TiN Coated	EDP No TiAlN Coated
3.00	25.00	64.00	3.00	1.50	4	FBK0500399	FBK0500400	FBK0500401
4.00	25.00	64.00	4.00	2.00	4	FBK0500402	FBK0500403	FBK0500404
5.00	25.00	64.00	5.00	2.50	4	FBK0500405	FBK0500406	FBK0500407
6.00	30.00	76.00	6.00	3.00	4	FBK0500408	FBK0500409	FBK0500410
7.00	30.00	83.00	7.00	3.50	4	FBK0500411	FBK0500412	FBK0500413
8.00	35.00	83.00	8.00	4.00	4	FBK0500414	FBK0500415	FBK0500416
10.00	40.00	89.00	10.00	5.00	4	FBK0500417	FBK0500418	FBK0500419
12.00	50.00	102.00	12.00	6.00	4	FBK0500420	FBK0500421	FBK0500422
16.00	65.00	117.00	16.00	8.00	4	FBK0500423	FBK0500424	FBK0500425
20.00	80.00	133.00	20.00	10.00	4	FBK0500426		FBK0500427

Application data on page no 2.185

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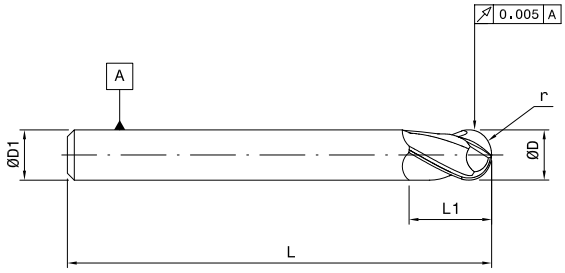
2 Flute

Centre cutting ball nose long length end mill

Carbide | LONG LENGTH | 30° | 6535 HA | TiAIN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

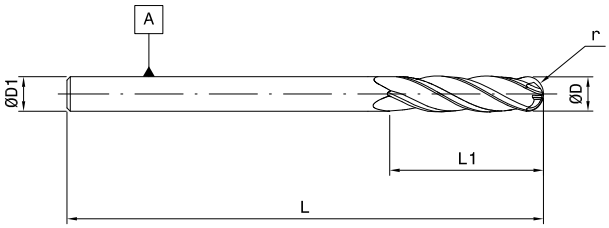
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No Uncoated	EDP No TiN Coated	EDP No TiAIN Coated
3.00	25.00	64.00	3.00	1.50	2	FBK0500428	FBK0500429	FBK0500430
4.00	25.00	64.00	4.00	2.00	2	FBK0500431	FBK0500432	FBK0500433
5.00	25.00	64.00	5.00	2.50	2	FBK0500434	FBK0500435	FBK0500436
6.00	30.00	76.00	6.00	3.00	2	FBK0500437	FBK0500438	FBK0500439
8.00	35.00	83.00	8.00	4.00	2	FBK0500440	FBK0500441	FBK0500442
10.00	40.00	89.00	10.00	5.00	2	FBK0500443	FBK0500444	FBK0500445
12.00	50.00	102.00	12.00	6.00	2	FBK0500446		FBK0500447
16.00	65.00	117.00	16.00	8.00	2	FBK0500448		FBK0500449
20.00	80.00	133.00	20.00	10.00	2	FBK0500450		FBK0500451
25.00	80.00	152.00	25.00	12.50	2	FBK0500452		FBK0500453

Application data on page no 2.185

4 Flute Centre cutting ball nose extra long end mill

Carbide | EXTRA LONG | 30° | 6535 HA | TiAlN



P0-P4
K1-K3
S1-S4
H1-H3
N1-N3
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No Coated
3.00	40.00	100.00	3.00	1.50	4	FBK0502690
4.00	40.00	100.00	4.00	2.00	4	FBK0502691
5.00	40.00	100.00	5.00	2.50	4	FBK0502961
6.00	40.00	100.00	6.00	3.00	4	FBK0502692
8.00	50.00	100.00	8.00	4.00	4	FBK0502693
8.00	75.00	150.00	8.00	4.00	4	FBK0501480
10.00	40.00	100.00	10.00	5.00	4	FBK0500887
10.00	75.00	152.00	10.00	5.00	4	FBK0502694
12.00	75.00	152.00	12.00	6.00	4	FBK0502695
16.00	75.00	152.00	16.00	8.00	4	FBK0502696
20.00	75.00	152.00	20.00	10.00	4	FBK0502697

Application data on page no 2.185

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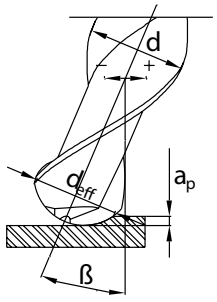
Cutting parameters

CT- Chip Thinning — Series F111/163/116/164/121/165/140/150/166 GP, Metric - 1.0 mm to 8.0 mm
NCT- No Chip Thinning — Series F123/F126/F122/F125/F183/F186/F181/F184/F187/F188 GP, Metric - 1.0 mm to 8.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT																
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.												
			ap Max	ap 2D	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 0.25D	ap 0.5D	ap 1D	Cutting Speed (Vc) m/min			Diameter in mm												
															mm	1.0		2.0		3.0		4.0		5.0		6.0		8.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		1	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		4	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	55	55	115	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	80	63	57	53	51	50	48	46	42	38	38	80	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	75	59	54	50	48	46	45	43	39	36	36	75	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	140	110	100	93	90	87	83	80	73	67	67	140	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	100	79	71	67	64	62	60	57	52	48	48	100	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	476	476	1000	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		2	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		3	70	55	50	47	45	43	42	40	37	33	33	70	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		4	63	50	45	42	41	39	38	36	33	30	30	60	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		2	63	50	45	42	41	39	38	36	33	30	30	63	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		3	53	41	38	35	34	33	31	30	28	25	25	53	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032

		2flute		3flute		4flute	
		Flat/ Cr	Ball	Flat/ Cr	Ball	Flat/ Cr	Ball
CT	Stub Length	**F164**	**F166**			**F163**	**F165**
CT	Standard	**F121**	**F150**	**F116**		**F111**	**F140**
NCT	Long Length	**F123**	**F126**			**F122**	**F125**
NCT	Long Reach	**F183**	**F186**			**F181**	**F184**
NCT	Extra Long					**F187**	**F188**

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor



* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1
* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

* * Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

* For TiN Coated ToolS Decrease RPM by 5%

* For Uncoated Tools Decrease RPM by 20%

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Cutting parameters

CT- Chip Thinning — Series F111/163/116/164/121/165/140/150/166 GP, Metric - 10.0 mm to 25.0 mm
NCT- No Chip Thinning — Series F123/F126/F122/F125/F183/F186/F181/F184/F187/F188 GP, Metric- 10.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							for Slot Milling					Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT														
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1			Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			ap Max	ap 2D	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 0.25D	ap 0.5D	ap 1D	Cutting Speed (Vc) m/min			Diameter in mm										
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	ae/D 100%	min	max	Range	10.0		12.0		14.0		16.0		20.0		25.0	
																min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		1	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		4	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	55	55	115	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	80	63	57	53	51	50	48	46	42	38	38	80	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	75	59	54	50	48	46	45	43	39	36	36	75	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	140	110	100	93	90	87	83	80	73	67	67	140	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	100	79	71	67	64	62	60	57	52	48	48	100	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	476	476	1000	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		2	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		3	70	55	50	47	45	43	42	40	37	33	33	70	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		4	63	50	45	42	41	39	38	36	33	30	30	60	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100
		2	63	50	45	42	41	39	38	36	33	30	30	63	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100
		3	53	41	38	35	34	33	31	30	28	25	25	53	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100

		2flute		3flute		4flute	
		Flat/ Cr	Ball	Flat/ Cr	Ball	Flat/ Cr	Ball
CT	Stub Length	**F164**	**F166**			**F163**	**F165**
CT	Standard	**F121**	**F150**	**F116**		**F111**	**F140**
NCT	Long Length	**F123**	**F126**			**F122**	**F125**
NCT	Long Reach	**F183**	**F186**			**F181**	**F184**
NCT	Extra Long					**F187**	**F188**

CT- indicates that when using these end mills – use the Chip load multiplication factor
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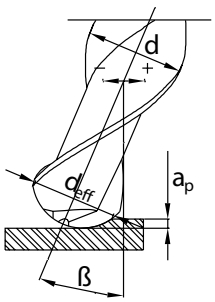

* For ball nose end mills - If axial depth (ap) is less than the ball diameter, the speed is figured using the effective cutting diameter (D_{eff}) Formula 1
* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin e \left[ß + \arccos \left(\frac{D-2 \times ADOC}{D} \right) \right]$$

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

* * Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

* For TiN Coated ToolS Decrease RPM by 5%

* For Uncoated Tools Decrease RPM by 20%

Disclaimer
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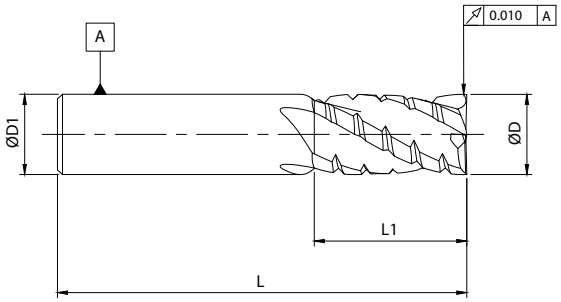
sales@forbes.co.in

4 Flute

Centre cutting regular length chip breaker end mill

Carbide | REG | 30° | 6535 HA | TiAIN



P0-P6
K1-K3
S1-S4
H1-H4
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No Uncoated	EDP No TiAIN Coated
4.00	14.00	51.00	4.00	4	FBK0500636	FBK0504095
5.00	20.00	51.00	5.00	4	FBK0500637	FBK0500638
6.00	20.00	64.00	6.00	4	FBK0500639	FBK0500640
8.00	20.00	64.00	8.00	4	FBK0500642	FBK0500643
9.00	20.00	64.00	9.00	4	FBK0500644	FBK0500645
10.00	25.00	70.00	10.00	4	FBK0500646	FBK0500647
12.00	25.00	76.00	12.00	4	FBK0500648	FBK0500649
14.00	30.00	89.00	14.00	4	FBK0500650	FBK0500651
16.00	30.00	89.00	16.00	4	FBK0500652	FBK0500653
18.00	35.00	102.00	18.00	4	FBK0500654	FBK0504096
20.00	38.00	102.00	20.00	4	FBK0500655	FBK0503975

Application data on page no 2.189

TOTEM

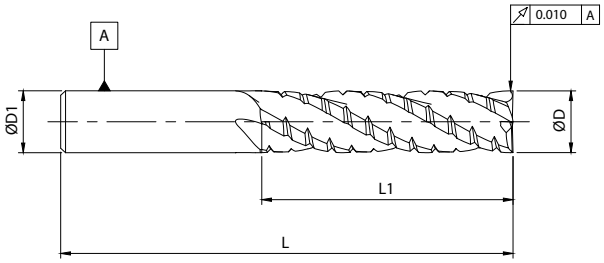
Solid Carbide End Mills

F132CB GP Series

4 Flute

Centre cutting long length chip breaker end mill

Carbide | LONG | 30° | 6535 HA



P0-P6
K1-K3
S1-S4
H1-H4
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No Uncoated	EDP No TiAlN Coated
6.00	30.00	76.00	6.00	4	FBK0500656	FBK0500657
8.00	35.00	83.00	8.00	4	FBK0500658	FBK0500659
10.00	40.00	89.00	10.00	4	FBK0500660	FBK0500661
12.00	50.00	102.00	12.00	4	FBK0500662	FBK0500663
16.00	65.00	117.00	16.00	4	FBK0500664	FBK0503024

Application data on page no 2.189

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Cutting parameters

F114CB/132CB/ Metric - 1.0 mm to 8.0 mm

Material Group			Cutting Speed (Vc) m/min													Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%							
			Shoulder Milling / Rough and Semi Finish							Slot Milling													
																							
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT NCT												
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.							
			ap max	ap max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 0.25D	ap 0.5D	ap 1D	Cutting Speed (Vc) m/min		mm	4.0		5.0		6.0		8.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		1	210	165	150	140	135	130	125	120	110	120	100	210	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		2	180	141	129	120	116	111	107	103	94	103	86	180	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		3	180	141	129	120	116	111	107	103	94	103	86	180	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		4	150	118	107	100	96	93	89	86	79	86	71	150	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	66	55	115	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		2	80	63	57	53	51	50	48	46	42	46	38	80	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		3	75	59	54	50	48	46	45	43	39	43	36	75	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	86	71	150	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		2	140	110	100	93	90	87	83	80	73	80	67	140	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		3	100	79	71	67	64	62	60	57	52	57	48	100	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	571	476	1000	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		2	750	589	536	500	482	464	446	429	393	429	357	750	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
		3	750	589	536	500	482	464	446	429	393	429	357	750	fz	0.016	0.020	0.020	0.025	0.024	0.030	0.038	0.048
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		2	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		3	70	55	50	47	45	43	42	40	37	40	33	70	fz	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		4	63	50	45	42	41	39	38	36	33	36	30	60	fz	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	63	50	45	42	41	39	38	36	33	36	30	63	fz	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	53	41	38	35	34	33	31	30	28	30	25	53	fz	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040

F114CB/132CB/ Metric - 10.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min													Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%									
			Shoulder Milling / Rough and Semi Finish							Slot Milling															
																									
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT NCT													
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.									
			ap max	ap max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 0.25D	ap 0.5D	ap 1D	Cutting Speed (Vc) m/min		mm	10.0		12.0		14.0		16.0		20.0	
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	ae/D 100%	min	max	Range	min	max	min	max	min	max	min	max	min	max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		1	210	165	150	140	135	130	125	120	110	120	100	210	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		2	180	141	129	120	116	111	107	103	94	103	86	180	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		3	180	141	129	120	116	111	107	103	94	103	86	180	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		4	150	118	107	100	96	93	89	86	79	86	71	150	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	66	55	115	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		2	80	63	57	53	51	50	48	46	42	46	38	80	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		3	75	59	54	50	48	46	45	43	39	43	36	75	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	86	71	150	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		2	140	110	100	93	90	87	83	80	73	80	67	140	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		3	100	79	71	67	64	62	60	57	52	57	48	100	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	571	476	1000	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		2	750	589	536	500	482	464	446	429	393	429	357	750	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
		3	750	589	536	500	482	464	446	429	393	429	357	750	fz	0.048	0.060	0.058	0.072	0.067	0.084	0.077	0.096	0.096	0.120
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080
		2	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080
		3	70	55	50	47	45	43	42	40	37	40	33	70	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080
		4	63	50	45	42	41	39	38	36	33	36	30	60	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	42	35	75	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100
		2	63	50	45	42	41	39	38	36	33	36	30	63	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100
		3	53	41	38	35	34	33	31	30	28	30	25	53	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100

#RPM(N) = Vc(m/min) X 318.18/Tool Dia. #Vf(mm/min) = RPM(N) X frev (mm/rev)

		4flute
		Flat
CT	Standard	**F114CB**
NCT	Long Length	**F132CB**

ae > .3D use < 1D ap
ae < .2D use < 1.5 D ap
ae > .1D use < 2D ap
ae < .05D use < L1 Max

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor

CT- Chip Thinning
NCT- No Chip Thinning

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

2 Flute F121 XL

Carbide | REG | 30° | 6535 HA | 0.1X45° | TiAIN

IMAGE 1

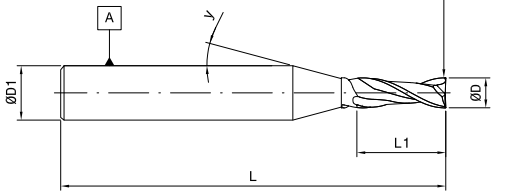
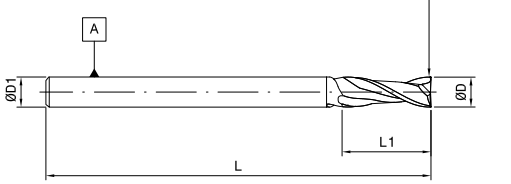


IMAGE 2



P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No TiAIN Coated
1.00	3.00	38.00	3.00	2	10	1	FBK0500705
1.50	6.00	38.00	3.00	2	10	1	FBK0500706
2.00	9.00	38.00	3.00	2	10	1	FBK0500707
2.50	12.00	38.00	3.00	2	10	1	FBK0500708
3.00	12.00	38.00	3.00	2	-	2	FBK0500709
4.00	14.00	51.00	4.00	2	-	2	FBK0500710
5.00	20.00	51.00	5.00	2	-	2	FBK0500711
6.00	20.00	64.00	6.00	2	-	2	FBK0500712
8.00	20.00	64.00	8.00	2	-	2	FBK0500713
10.00	25.00	70.00	10.00	2	-	2	FBK0500714
12.00	25.00	76.00	12.00	2	-	2	FBK0500715
16.00	30.00	89.00	16.00	2	-	2	FBK0500716
20.00	38.00	102.00	20.00	2	-	2	FBK0500717

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4 Flute F111 XL

Carbide | REG | 30° | 6535 HA | 0.1X45° | TiAlN

IMAGE 1

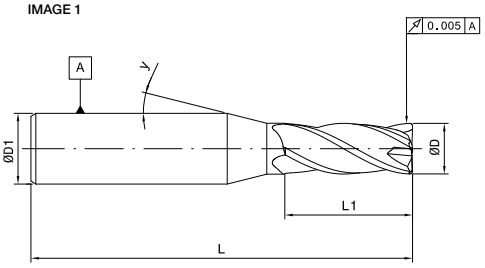
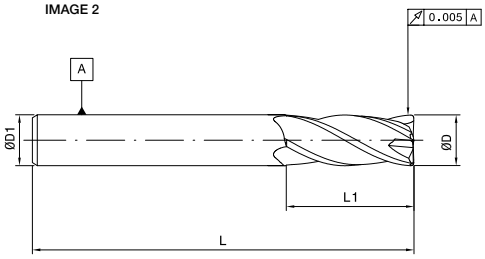


IMAGE 2



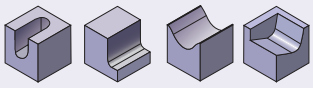
P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	γ (°)	Image	EDP No TiAlN Coated
1.00	3.00	38.00	3.00	4	10	1	FBK0500718
1.50	6.00	38.00	3.00	4	10	1	FBK0500719
2.00	9.00	38.00	3.00	4	10	1	FBK0500720
2.50	12.00	38.00	3.00	4	10	1	FBK0500721
3.00	12.00	38.00	3.00	4	-	2	FBK0500722
4.00	14.00	51.00	4.00	4	-	2	FBK0500723
5.00	20.00	51.00	5.00	4	-	2	FBK0500724
6.00	20.00	64.00	6.00	4	-	2	FBK0500725
8.00	20.00	64.00	8.00	4	-	2	FBK0500726
10.00	25.00	70.00	10.00	4	-	2	FBK0500727
12.00	25.00	76.00	12.00	4	-	2	FBK0500728
16.00	30.00	89.00	16.00	4	-	2	FBK0500729
20.00	38.00	102.00	20.00	4	-	2	FBK0500730

Application data on page no 2.197

2 Flute F150 XL



Carbide | REG | 30° | 6535 HA | TiAIN

IMAGE 1

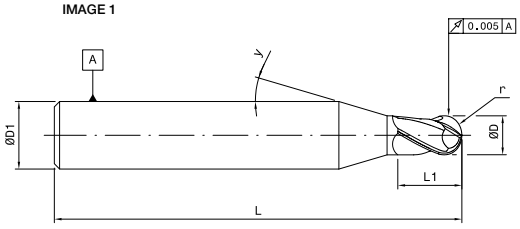
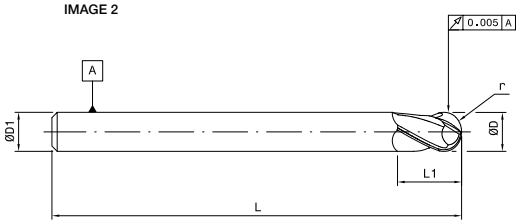


IMAGE 2



P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No TiAIN Coated
1.00	3.00	38.00	3.00	0.50	2	10	1	FBK0500731
1.50	6.00	38.00	3.00	0.75	2	10	1	FBK0500732
2.00	9.00	38.00	3.00	1.00	2	10	1	FBK0500733
2.50	12.00	38.00	3.00	1.25	2	10	1	FBK0500734
3.00	12.00	38.00	3.00	1.50	2	-	2	FBK0500735
4.00	14.00	51.00	4.00	2.00	2	-	2	FBK0500736
5.00	20.00	51.00	5.00	2.50	2	-	2	FBK0500737
6.00	20.00	64.00	6.00	3.00	2	-	2	FBK0500738
8.00	20.00	64.00	8.00	4.00	2	-	2	FBK0500739
10.00	25.00	70.00	10.00	5.00	2	-	2	FBK0500740
12.00	25.00	76.00	12.00	6.00	2	-	2	FBK0500741
16.00	30.00	89.00	16.00	8.00	2	-	2	FBK0500742
20.00	38.00	102.00	20.00	10.00	2	-	2	FBK0500743

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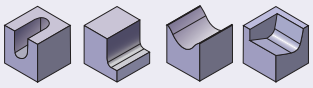
4 Flute F140 XL



Carbide | REG | 30° | 6535 HA | TiAIN

IMAGE 1

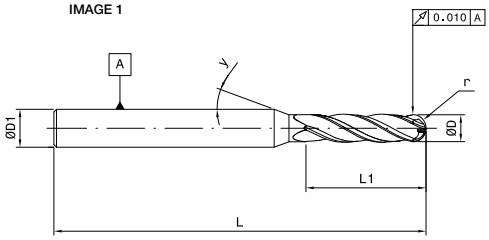
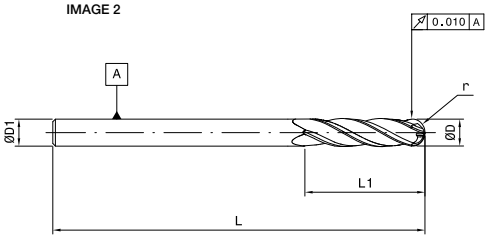


IMAGE 2



P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

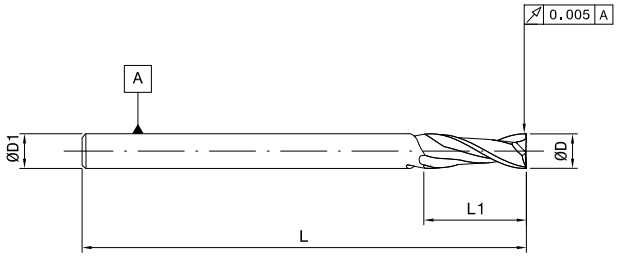
Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	EDP No TiAIN Coated
1.00	3.00	38.00	3.00	0.50	4	10	1	FBK0500744
1.50	6.00	38.00	3.00	0.75	4	10	1	FBK0500745
2.00	9.00	38.00	3.00	1.00	4	10	1	FBK0500746
2.50	12.00	38.00	3.00	1.25	4	10	1	FBK0500747
3.00	12.00	38.00	3.00	1.50	4	-	2	FBK0500748
4.00	14.00	51.00	4.00	2.00	4	-	2	FBK0500749
5.00	20.00	51.00	5.00	2.50	4	-	2	FBK0500750
6.00	20.00	64.00	6.00	3.00	4	-	2	FBK0500751
8.00	20.00	64.00	8.00	4.00	4	-	2	FBK0500752
10.00	25.00	70.00	10.00	5.00	4	-	2	FBK0500753
12.00	25.00	76.00	12.00	6.00	4	-	2	FBK0500754
16.00	30.00	89.00	16.00	8.00	4	-	2	FBK0500755
20.00	38.00	102.00	20.00	10.00	4	-	2	FBK0500756

Application data on page no 2.197

2 Flute F123XL

Carbide | LONG | 30° | 6535 HA | 0.1X45° | TiAIN



P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No TiAIN Coated
3.00	25.00	64.00	3.00	2	FBK0500757
4.00	25.00	64.00	4.00	2	FBK0500758
5.00	25.00	64.00	5.00	2	FBK0500759
6.00	30.00	76.00	6.00	2	FBK0500760
8.00	35.00	83.00	8.00	2	FBK0500761
10.00	40.00	89.00	10.00	2	FBK0500762
12.00	50.00	102.00	12.00	2	FBK0500763
16.00	65.00	117.00	16.00	2	FBK0500764
20.00	80.00	133.00	20.00	2	FBK0500765

Application data on page no 2.197

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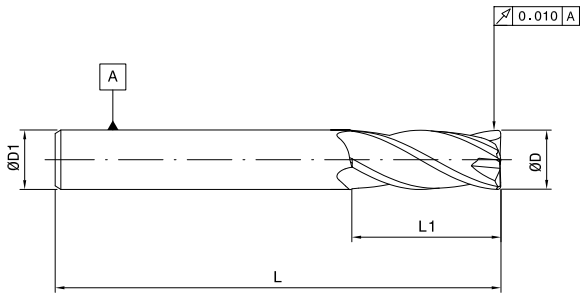
4 Flute F122 XL

Carbide | LONG | 30° | 6535 HA | 0.1X45° | TiAlN



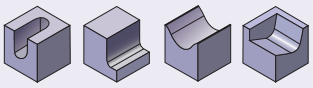
P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

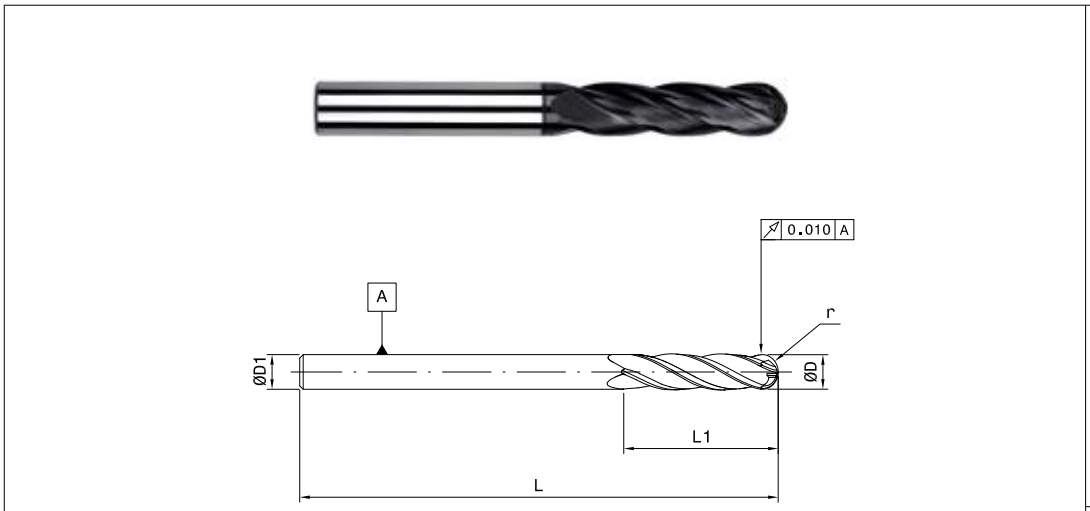
ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	z	EDP No TiAlN Coated
3.00	25.00	64.00	3.00	4	FBK0500766
4.00	25.00	64.00	4.00	4	FBK0500767
5.00	25.00	64.00	5.00	4	FBK0500768
6.00	30.00	76.00	6.00	4	FBK0500769
8.00	35.00	83.00	8.00	4	FBK0500770
10.00	40.00	89.00	10.00	4	FBK0500771
12.00	50.00	102.00	12.00	4	FBK0500772
16.00	65.00	117.00	16.00	4	FBK0500773
20.00	80.00	133.00	20.00	4	FBK0500774

Application data on page no 2.197

4 Flute F125 XL



Carbide | LONG | 30° | 6535 HA | TiAIN



P0-P6
K1-K3
S1-S4
H1-H4
N1-N6
M1-M3

Unit : mm

ØD (mm)	L1 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	EDP No TiAIN Coated
3.00	25.00	64.00	3.00	1.50	4	FBK0503374
4.00	25.00	64.00	4.00	2.00	4	FBK0503375
5.00	25.00	64.00	5.00	2.50	4	FBK0503376
6.00	30.00	76.00	6.00	3.00	4	FBK0503377
8.00	35.00	83.00	8.00	4.00	4	FBK0503378
10.00	40.00	89.00	10.00	5.00	4	FBK0503379
12.00	50.00	102.00	12.00	6.00	4	FBK0503380
16.00	65.00	117.00	16.00	8.00	4	FBK0503381
20.00	80.00	133.00	20.00	10.00	4	FBK0503382

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Cutting parameters

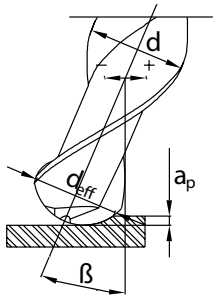
F121XL/F150XL/F111XL/F140XL/F123XL/F122XL/F125XL Metric - 1.0 mm to 8.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling						Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%													
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT NCT				Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.													
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1																		
			ap max ae/D 1%	ap max ae/D 5%	ap 2D ae/D 10%	ap 1.5D ae/D 15%	ap 1.25D ae/D 20%	ap 1D ae/D 30%	ap 1D ae/D 50%	ap 0.25D ae/D 100%	ap 0.5D ae/D 100%	ap 1D ae/D 100%	Cutting Speed (Vc) min	Cutting Speed (Vc) max	mm Range	Diameter in mm 1.0 min	1.0 max	2.0 min	2.0 max	3.0 min	3.0 max	4.0 min	4.0 max	5.0 min	5.0 max	6.0 min	6.0 max	8.0 min	8.0 max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		1	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		4	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	55	55	115	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	80	63	57	53	51	50	48	46	42	38	38	80	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	75	59	54	50	48	46	45	43	39	36	36	75	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	140	110	100	93	90	87	83	80	73	67	67	140	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	100	79	71	67	64	62	60	57	52	48	48	100	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	476	476	1000	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		2	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
		3	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.003	0.004	0.006	0.008	0.010	0.012	0.013	0.016	0.016	0.020	0.019	0.024	0.032	0.040
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		2	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		3	70	55	50	47	45	43	42	40	37	33	33	70	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
		4	63	50	45	42	41	39	38	36	33	30	30	60	fz	0.002	0.002	0.003	0.004	0.005	0.006	0.006	0.008	0.008	0.010	0.010	0.012	0.019	0.024
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		2	63	50	45	42	41	39	38	36	33	30	30	63	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032
		3	53	41	38	35	34	33	31	30	28	25	25	53	fz	0.002	0.003	0.005	0.006	0.007	0.009	0.010	0.012	0.012	0.015	0.014	0.018	0.026	0.032

		4flute		4flute	
		Flat	Ball	Flat	Ball
CT	Standard	**F121XL**	**F150XL**	**F111XL**	**F140XL**
NCT	Long Length	**F123XL**		**F122XL**	**F125XL**

ae > .3D use < 1D ap
ae < .2D use < 1.5 D ap
ae > .1D use < 2D ap
ae < .05D use < L1 Max

CT- indicates that when using these end mills – use the Chip load multiplication factor
NCT- Indicates that when using these end mills- do not use the chip load multiplication factor



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* For ball nose end mills - If axial depth (ap) is less than the ball diameter, and tool is tilted by an angle β, the speed is figured using the effective cutting diameter (D_{eff}) Formula 2

Formula 1

$$D_{eff} = 2 \times \sqrt{ADOC \times (D-ADOC)}$$

Formula 2

$$D_{eff} = D \times \sin\left[\beta + \arccos\left(\frac{D-2 \times ADOC}{D}\right)\right]$$

Note
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

* * Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

* For TiN Coated ToolS Decrease RPM by 5%

* For Uncoated Tools Decrease RPM by 20%

Disclaimer
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Cutting parameters

F121XL/F150XL/F111XL/F140XL/F123XL/F122XL/F125XL Metric - 10.0 mm to 25.0 mm

Material Group			Cutting Speed (Vc) m/min: Shoulder Milling / Rough and Semi Finish							Slot Milling			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%											
			CT NCT	CT NCT	CT NCT	CT NCT	CT NCT	CT	CT	CT NCT	CT NCT	CT NCT												
			5	2.3	1.6	1.4	1.2	1.1	1	1	1	1	Multiply fz by this X Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.											
			ap max	ap max	ap 2D	ap 1.5D	ap 1.25D	ap 1D	ap 1D	ap 0.25D	ap 0.5D	ap 1D	Cutting Speed (Vc)		mm	Diameter in mm									
			ae/D 1%	ae/D 5%	ae/D 10%	ae/D 15%	ae/D 20%	ae/D 30%	ae/D 50%	ae/D 100%	ae/D 100%	ae/D 100%	min	max	Range	10.0		12.0		14.0		16.0		20.0		25.0	
																min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	0	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		1	210	165	150	140	135	130	125	120	110	100	100	210	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	180	141	129	120	116	111	107	103	94	86	86	180	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		4	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Stainless Steel	M	1	115	90	82	77	74	71	68	66	60	55	55	115	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	80	63	57	53	51	50	48	46	42	38	38	80	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	75	59	54	50	48	46	45	43	39	36	36	75	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Cast Iron	K	1	150	118	107	100	96	93	89	86	79	71	71	150	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	140	110	100	93	90	87	83	80	73	67	67	140	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	100	79	71	67	64	62	60	57	52	48	48	100	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Non-Ferrous	N	1	1000	786	714	667	643	619	595	571	524	476	476	1000	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		2	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
		3	750	589	536	500	482	464	446	429	393	357	357	750	fz	0.040	0.050	0.048	0.060	0.056	0.070	0.064	0.080	0.080	0.100	0.100	0.125
Super Alloys	S	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		2	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		3	70	55	50	47	45	43	42	40	37	33	33	70	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
		4	63	50	45	42	41	39	38	36	33	30	30	60	fz	0.024	0.030	0.029	0.036	0.034	0.042	0.038	0.048	0.048	0.060	0.060	0.075
Hard Materials	H	1	74	58	53	49	47	46	44	42	39	35	35	75	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100
		2	63	50	45	42	41	39	38	36	33	30	30	63	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100
		3	53	41	38	35	34	33	31	30	28	25	25	53	fz	0.032	0.040	0.038	0.048	0.045	0.056	0.051	0.064	0.064	0.080	0.080	0.100

#RPM(N) = Vc(m/min) X 318.18/Tool Dia. #Vf(mm/min) = RPM(N) X frev (mm/rev)

		4flute		4flute	
		Flat	Ball	Flat	Ball
CT	Standard	**F121XL**	**F150XL**	**F111XL**	**F140XL**
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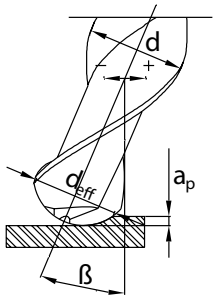

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Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

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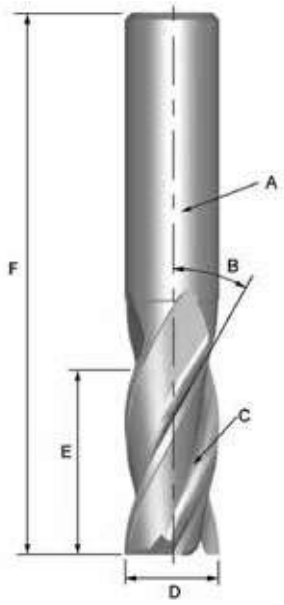
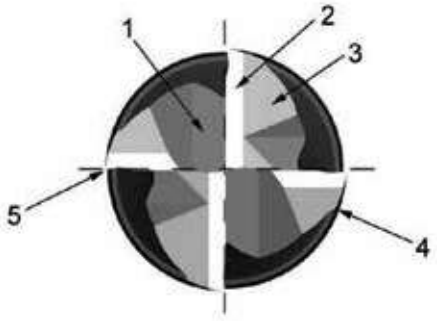
End mill nomenclature

A: Shank
B: Helix Angle
C: Flute
D: Outside Diameter
E: Cutting Length
F: Overall Length



Length of Cut (Flute Length) (E) – Always select the shortest Flute Length possible for your application.
By selecting the shortest Flute Length, you can increase rigidity and allow for higher feed rates.

End Mill Diameter (D) – Always select the largest diameter possible for your milling operation. Increasing your diameter by just 10%, can increase your rigidity by 25%.

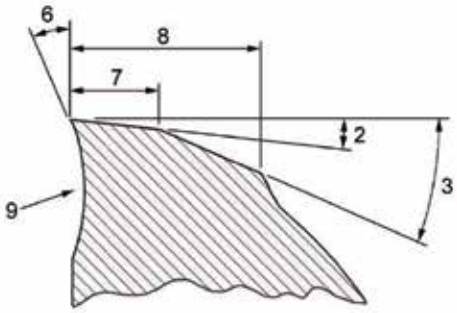


1: Gash
2: Primary Relief Angle
3: Secondary Relief Angle
4: Heel
5: Cutting Edge

Helix Angle – Varies from 0 to 60 degrees. Higher helix angles can increase the number of teeth in a cut, and help in redirecting cutting forces. This is beneficial in harder to machine materials in particular. Changes in helix angle can also greatly affect the flute form of an end mill, and affect chip evacuation.

Rake Angle (B) – The measurement of the curvature of the cutting edge in the face of the flute. A high rake angle will cut more aggressively and make the cutting action smoother, while a lower rake angle will increase the strength of the cutting edge.

Primary & Secondary Relief (2 & 3) – The clearance directly behind the cutting edge. High primary relief angles will allow for more aggressive milling, while lower relief angles will increase the strength of the cutting edge. The primary relief will also affect the wear on a cutting edge. Lower primary relief angles can tend to develop larger wear lands.



6: Rake Angle
7: Width of Primary Relief Land
8: Width of Secondary Relief Land
9: Undercut Face

Web Thickness – The cross section of the fluting of the end mill. Larger webs allow for more rigidity, while smaller webs allow for better chip evacuation. This feature is highly dependent on the material being machined.

How to reduce vibration & chatter in end milling

When chatter occurs, it can be self-sustaining until the problem is corrected. Chatter causes poor finish on the part, and will damage and significantly reduce the life of end mills. Carbide end mills are particularly susceptible to damage.

Typical methods to reduce chatter include reducing cutting forces by:

1. Reducing the number of flutes in cut.
2. Decreasing the chipload per tooth by reducing the feed or increasing the speed or RPM.
3. Reducing the axial or radical depth or cut.

Though these steps will reduce the chatter, slowing down the cutting process is not always the best course of action, and reducing the chipload can be detrimental to the cutter.
It is better to first improve rigidity and stability:

1. Use a larger end mill with a larger core diameter.
2. Use end mills with reduced clearance or a small circular margin.
3. Use the shortest overhang from spindle nose to tip of tool.
4. Use stub length end mills where possible.
5. Use balanced tool holders.
6. Rework fixture to hold the workpiece more securely.
7. Reprogram the cutter path to shift cutting forces into stiffer portions of the workpiece.
8. Look for ways to improve spindle speeds then adjust feed accordingly.

Chatter is common when machining corners. As the end mill enters the corner, the percentage of engagement increases the number of teeth in the cut. This drastically increases the cutting forces, causing chatter.

To reduce chatter when machining corners, consider using circular interpolation to produce a bigger corner radius than indicated by the part print. Then remove the remaining stock with a smaller end mill using circular interpretation.

Reducing Chatter in End Milling

Chatter in the form of vibration and noise is a frequent challenge when end milling. It can cause scalloping and uneven finishes.

To reduce chatter, try the following:

1. Ensure that the starting places for speeds and feeds are correct for the workpiece material and the cut.
2. Decrease the feed, or chipload per tooth/tool.
3. Make the workpiece as secure and rigid as possible.
4. Reduce excess overhang between the workpiece and spindle.
5. Select an end mill with less flutes.
6. Check the tool run-out.
7. Review the tool geometry to ensure the cutting face, relief, fluting and helix angle are appropriate for the workplace material.
8. If conventional, try climb milling.

End Mill Accuracy and Deflection

Because end mills are supported only at the shank end, they are subject to deflection, which can reduce the accuracy of the milled part. Several factors affect the amount of deflection that will occur.

1. Overall Length and Length of Cut: As the length of the mill increases, difficulty in maintaining dimensional accuracy also increases. Rigidity decreases in proportion to length of cut to the 3rd power. Thus, a 4th length of cut is 1/8 as rigid as a 2" length of cut. A regular length end mill cutting 7075 aluminium can deflect <.002", while an extra long end mill can deflect >.006".

2. End Mill Diameter: Rigidity increases in proportion to diameter to the 4th power. A 1" – diameter end mill is 16 times more rigid than a ½" end mill. A 1" – diameter end mill over a 5/8" length of cut in 1040 steel will cut to size, while a 3/8" – diameter end mill may deflect to >.003".

3. End Mill Material Composition: Solid carbide is about three times more rigid and resistant to deflection than high-speed steel end mills, but not as tough.

4. Radial Depth of Cut and Axial Length of Cut: Heavy radical cuts as well as long axial lengths of cuts will deflect the end mill much more. A light-finishing pass is generally required to produce accurate parallel cuts.

Tips:

- Always use the shortest tool possible.
- Shorter tools can reduce chatter.
- Increase coolant.
- Try left-hand spiral end mills.
- Try using higher helix end mills.
- Increase overall system rigidity.
- Reduce overhang.
- Conventional milling can resist deflection better than climb milling.
- Dull tools deflect more than sharp tools.

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Surface treatment

STEAM OXIDE:
A black oxided surface (Fe3O4) produced on the surface of a finished tap by means of a steam furnace. This oxidized surface is porous and helps retain cutting fluid in the working portion of the tap. The materials on which steam oxide has shown improvement in performance are stainless steels, steel forgings, tool and die steels, hot and cold rolled steels, and high nickel alloys.

TITANIUM NITRIDE (TiN):
A thin deposit (approx. 0.0001") applied to the surface of a finished tap utilizing PVD coating technology. TiN coating increases the surface hardness and wear resistance. Use of TiN coating on standard tools will help increase tool life in harder materials (up to 32 HRc), such as stainless steels, steel forgings, tool and die steels and hot and cold rolled steels. TiN coating also works very well with water-base cutting fluids.

TITANIUM CARBON NITRIDE (TiCN):
Similar to TiN, TiCN is applied utilizing PVD coating technology. This coating combines high hardness (approx. 2800 vickers) with the anti-seizure properties of Nitride. A lower coefficient of friction helps reduce welding by 75% over TiN coated tools. These features make TiCN especially beneficial in non-ferrous material and hardened steels.

TITANIUM ALUMINUM NITRIDE (TiAlN):
TiAlN is applied using PVD coating technology. The addition of aluminum reduces friction and increases the coating oxidation temperature. As a result, TiAlN has increased resistance to heat and oxidation wear. This makes TiAlN better suited for High Speed/High Heat applications. TiAlN coating is incorporated into many of our tools.

PROTON + COATING :
Proton + coating devised explicitly for solid carbide tools used in roughing and finishing of hardened steels and difficult-to-machine materials.
Major competitive advantages in tool and die-making can be attained by cutting steels with hardness >60 HRc.

Cr BASED COATING
Cr based coating, has made it possible to systematically optimize and decisively improve the key coating properties for milling applications.

Greater abrasion resistance, extra shear strength, lower adhesion tendency, maximum toughness and a very smooth surface achieve a quantum leap in drilling performance.

Material details

Material Group		Material Description	Content	Tensile Strength RM (MPa)*	Hardness (HB)	Hardness (HRc)
Steel	P0	Low-Carbon Steels, Long Chipping	C <0,25%	<530	<125	—
	P1	Low-Carbon Steels, Short Chipping, Free Machining	C <0,25%	<530	<125	—
	P2	Medium- and High-Carbon Steels	C >0,25%	<530	<220	<25
	P3	Alloy Steels and Tool Steels	C >0,25%	600-850	<330	<35
	P4	Alloy Steels and Tool Steels	C >0,25%	850-1400	340–450	35-48
	P5	Ferritic, Martensitic, and PH Stainless Steels	—	600-900	<330	<35
	P6	High-Strength Ferritic, Martensitic, and PH Stainless Steels	—	900-1350	350–450	35-48
Stainless Steel	M1	Austenitic Stainless Steel	—	<600	130-200	-
	M2	High-Strength Austenitic Stainless and Cast Stainless Steels	—	600-800	150–230	<25
	M3	Duplex Stainless Steel	—	<800	135–275	<30
Cast Iron	K1	Grey Cast Iron	—	125-500	120–290	<32
	K2	Low- and Medium-Strength Ductile Irons (Nodular Irons) and Compacted Graphite Irons (CGI)	—	<600	130–260	<28
	K3	High-Strength Ductile Irons and Austempered Ductile Iron (ADI)	—	>600	180–350	<43
Non-Ferrous	N1	Wrought Aluminium	—	—	—	—
	N2	Low-Silicon Aluminium Alloys and Magnesium Alloys	Si <12,2%	—	—	—
	N3	High-Silicon Aluminium Alloys and Magnesium Alloys	Si > 12,2%	—	—	—
	N4	Copper-, Brass-, Zinc-Based on Machinability Index Range of 70–100	—	—	—	—
	N5	Nylon, Plastics, Rubbers, Phenolics, Resins, Fibreglass	—	—	—	—
	N6	Carbon, Graphite Composites, CFRP	—	—	—	—
	N7	Metal Matrix Composites (MMC)	—	—	—	—
Special Alloys	S1	Iron-Based, Heat-Resistant Alloys	—	500-1200	160-260	25-48
	S2	Cobalt-Based, Heat-Resistant Alloys	—	1000-1500	250-450	25-48
	S3	Nickel-Based, Heat-Resistant Alloys	—	600-1700	160-450	<48
	S4	Titanium and Titanium Alloys	—	900-1600	300-400	33-48
Hardened Steel	H1	Hardened Materials	—	—	—	44-48
	H2	Hardened Materials	—	—	—	48-55
	H3	Hardened Materials	—	—	—	56-60
	H4	Hardened Materials	—	—	—	>60

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Material details

Material Group		ANSI	DIN
Steel	P0	A36, 1008, 1010, 1018 through 1029; 1108, 1117	
	P1	10L18, 1200 Series, 1213, 12L14	C15, Ck22, ST37-2, S235JR, 9SMnPb28, GS38
	P2	1035, 1045, 10L45, 1050, 10L50, 1080, 1137, 1144, 11L44, 1525, 1545, 1572	ST52, S355JR, C35, GS60, Cf53
	P3	1300, 2000, 3000, 4000, 5000, 8000, P20, SAE: A, D, H, O, S, M, T	16MnCr5, Ck45, 21CrMoV5-7, 38SMn28
	P4	1300, 2000, 3000, 4000, 5000, 8000, P20, SAE: A, D, H, O, S, M, T	100Cr6, 30CrNiMo8, 42CrMo4, C70W2, S6525, X120Mn12
	P5	15–5 PH, 13–8 PH, 17–4 PH, 400 and 500 Series	100Cr6, 30CrNiMo8, 42CrMo4, C70W2, S6525, X120Mn12
	P6	15–5 PH, 13–8 PH, 17–4 PH, 400 and 500 Series	X102CrMo17, G-X120Cr29
Stainless Steel	M1	200 Series, 301, 302, 304, 304L, 309	X5CrNi 18 10, X2CrNiMo 17 13 2, G-X25CrNiSi18 9, X15CrNiSi 20 12
	M2	310, 316, 316L, 321, 347, 384 ASTM Cast XM-1, XM-5, XM-7, XM-21	X2CrNiMo 13 4, X5NiCr 32 21, X5CrNiNb 18 10, G-X15CrNi 25-20
	M3	323, 329, F55, 2205, S329000	X8CrNiMo27 5, X2CrNiMoN22 5 3, X20CrNiSi25 4, G-X40CrNiSi27 4
Cast Iron	K1	class 20, 25, 30, 35, 40, 45, 50, 55, 60, G1800, G3000, G3500, G4000	GG15, GG25, GG30, GG40, GTW40
	K2	60-40-18, 65-45-12, 80-55-06, SAE J434:D4018, D4512, D5506, ASTM A47: Grade 32510, 35018, SAE J158: Grade M3210, M4504, M5003, M5503, M7002,ASTM A842: Grade 250, 300, 350, 400, 450	GGG40, GTS35
	K3	ASTM A536:100-70-03, 120-90-02, SAE J434: D7003, SAE J158:Grade M8501AST A897: 125-80-10, 150-100-7, 175-125-4, 200-150-1, 230-185	GGG60, GTW55, GTS65
Non-Ferrous	N1	2025, 5050, 7050, 1000, 2017	AlMg1, Al99.5, AlCuMg1, AlCuBiPb, AlMgSi1, ALMgSiPb
	N2	2024, 6061, 7075	GAlSiCu4, GDAlSi10Mg
	N3	—	G-ALSi12, G-AlSi17Cu4, G-AlSi21CuNiMg
	N4	C81500	CuZn40, Ms60, G-CuSn5ZnPb, CuZn37, CuSi3Mn
	N5	—	LEXAN®, HOSTALEN™, Polystyrol, Makralon®
	N6	Graphite, CFK, CFRP	CFK, GFK
	N7	C63000	—
Special Alloys	S1	INCOLOY® 800 Series, A608, A567, Discaloy™, INVAR®, N-155, 16-25-6, 19-9 DL; Cast: ASTM A-297, A-351, A-567, A-608	X1NiCrMoCu32 28 7, X12NiCrSi36 16, X5NiCrAlTi31 20, X40CoCrNi20 20
	S2	Haynes® 25 (L605), Haynes 188, J-1570, Stellite®, AiResist 213; Cast: AiResist 13, Haynes 21, MAR-M302, MAR-M509, NASA Co-W-Re, WI-52	Haynes® 188, Stelllite® 6,21,31
	S3	Astroloy™, Hastelloy® B/C/ C-276 /X, INCONEL® 600 and 700 Series, IN102,INCOLOY 900 Series, Rene 41, Waspalloy®, Monel®, K-500, MAR-M20, NIMONIC®, UDIMET®	INCONEL® 690, INCONEL 625, Hastelloy®, NIMONIC® 75
	S4	Pure: Ti 98.8, Ti 98.9,Ti 99.9; Alloyed: Ti 5Al-2.5Sn, Ti6Al-4V, Ti6Al-2Sn-4Zr-2Mo,Ti-3Al-8V-6Cr-4Mo-4Zr, Ti-10V-2Fe-3Al, Ti-13V-11Cr-3Al	Ti1, TiAl5Sn2, TiAl6V4, TiAl4Mo4Sn2
Hardened Steel	H1	Tool Steel H10, H11, H13, D2, D3, 4340, P20	GX260NiCr42, GX330NiCr42, GX300CrNiSi952, GX300CrMo153, HARDOX® 400
	H2	Tool Steel H10, H11, H13, D2, D3, 4340, P20	—
	H3	Tool Steel H10, H11, H13, D2, D3, 4340, P20	—
	H4	Tool Steel H10, H11, H13, D2, D3, 4340, P20	—

End mill troubleshooting

Problem	Rigidity	Increase Inches/Tooth	Reduce Inches/Tooth	Material	Recutting Chips	Increase Rake Angle	Handling	Runout	Reduce Speed	Increase Speed	Depth of Cut	Fixturing	Coolant	Finish	Dull Tool	Chip Evaluation	Inadequate Number of Flutes	Insufficient Coolant	Plunge Cutting	Reduce Feed	Increase Feed	Tool Holder	Balance Holder & Tool
Chipping	X		X	X	X		X	X														X	
Chatter	X	X							X		X	X										X	
Built Up Edge		X				X				X			X	X									
Breakage	X		X								X				X	X						X	
Chip Packing																	X	X	X				
Poor Slotting	X	X	X						X		X	X								X			
Premature Wear				X					X	X			X							X	X	X	
Chip Welding			X			X			X				X	X									
Cratering																							X

FORMULAS:-

INCH
RPM = SFM x 3.82/Tool Diameter
IPM = RPM x number of teeth x (inches/tooth)

METRIC
RPM = Vc x 318.057/Tool Diameter
mm/min. = RPM x number of teeth x (mm/tooth)

CONVERSION INCH TO METRIC
Vc = SFM x 0.3048
mm/min. = IPM x 25.4

CONVERSION METRIC TO INCH
SFM = Vc/ . 3048
IPM = (mm/min.)/25.4

SAFETY NOTE:-

Always wear the appropriate personal protective equipment such as safety glasses and protective clothing when using solid carbide or HSS cutting tools. Machines should fully guarded. Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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End mill troubleshooting guide

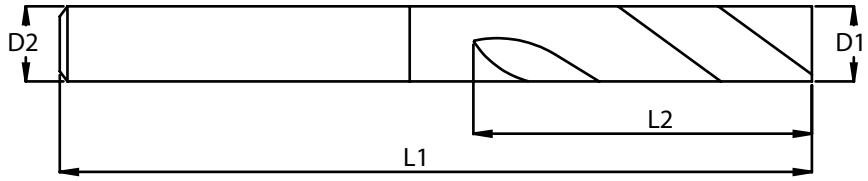
PROBLEM	CAUSE	SOLUTION
Chip packing	Too great a cutting amount	Adjust feed or speed
	Not enough chip room	Use end mill fewer flutes
	Not enough coolant	Apply more coolant. Use air pressure
Rough surface finish	Feed too fast	Slow down to correct feed
	Slow speed	Use higher speed
	Too much wear	Regrind earlier stage
	Chip biting	Cut less amount per pass
	No end tooth concavity	Add margin (touch primary with oilstone)
Burr	Too much wear on primary relief	Regrind sooner
	Incorrect condition	Correct milling condition
	Improper cutting angle	Change to correct cutting angle
No dimensional accuracy	Too tough condition	Change to easier condition
	Lack of accuracy (machine & holder)	Repair machine or holder
	Not enough rigidity (machine & holder)	Change machine or holder or condition
	Not sufficient number of flutes	Use end mill with greater number of flutes
No perpendicular side	Feed too fast	Slow down to correct feed
	Too great a cutting amount	Reduce cutting amount
	Too long a flute length or long overall length	Use proper length tool. Hold shank deeper
	Not sufficient number of flutes	Use end mill with greater number of flutes
Chipping	Feed too fast	Slow down to proper feed
	Feed too fast on first cut	Slow down on first bite
	Not enough rigidity of machine tool & holder	Change rigid machine tool or holder
	Loose holder	Tighten tool holder
	Loose holder (workpiece)	Tighten workpiece fixture
	Lack of rigidity (tool)	Use shortest end mill available. Hold shank deeper. Try down cut
	Teeth too sharp	Change to lower cutting angle, primary relief
Wear	Speed too fast	Slow down, use more coolant
	Hard material	Use higher grade tool material, add surface treatment
	Biting chips	Change feed speed to change chip size or clear chips with coolant or air pressure
	Improper feed speed (too slow)	Increase feed speed. Try down cut
	Improper cutting angle	Change to correct cutting angle
	Too low a primary relief angle	Change to larger relief angle
Breakage	Feed too fast	Slow down feed
	Too large cutting amount	Adjust to smaller cutting amount per teeth
	Too long flute length or long overall length	Hold shank deeper, use shorter end mill
	Too much wear	Regrind at earlier stage
Chattering	Feed and speed too fast	Correct feed and speed
	Not enough rigidity (machine & holder)	Use better machine tool or holder or change condition
	Too much relief angle	Change to smaller relief angle. Add margin (touch primary with oil stone)
	Loose holder (workpiece)	Hold workpiece tighter
	Cutting too deep	Correct to smaller cutting depth
	Too long flute length or long overall length	Hold shank deeper, use shorter end mill or try down cut

Custom tool request form

Fill in information requested on drawing.
(*Required Fields)

☐ Request Approval Drawing

D1 = _____
D2 = _____
L1 = _____
L2 = _____



***Material**

☐ Solid Carbide
☐ Carbide Coolant Thru

***Number of Flutes**

_____

***Flute Form**

☐ Straight
☐ Helical _____ ° Helix

***Flute Form**

☐ Cylindrical
☐ Shank Flat
Flat Style _____

***Flute Form**

☐ Corner Radius _____ +/-.002"
☐ Corner Chamfer _____ x _____ °
☐ Chipbreaker

***Coating**

☐ TiN
☐ TiCN
☐ TiAlN
☐ None
Other _____

Note:
This information enables us to engineer and manufacture a tool for your specific requirments.

Customer Name: _____

Phone: _____

* Work Material Machined:

Hardness: _____

Distributor: _____

Quantities: _____

Note: Trial tool/custom tool request form can be downloaded from our website www.totem-forbes.com

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Trial tool results form

Customer Name		Ref No.	
Address		Date	
		Sales Engineer Name:	
		Contact No.:	
Contact Person :		Trial PO OA No:	
Tool Diameter :			
Component Details:		**Operation Details:**	
Name		End Milling Depth	
Material		No of Passes	
Material Hardness		Slotting/Profiling/Ramping	
Machine Make /Model/No.		Roughing/Finishing	
Tool No.		Tol/Finish required :	
Machining Details :			
Parameters	**Existing**	**Proposed**	
Holding			
M/c.Type			
Cycle Time			
Coolant			
Coolant Press.			
Tool Data:			
Parameters	**Existing**	**Trial 1**	**Trial 2**
Make			
Ext/Thru cool			
Cutting Speed (Vc) m/min			
RPM			
Feed			
Depth of cut			
Life Obtained (TIME)			
Kind of Failure			
Cost Data:			
Tool Cost (Rs.)			
Cost/Component (Rs.)			
Remarks:-			
Customer Benefit:-1.			
Customer Benefit:-2.			

Sales Engineer
FORBES & COMPANY LIMITED

Authorised Signatory
CUSTOMER

Note: Trial tool/custom tool request form can be downloaded from our website www.totem-forbes.com

Milling formulas and definitions

Below are the complied list of milling formulas and definitions that are used in milling process, milling cutters, milling techniques etc. This will help you to calculate correct cutting speed, feed per tooth or metal removal rate in any milling operation.

METRIC	IMPERIAL
Table feed, F (mm/min) $F = f_z \times n \times Z$	Table feed, F (inch/min) $F = f_z \times n \times Z$
Cutting speed, v_c (m/min) $V_c = \frac{\pi \times D \times n}{1000}$	Cutting speed, v_c (ft/min) $V_c = \frac{\pi \times D \times n}{12}$
Spindle speed, n (r/min) $n = \frac{V_c \times 1000}{\pi \times D}$	Spindle speed, n (rpm) $n = \frac{V_c \times 12}{\pi \times D}$
Feed per tooth, f_z (mm) $f_z = \frac{F}{n \times Z}$	Feed per tooth, f_z (inch) $f_z = \frac{F}{n \times Z}$
Feed per revolution, f_{rev} (mm/rev) $f_{rev} = \frac{F}{n}$	Feed per revolution, f_{rev} (inch/rev) $f_{rev} = \frac{F}{n}$
Metal removal rate, Q (cm^3/min) $Q = \frac{ap \times ae \times F}{1000}$	Metal removal rate, Q ($inch^3$/min) $Q = ap \times ae \times F$
Net power, P (kW) $Q = \frac{ae \times ap \times F \times K_c}{60 \times 10^6}$	Net power, P (HP) $Q = \frac{ae \times ap \times F \times K_c}{396 \times 10^3}$
Torque, M_c (Nm) $M_c = \frac{P \times 30 \times 10^3}{\pi \times n}$	Torque, M_c (lbf ft) $M_c = \frac{P \times 16501}{\pi \times n}$

Symbol	Designation/Definition	Metric	Imperial
ae	Radial depth of cut	mm	inch
ap	Axial depth of cut	mm	inch
D	Cutting diameter at cutting depth ap	mm	inch
f_z	Feed per tooth	mm	inch
f_{rev}	Feed per revolution	mm/r	inch
n	Spindle speed	rpm	rpm
V_c	Cutting speed	m/min	ft/min
V_e	Effective cutting speed	mm/min	inch/min
F	Table feed	mm/min	inch/min
z	Number of effective teeth	pcs	pcs
h_{ex}	Maximum chip thickness	mm	inch
hm	Average chip thickness	mm	inch
k_c	Specific cutting force	N/mm^2	$N/inch^2$
P	Net power	kW	HP
M_c	Torque	Nm	lbf ft
Q	Metal removal rate	cm^3/min	$inch^3$/min

MILLING TECHNIQUES – DEFINITIONS

Linear ramping
A simultaneous straight movement in axial and radial feed directions.

Circular milling
A circular tool path on a constant z-level (circular interpolation).

Circular ramping
A circular ramping tool path (helical interpolation).

Waterline milling
Milling on a constant z-level.

Point milling
A shallow radial cut with round insert or ball nose cutters in which the cutting zone is moved away from the tool centre.

Scallop
A configuration with cusps that occurs when producing sculptured surfaces.

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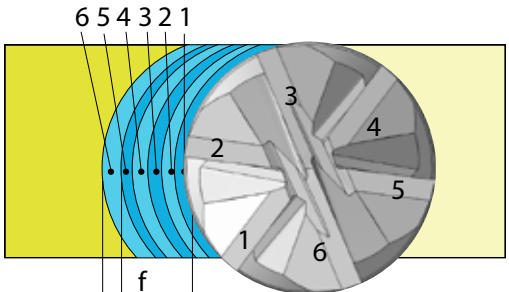
Milling formulas and definitions

THE MILLING PROCESS – DEFINITIONS

Cutting speed, V_c

Indicates the surface speed at which the cutting edge machines the workpiece.



$$f_z = \frac{V_f}{n \times Z_c}$$

Spindle speed, n

The number of revolutions the milling tool makes per minute on the spindle. This is a machine oriented value, which is calculated from the recommended cutting speed value for an operation.

Feed per tooth, f_z

A value for calculating the table feed. The feed per tooth value is calculated from the recommended maximum chip thickness value.

Feed per revolution, f_{rev}

Auxiliary value indicating how far the tool moves during one complete rotation. It is used specifically for feed calculations and often to determine the finishing capability of a cutter.

Average chip thickness, h_m

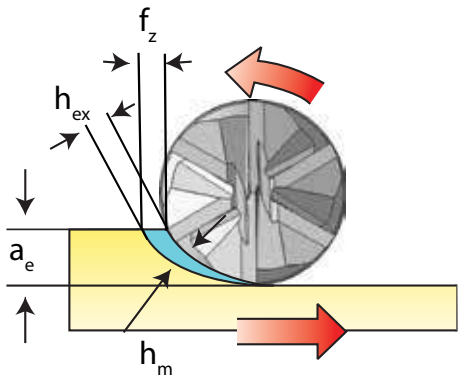
A useful value in determining the specific cutting force, used for net power calculations.

Feed per minute, F

Also known as the table feed, machine feed or feed speed. It is the feed of the tool in relation to the workpiece in distance per time-unit related to feed per tooth and number of teeth in the cutter. The number of available cutter teeth in the tool (zn) varies considerably and is used to determine the table feed while the effective number of teeth (z) is the number of effective teeth in cut. Feed per revolution (f_{rev}) in mm/rev (inch/rev) is a value used specifically for feed calculations and often to determine the finishing capability of a cutter.

Maximum chip thickness, h_{ex}

This value is a result of the cutter engagement as it is related to (f_z), (ae). The chip thickness is an important consideration when deciding the feed per tooth, to ensure that the most productive table feed is employed.



Metal removal rate, Q (cm^3/min)

The volume of metal removed in cubic mm per minute ($inch^3$/minute). It is established using the values for cutting depth, width and feed.

Specific cutting force, k_c

A material constant which is a factor used for power calculations, expressed in N/mm^2

Machining time, T_c (min)

Machining length (l_m) divided by the table feed (F).

Net power, P and efficiency, ηmt

Machine tool oriented values, which assist in calculating the net power to ensure that the machine can handle the cutter and operation.

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