



High Performance Cutting Tools

SOLID CARBIDE TOOLS



FORBES PRECISION TOOLS AND MACHINE PARTS LIMITED



FORBES PRECISION TOOLS AND MACHINE PARTS LIMITED

ABOUT US

Forbes Precision Tools and Machine Parts Limited manufacturers both carbide and high-speed steel round cutting tools under the brand 'TOTEM'.

Totem offers complete tooling solutions in Internal & External Threading, Drilling, Milling, Deburring and Reaming and as on date has over.

60 years of expertise of manufacturing high precision round cutting tools These tools are manufactured in a state-of-the-art manufacturing facility at Aurangabad India.

FPTMPL provides tooling solutions for a wide variety of industry sectors, including automotive, oil & gas, aerospace, defence, valve & pump, mold & die, heavy engineering, and electrical & electronics. These solutions are designed with material-specific geometries to optimize tool performance, ensuring maximum efficiency and longevity for the end-user.

Our range of products include HSS Hand and Machine Taps, Carbide Thread Mills and Taps, Solid Carbide Endmills and Drills, Tungsten Carbide Rotary Burrs, HSS Drills, Carbon Steel Taps, HSS and Carbon Steel Round and Hexagonal Dies. We are also the largest manufacturer of Spring lock washers in India serving major auto and transmission segments.

QUALITY POLICY

We will continue to delight our customers by delivering high quality, innovative products and solutions through excellent manufacturing practises, its effective monitoring, sustenance, and further continual improvements of all business processes by active participation of all our associates.

We will remain committed towards Safety, Environment and Statutory Compliance.





High Performance Cutting Tools



SOLID CARBIDE END MILLS

END MILL SELECTION GUIDE



	For 55-70 HRc				For 45-70 HRc				High feed	
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	Torus cutter for high feed machining	Multi flute finisher
Page No.	2.015	2.021	2.027	2.028	2.031	2.032	2.034	2.036	2.039	2.041
Length	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	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	2.0-12.0	3.0-20.0
Dia Range Spl										
Length of Cut (ap Max)	0.2D	0.75D	2D	2D	2D	2D	2D	2D	0.05D	2D
No of Flutes	2	4	6-16	6-16	2	4	2	4	4	6-8
Helix	30°	30°	45°	45°	30°	30°	30°	30°		45°
Coating	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN
Shank	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



											
		Micro End Mill						Diamond Tipped		Graphite Milling	
Description	Multi flute finisher with corner radius	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.	2.044	2.047	2.053	2.057	2.063	2.067	2.076	2.079	2.081	2.088	2.090
Length	Stub/Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std	3.0-20.0	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)	2D	0.6D	0.6D	0.6D	0.6D	0.6D	1.5D	0.65D	0.65D	2.5D	2D
No of Flutes	6-8	2	4	2	4	2	2	2	2	2	3
Helix	45°	30°	30°	30°	30°	30°	30°	0°	0°	25°	40°
Coating	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	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	v			√	√			√			
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				For 45 - 62 HRc Proton Plus					
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°	40°	40°	40°	30°	30°	30°	50°	50°	
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				For 32- 45 HRc High Speed Machining			
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°	30°	30°	30°	30°	30°	30°	30°
Coating		Proton Plus	Proton Plus	Proton Plus	Proton Plus	TiAIN	TiAIN	TiAIN	TiAIN
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				Trochoidal milling		
Description	4 Flute Variable Helix End mill F177TRV/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 trochoidal milling F180TR/NF180TRV/F180TRL	5 Flute end mill for trochoidal milling 5VR	6 Flute end mill for trochoidal milling 6VR
Page No.	2.124	2.127	2.128	2.130	2.132	2.135	2.136
Length	Reg	Reg	Long	Reg	Long	Reg	Reg
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
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
Length of Cut (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
Helix	35°/ 38°	35°/ 38°	35°/ 38°	35°/ 38°	38°	Vari	45°
Coating	Cr Base	Cr Base	Cr Base	Cr Base	Cr Base	Cr Base	Cr Base
Shank	Round	Round	Round	Round	Round	Round	Round
Square End	√			√			√
Ball Nose		√	√				
Corner Radius	√			√	√	√	
Corner Chamfer	√						
Center Cutting	√	√	√	√	√	√	√
Chip Breaker							
Neck Type	√			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								
Description	CBC	CBCH / NCBC	3FWFXL	3FWFCR	3FWF	3F	2FWF	1F	
Page No.	2.140	2.141	2.142	2.143	2.144	2.144	2.145	2.146	
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						For General Purpose Application on Variety of Materials			
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.	2.151	2.152	2.153	2.154	2.155	2.156	2.162	2.163	2.164	2.165
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°	20°	20°	45°	45°	45°	30°	30°	30°	30°
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	√	√		√	√	√	√	√	√	√

END MILL SELECTION GUIDE



For General Purpose Application on Variety of Materials										
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.		2.166	2.167	2.168	2.169	2.170	2.171	2.172	2.173	2.174
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°	30°	30°	30°	30°	30°	30°	30°	30°
Coating		TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN
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							
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.	2.175	2.176	2.177	2.178	2.179	2.180	2.183	2.184
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°	30°	30°	30°	30°	30°	30°	30°
Coating	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN
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								
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	Express Carbide End Mills
Page No.		2.186	2.187	2.188	2.189	2.190	2.191	2.192	2.195
Length		Reg	Reg	Reg	Reg	Long Length	Long Length	Long Length	Reg
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	1.0-20.0
Dia Range Spl									
Length of Cut (ap Max)		ap max	ap max	ap max	ap max	ap max	ap max	ap max	ap max
No of Flutes		2	4	2	4	2	4	4	4
Helix		30°	30°	30°	30°	30°	30°	30°	30°
Coating		TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN	TiAIN
Shank		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		√	√	√	√	√	√	√	√

USE YOUR ENDMILLS SELECTOR

Select HP/GP
(High Performance /
General Performance)



Select length of tool



Select corner style



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	ball nose 2 flute regular length	ball nose 2 flute long length	ball nose 2 flute long reach	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	TAIIN	TAIIN	TAIIN	TAIIN
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Find your tool on the page



Solid Carbide End Mills

HSM Series

4 Flute

Centre cutting HSM end mill for
30-45 HRc steel



Carbide



REG

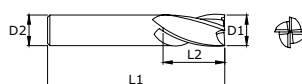
30°

6335 HA

30-45 HRC

TAIIN

P2-P4



Diameter Ø D1	EDP No	Flute Length L2	Overall Length L1	Unit : mm Shank Diameter Ø D2
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

Select tool
diameter



*Custom Solution possible Refer page 2.171

sales@forbesprecision.co.in



High Performance Cutting Tools



**HIGH PERFORMANCE
END MILLS**

PROTON HD 2 FLUTE BALL NOSE END MILL

2.015

WORK PIECE MATERIALS

PRIMARY

Hardened steel from 55-70 HRc (H3-H4)

FEATURES

- New designed ball nose geometry with ultra fine grade
- 2 flute Centre Cutting tool with 30 degrees helix
- high precision end mill for finishing

FUNCTION

- High cutting speeds on Hard materials
- Excellent surface finish

BENEFITS

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



PROTON HD 4 FLUTE END MILL

2.021

WORK PIECE MATERIALS

PRIMARY

Hardened steel from 55-70 HRc (H3-H4)

FEATURES

- Upgraded geometry with ultra fine grade
- 4 flute centre cutting tool with 30 degrees helix
- High precision torus cutter for profiling

FUNCTION

- High cutting speeds on Hard materials
- Excellent surface finish

BENEFITS

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



PROTON HD MULTI FLUTE END MILL (WITH/WITHOUT CORNER RADIUS)

2.027

WORK PIECE MATERIALS

PRIMARY

Hardened steel from 55-70 HRc (H3-H4)

FEATURES

- Upgraded geometry with ultra fine grade
- Multi flute centre cutting tool with 45 degrees helix

FUNCTION

- High precision tool for wall finishing
- Excellent surface finish

BENEFITS

- No EDM is required (milling is much faster).
- Polishing can be minimized.
- One single clamping, so it is easier to achieve accurate results.
- Available with extra teeth for higher productivity



PROTON HD 2/4 FLUTE BALL NOSE END MILL

2.031

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6) and hardened steel from 45-70 HRc (H1-H4)

FEATURES

- 2 /4 flute Ball Nose- Center Cutting tool with 30 degrees Helix
- Superior surface finish
- high precision end mill for finishing

FUNCTION

- Optimized coating for better tool life
- High cutting speeds on Hard materials

BENEFITS

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



PROTON HD 2/4 FLUTE END MILL

2.034

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6) and hardened steel from 45-70 HRc (H1-H4)

FEATURES

- 2 /4 flute torus- center cutting tool with 30 degrees Helix
- Superior surface finish
- high precision end mill for profiling

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- No EDM is required (milling is much faster).
- Polishing can be minimized.
- Best suited for roughing and finishing application.
- One single clamping, so it is easier to achieve accurate results.



PROTON HD MULTI FLUTE END MILL (WITH/WITHOUT CORNER RADIUS)

2.041

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6) and hardened steel from 45-70 HRc (H1-H4)

FEATURES

- Upgraded geometry with ultra fine grade
- Multi flute centre cutting tool with 45 degrees helix
- Superior surface

FUNCTION

- High precision tool for wall finishing
- Excellent surface finish

BENEFITS

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



CONTENTS



PROTON HD TORUS CUTTER FOR HIGH FEED MACHINING

2.039

WORK PIECE MATERIALS

PRIMARY

Steel upto 40 Hrc (P3-P4), hardened steel (H1)

FEATURES

- 4 flute, high feed geometry
- Unique high feed geometry for superior MRR

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- High feed with superior MRR



PROTON HD 2/4 FLUTE MICRO END MILL

2.047

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6), Cast Iron (K1), Stainless Steel (M1-M3), Super Alloys (S1-S4)

SECONDARY

Hardened steel (H1-H4)

FEATURES

- 2/4 flute micro tool geometry
- Superior surface finish
- Wear resistance coating for superior tool life

FUNCTION

- Excellent for rib milling
- Special designed centre geometry to ensure least deflection

BENEFITS

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



PROTON HD 2/4 FLUTE MICRO END MILL WITH CORNER RADIUS

2.057

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6), Cast Iron (K1), Stainless Steel (M1-M3), Super Alloys (S1-S4)

SECONDARY

Hardened steel (H1-H4)

FEATURES

- 2/4 flute micro tool geometry with corner radius
- Superior surface finish
- Wear resistance coating for superior tool life

FUNCTION

- Excellent for rib milling
- Special designed centre geometry to ensure least deflection

BENEFITS

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



PROTON HD 2 FLUTE MICRO BALL NOSE END MILL

2.067

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6), Cast Iron (K1), Stainless Steel (M1-M3), Super Alloys (S1-S4)

SECONDARY

Hardened steel (H1-H4)

FEATURES

- 2/4 flute micro ball nose geometry
- Superior surface finish
- Wear resistance coating for superior tool life

FUNCTION

- Excellent for rib milling
- Special designed centre geometry to ensure least deflection

BENEFITS

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



PROTON HD 2 FLUTE MICRO BALL NOSE END MILL FOR EXOTIC MATERIALS

2.076

WORK PIECE MATERIALS

PRIMARY

Super Alloys (S1-S4)

SECONDARY

Steel (P5-P6), Cast Iron (K1-K2), Stainless Steel (M1-M3), Hardened Steel (H1)

FEATURES

- 2 Ball nose- center cutting tool with 30 degrees helix
- Superior coating for super alloys

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- More accuracy & a better surface finish



PROTON HD 2 FLUTE DIAMOND TIPPED END MILL WITH CORNER RADIUS

2.079

WORK PIECE MATERIALS

PRIMARY

CFRP, GFRP, Plastics, Nylon (N5/N6/N7)

SECONDARY

Non-Ferrous (N1-N4)

FEATURES

- 2 flute
- Smooth surface finish
- 0 Degree helix
- Available in standard and Long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

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



CONTENTS



PROTON HD 2 FLUTE DIAMOND TIPPED BALL NOSE END MILL

2.081

WORK PIECE MATERIALS

PRIMARY

CFRP, GFRP, Plastics, Nylon (N5/N6/N7)

SECONDARY

Non-Ferrous (N1-N4)

FEATURES

- 2 flute
- Smooth surface finish
- 0 Degree helix
- Available in standard and Long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

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



PROTON HD 2 FLUTE DIAMOND COATED ROUGHER FOR GRAPHITE

2.088

WORK PIECE MATERIALS

PRIMARY

Graphite (N6)

SECONDARY

Non-Ferrous (N5/N7)

FEATURES

- 2 flute
- Smooth surface finish
- 25 Degree helix
- Available in standard and Long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- High accuracy & a better surface finish
- Higher machine efficiency



PROTON HD 3 FLUTE DIAMOND COATED END MILL FOR GRAPHITE

2.090

WORK PIECE MATERIALS

PRIMARY

Graphite (N6)

SECONDARY

Non-Ferrous (N5/N7)

FEATURES

- 3 flute
- Smooth surface finish
- 40 Degree helix

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- High accuracy & a better surface finish
- Higher machine efficiency



PROTON HD OPTIMUM FLUTE DIAMOND COATED END MILL WITH CORNER RADIUS FOR GRAPHITE

2.091

WORK PIECE MATERIALS

PRIMARY

Graphite (N6)

SECONDARY

Non-Ferrous (N5/N7)

FEATURES

- Optimum flute
- Smooth surface finish
- 40 Degree helix
- Available in short, standard and long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- High accuracy & a better surface finish
- Higher machine efficiency



PROTON HD OPTIMUM FLUTE DIAMOND COATED BALL NOSE END MILL FOR GRAPHITE

2.095

WORK PIECE MATERIALS

PRIMARY

Graphite (N6)

SECONDARY

Non-Ferrous (N5/N7)

FEATURES

- Optimum flute
- Smooth surface finish
- 40 Degree helix
- Available in short, standard and long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- High accuracy & a better surface finish
- Higher machine efficiency



PROTON HD 2 FLUTE DIAMOND COATED MICRO END MILL WITH CORNER RADIUS FOR GRAPHITE

2.099

WORK PIECE MATERIALS

PRIMARY

Graphite (N6)

SECONDARY

Non-Ferrous (N5/N7)

FEATURES

- Optimum flute
- Smooth surface finish
- 40 Degree helix

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

- Superior tool life
- High accuracy & a better surface finish
- Higher machine efficiency



CONTENTS



PROTON HD 2 FLUTE DIAMOND TIPPED BALL NOSE END MILL

2.101

WORK PIECE MATERIALS

PRIMARY

CFRP, GFRP, Plastics, Nylon (N5/N6/N7)

SECONDARY

Non-Ferrous (N1-N4)

FEATURES

- 2 flute
- Smooth Surface Finish
- 0 Degree helix
- Available in Standard and Long

FUNCTION

- Optimized coating for better tool life
- Special designed centre

BENEFITS

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



PROTON PLUS 4 FLUTE END MILL - R SERIES

2.104

WORK PIECE MATERIALS

PRIMARY

Hardened Steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher Tool Life and consistency



PROTON PLUS 4 FLUTE END MILL - L SERIES

2.105

WORK PIECE MATERIALS

PRIMARY

Hardened steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher tool Life and consistency
- Higher machine efficiency



PROTON PLUS 4 FLUTE END MILL - LR SERIES

2.106

WORK PIECE MATERIALS

PRIMARY

Hardened steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher tool Life and consistency



PROTON PLUS 4 FLUTE END MILL WITH 50 DEGREE HELIX

2.107

WORK PIECE MATERIALS

PRIMARY

Hardened Steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher Tool Life and consistency



PROTON PLUS 4 FLUTE END MILL WITH 50 DEGREE HELIX - LONG FLUTE SERIES

2.108

WORK PIECE MATERIALS

PRIMARY

Steel (P5-P6) from 45-60 HRc

SECONDARY

Hardened steel (H1-H4)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher tool Life and consistency



PROTON PLUS 4 FLUTE END MILL WITH 50 DEGREE HELIX - CR SERIES

2.109

WORK PIECE MATERIALS

PRIMARY

Hardened steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher tool life and consistency



PROTON PLUS 2 FLUTE BALL NOSE END MILL - REGULAR, LONG & LONG REACH SERIES

2.110

WORK PIECE MATERIALS

PRIMARY

Hardened steel (H1-H4)

SECONDARY

Steel (P5-P6)

FEATURES

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

FUNCTION

- 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

- More accuracy & a better surface finish
- Higher tool life and consistency



HSM SERIES 2/4 FLUTE END MILL

2.115

WORK PIECE MATERIALS

PRIMARY

P3-P4 Steel from 30-45 HRc

SECONDARY

Stainless steel (M1)

FEATURES

- Superior micro grain structure raw material
- 2 /4 Flute
- Wear resistant grade
- Same tool for roughing and finishing for mould machining
- Ideal to machine upto 42 HRc
- Smooth surface finish
- 30 Degree helix

FUNCTION

- Optimized coating for better tool life
- Operates at high cutting speeds on moulds

BENEFITS

- No EDM is required (milling is much faster).
- Higher tool life and consistency



HSM SERIES 2/4 FLUTE BALL NOSE END MILL

2.117

WORK PIECE MATERIALS

PRIMARY

P3-P4 Steel from 30-45 HRc

SECONDARY

Stainless Steel (M1)

FEATURES

- Superior micro grain structure raw material
- 2 /4 Flute
- Wear resistant grade
- Same tool for roughing and finishing for mould machining
- Ideal to machine upto 42 HRc
- Smooth surface finish
- 30 Degree helix

FUNCTION

- Optimized coating for better tool life
- Operates at high cutting speeds on Moulds

BENEFITS

- No EDM is required (milling is much faster).
- Higher tool life and consistency



TURBO ROUGHER-TR (F177TR / NF177TR)

2.124

WORK PIECE MATERIALS

PRIMARY

PH Steel

SECONDARY

(Stainless steel)

FEATURES

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

FUNCTION

- High MRR
- Ability to work at high parameters due to the reinforced core.

BENEFITS

- Higher productivity
- Superior tool Life.
- Excellent surface finish.



FOR TROCHOIDAL MILLING

TURBO ROUGHER-TR (F179TR / F179TRL)

2.127

WORK PIECE MATERIALS

PRIMARY

PH Steel

SECONDARY

(Heat resistant super alloys)

FEATURES

- Variable pitch and variable helix
- Stable core geometry
- Optimized centre cutting geometry ball profile
- New generation coating
- Available in 4 flutes

FUNCTION

- Ability to work at high parameters due to the reinforced core.
- High MRR
- Higher productivity

BENEFITS

- Superior tool Life.
- Excellent wall surface finish.
- High MRR



CONTENTS



TURBO ROUGHER-TR (F178TR- BLACK)

2.130

WORK PIECE MATERIALS

PRIMARY

Titanium

SECONDARY

(Heat Resistant Super Alloys)

FEATURES

- Variable pitch and variable helix
- Stable core geometry
- Optimized centre cutting geometry with 3 degree ramping capability
- New generation coating
- Available in 5 Flutes

FUNCTION

- Ability to work at high parameters due to the reinforced core.
- High MRR
- Higher productivity

BENEFITS

- Superior tool life.
- Excellent wall surface finish.
- High MRR

FOR
TROCHOIDAL
MILLING



TURBO ROUGHER-TR (F178TR- GOLD)

2.130

WORK PIECE MATERIALS

PRIMARY

Stainless Steel

SECONDARY

(Steel)

FEATURES

- Variable pitch and variable helix
- Stable core geometry
- Optimized centre cutting geometry with 3 degree ramping capability
- New generation coating
- Available in 5 flutes

FUNCTION

- Ability to work at high parameters due to the reinforced core.
- High MRR
- Higher productivity

BENEFITS

- Superior tool Life.
- Excellent wall surface finish.
- High MRR

FOR
TROCHOIDAL
MILLING



TURBO ROUGHER-TR (F180TR/NF180TR/F180TRL)

2.132

WORK PIECE MATERIALS

PRIMARY

Titanium

SECONDARY

(Stainless Steel)

FEATURES

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

FUNCTION

- Ability to work at high parameters due to the reinforced core.
- High MRR
- Higher productivity

BENEFITS

- Superior tool life.
- Excellent wall surface finish.
- High MRR

FOR
TROCHOIDAL
MILLING



5VR

2.135

WORK PIECE MATERIALS

PRIMARY

Titanium

SECONDARY

(PH Steel)

FEATURES

- Robust core design
- 5 flutes for high productivity
- Optimized centre cutting geometry with 3 degree ramping capability

FUNCTION

- 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

FOR
TROCHOIDAL
MILLING



6VR

2.136

WORK PIECE MATERIALS

PRIMARY

Titanium

SECONDARY

(Stainless steel)

FEATURES

- Robust core design
- 6 flutes for high productivity

FUNCTION

- 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

FOR
TROCHOIDAL
MILLING



RAZORCUT CBC/CBCH/NCBCH

2.140

WORK PIECE MATERIALS

PRIMARY

Aluminium 6000/7000 series

SECONDARY

Wrought Aluminium 6061 & Cast Aluminum 6061

FEATURES

- 3 Flutes
- Center cutting
- Coarse pitch (CBC)/chamfered pitch (CBCH/NCBCH)
- Roughing for aluminium
- Uncoated

FUNCTION

- High MRR
- Excellent for roughing of aluminium

BENEFITS

Superior tool life

FOR
TROCHOIDAL
MILLING



Note:- Ask for the TiCN Coated Program to machine Cast Aluminium Skin

CONTENTS



RAZORCUT 3FWF/3FWFCR/3FWFXL

2.142

WORK PIECE MATERIALS

PRIMARY

Aluminium 6000/7000 series

SECONDARY

Wrought aluminium 6061 & cast aluminium 6061

FEATURES

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

FUNCTION

- High MRR
- Excellent for finishing of aluminium

BENEFITS

- Superior tool life
- Excellent floor finish



FOR
TROCHOIDAL
MILLING

Note:- Ask for the TiCN Coated Program to machine Cast Aluminium Skin

RAZORCUT 3F

2.144

WORK PIECE MATERIALS

PRIMARY

Aluminium 6000/7000 series

SECONDARY

Wrought aluminium 6061 & cast aluminium 6061

FEATURES

- 3 Flutes
- Unequal flute design
- Center cutting
- Uncoated

FUNCTION

- High MRR
- Excellent for semifinishing of aluminium

BENEFITS

- Superior tool life
- Excellent floor finish



FOR
TROCHOIDAL
MILLING

RAZORCUT 2FWF

2.145

WORK PIECE MATERIALS

PRIMARY

Aluminium 6000/7000 series

SECONDARY

Wrought aluminium 6061 & cast aluminium 6061

FEATURES

- 2 Flutes
- 45 Degree helix
- Center cutting
- Wiper design for excellent floor finish
- Uncoated

FUNCTION

- High MRR
- Excellent for finishing of aluminium

BENEFITS

- Superior tool life
- Excellent floor finish



RAZORCUT 1F

2.146

WORK PIECE MATERIALS

PRIMARY

Aluminium & Plastics

SECONDARY

Delrin, PEEK, Organic Materials

FEATURES

- 1 Flute
- 30 Degree helix
- Unique flute design for excellent wall finish
- Uncoated & polished
- Sharp cutting edge

FUNCTION

- High MRR
- Excellent for machining plastics, delrin and organic materials

BENEFITS

- Superior tool life
- Excellent floor finish



Note:- Ask for the TiCN Coated Program to machine Cast Aluminium Skin

F192CB / F192 CBS / F192 CBL

2.151

WORK PIECE MATERIALS

PRIMARY

Steel

SECONDARY

Cast iron

FEATURES

- 3-4 Flutes
- Center cutting
- Sinusoidal pitch
- Superior coating

FUNCTION

- High MRR
- Stable cutting at high cutting speeds

BENEFITS

Superior tool life



F193CB/NF193CB/NF193CBL

2.154

WORK PIECE MATERIALS

PRIMARY

Titanium & PH Steel

SECONDARY

Stainless steel

FEATURES

- 4-6 Flutes
- Center cutting
- 45 degree helix for faster chip evacuation
- Flat pitch
- Superior coating

FUNCTION

- High MRR
- Excellent for machining plastics, delrin and organic materials

BENEFITS

- Superior tool life
- Excellent floor finish



FOR
TROCHOIDAL
MILLING

CONTENTS



F194CB

2.156

WORK PIECE MATERIALS

PRIMARY

Titanium

SECONDARY

Stainless steel

FEATURES

- 4-6 Flutes
- Center cutting
- 45 degree Helix for faster chip evacuation
- Flat pitch
- Superior coating

FUNCTION

- High MRR
- Stable cutting at high cutting speeds

BENEFITS

Superior tool life



FOR
TROCROIDAL
MILLING

GENERAL PURPOSE ENDMILLS - GP SERIES

2.162

WORK MATERIAL

Steel, Stainless Steel, Cast Iron, Non Ferrous, Special Alloy, Hardened Steel

DIA

1-25 mm

SIZE

Stub/STD/long/extra long/long reach
Available in 2 flute / 3 flute / 4 flute
Available in ball nose and end mill
Available uncoated/ TiN coated and TiAlN coated

FEATURES & BENEFITS

- Low cost of operation
- Lower CPC
- TiAlN coating for better tool life
- Universal grade for all materials



ECONOMY RANGE ENDMILLS - XL SERIES

2.186

WORK MATERIAL

Steel, Stainless Steel, Cast Iron, Non Ferrous, Special Alloy, Hardened Steel

DIA

1-20 mm

SIZE

Stub/STD/long
Available in ball nose and end mill
Available uncoated / TiN coated and TiAlN coated

FEATURES & BENEFITS

- Low cost of operation
- Lower CPC
- TiAlN coating for better tool life
- Universal grade for all materials



EXPRESS RANGE

2.195

WORK MATERIAL

Steel, Stainless Steel, Cast Iron, Non Ferrous, Special Alloy, Hardened Steel

DIA

1-20 mm

SIZE

Standard End mill 4 flutes
Available in TiAlN coated

FEATURES & BENEFITS

- Low cost of operation
- Lower CPC
- TiAlN coating for better tool life
- Universal grade for all materials





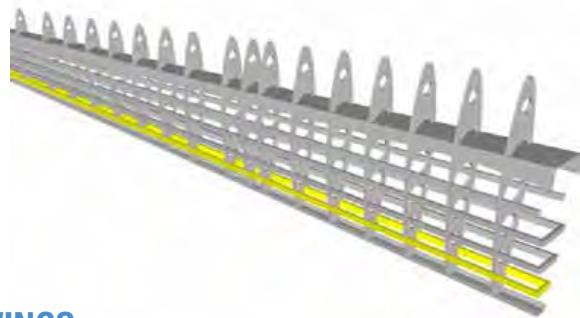
**ENGINE COMPONENTS
POWER PLANT**



FUSELAGE



LANDING GEAR



WINGS



EMPENNAGE







High Performance Cutting Tools



**TOOLING SOLUTIONS
FOR DIE, MOULD &
PATTERN INDUSTRY**





TOOLING SOLUTIONS FOR DIE & MOULD INDUSTRY

	ISO Material Group	Application Hardness Range	Catalogue Series	Surface Coating	Standard Range	Size Range	No of Flute	Trochoidal Milling Capability	Pg No.
	P2-P4	32 -45 HRC	HSM	TiAlN Base	Flat Endmill	3 mm to 20 mm	2 Flute / 4 Flute	Yes	2.115
					Ball nose Endmill	3 mm to 20 mm	2 Flute / 4 Flute	Yes	2.117
	P6 H1-H3	45-58 HRC	Proton Plus Series	Proton Plus	Flat Endmill	1 mm to 25 mm	2 /4/5/6 Flute	Yes	2.104
					Ball nose Endmill	1 mm to 12 mm	2 Flute	Yes	2.110
	P3-P4 H1-H4	45-70 HRC	Proton HD	TiAlN Base	Ball nose Endmill	1.0 mm to 16 mm	2 Flute / 4 Flute	Yes	2.031
					Torus Style	3mm to 16 mm	2 Flute / 4 Flute	Yes	2.034
					Multi flute finisher	3.0 mm to 20 mm	6-8 Flute	Yes	2.039
					Multi flute finisher with CR	3.0 mm to 20 mm	6-8 Flute	Yes	2.042
	H1-H4 P2-P6	45-70 HRC	Proton HD	TiAlN Base	Micro Flat Endmill	0.1 mm to 3 mm	2 Flute	Yes	2.047
					Micro Flat Endmill	0.2 mm to 3 mm	4 Flute	Yes	2.053
					Micro Ball nose Endmill	0.1 mm to 3 mm	2 Flute	Yes	2.067
					Micro - Flat & Ball with CR	0.1 mm to 3 mm	2 Flute / 4 Flute	Yes	2.057
	H3/H4	55-70 HRC	Proton HD	TiAlN Base	Ball nose 2 flute	0.1 mm to 12 mm	2 Flute	Yes	2.015
					Torus Style	0.1 mm to 12 mm	4 Flute	Yes	2.021
					Multi flute finisher	3.0 mm to 20 mm	6-16 Flute	Yes	2.027
					Multi flute finisher with CR	3.0 mm to 20 mm	6-16 Flute	Yes	2.028

SUCCESS STORIES

Customer	Mould Maker		Customer	Mould Maker		Customer	Mould Maker		Customer	Mould Maker	
Component	Mould		Component	Mould		Component	Mould		Component	Mould	
Material	1.2379 62 HRc		Material	1.2379 62 HRc		Material	1.21662 60 HRc		Material	Elmax Hardened 62 HRc	
Code	FBK0503571		Code	FBK0503535		Code	FBK0503554		Code	FBK0505796	
Description	EM 10.0 (FHPM 6 100 078 10 40) PHD		Description	BEM 6.0 (FHPK 2 060 064 06 L070) PHD		Description	EM 8.0 (FHPT 4 08B 078 08 40 L160) PHD		Description	EM 1.5 (FHPT 4 015 064 06 40 L015) PHD	
	Competitor	Forbes		Competitor	Forbes		Competitor	Forbes		Competitor	Forbes
Ø	10 mm	10 mm	Ø	6 mm	6 mm	Ø	8 mm	8 mm	Ø	1.5 mm	1.5 mm
Z	6 Flutes	6 Flutes	Z	2 Flutes	2 Flutes	Z	4 Flutes	4 Flutes	Z	4 Flutes	4 Flutes
Vc	100 m/min	100 m/min	Vc	160 m/min	160 m/min	Vc	25 m/min	200 m/min	Vc	85 m/min	85 m/min
n	3180 rpm	3180 rpm	n	8400 rpm	8400 rpm	n	995 rpm	7958 rpm	n	18000 rpm	18000 rpm
F	0.05 mm/rev	0.6 mm/rev	F	0.157 mm/rev	0.157 mm/rev	F	0.038 mm/rev	0.079 mm/rev	F	0.0115 mm/rev	0.02 mm/rev
Vf	954 mm/min	11448 mm/min	Vf	2630 mm/min	2630 mm/min	Vf	150 mm/min	2500 mm/min	Vf	828 mm/min	1440 mm/min
ap	20mm	20mm	ap	0.3 mm	0.3 mm	ap	3 mm	3 mm	ap	0.65 mm	0.65 mm
ae	0.1 mm	0.1 mm	ae	1.2 mm	1.2 mm	ae	0.25 mm	0.1 mm	ae	0.04 mm	0.04 mm
Coolant	Cold Air	Cold Air	Coolant	Min Lubrication	Min Lubrication	Coolant	Cold Air	Cold Air	Coolant	Min Lubrication	Min Lubrication
Productivity	10 times Higher		Productivity	4 times Higher		Productivity	6 times Higher		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 Performance 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

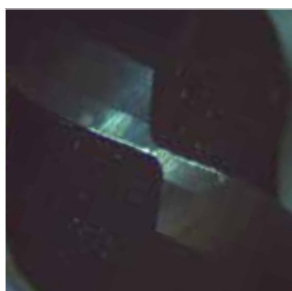
- Centre cutting high performance ball nose 2 Flute for 55-70 HRc
- Centre cutting high performance torus 4 Flute for 55-70 HRc
- Centre cutting high performance multi flute finisher for 55-70 HRc
- Centre cutting high performance multi flute finisher with corner radius for 55-70 HRc

Coating Details

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



Optimized
center



Wear

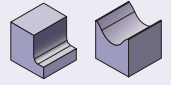


Edge
preparation

For multi flute finisher with corner radius the tolerance on the corner radius is $\pm 0.005\text{mm}$.

2 Flute

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



H3-H4

IMAGE 1

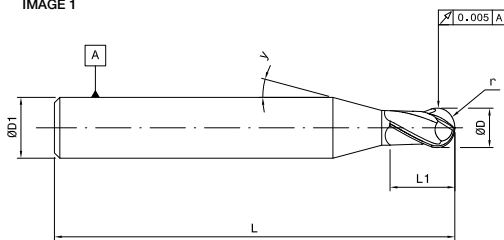
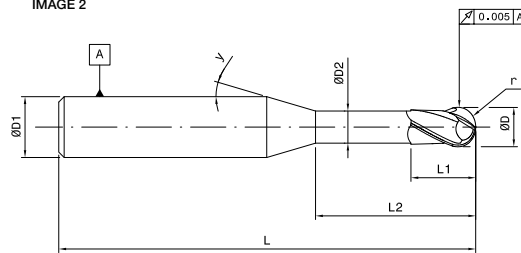


IMAGE 2



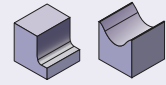
Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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



H2-H3

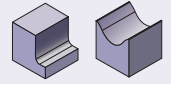
Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
										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

2 Flute

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



HSM



END MILLS

H3-H4

IMAGE 1

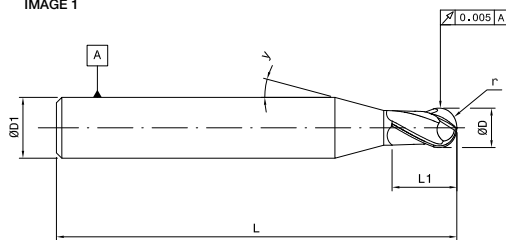
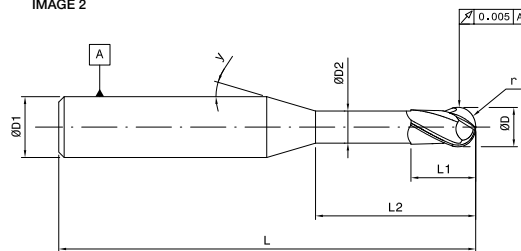


IMAGE 2



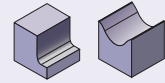
Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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



H3-H4

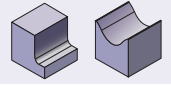
Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	Effective length compared with Inclined Angle				EDP No
										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

2 Flute

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



END MILLS

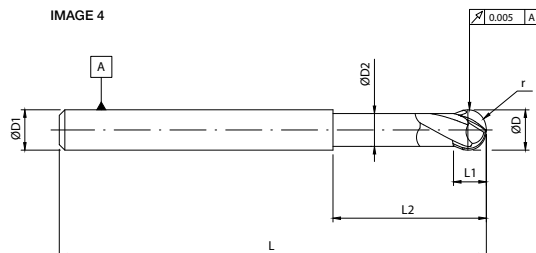
H3-H4



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 collision 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		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				
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		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																		
			Shoulder Milling	Profiling				Diameter in mm																		
																										
			ap 0.2D ae/D 3%					ap 0.2D ae/D 3%		mm	2.5		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	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

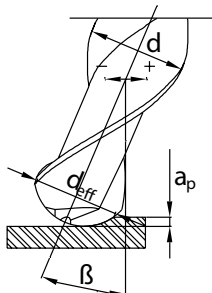
Advantages

- 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)

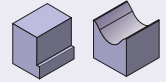
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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

4 Flute

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



END MILLS

H3-H4

IMAGE 1

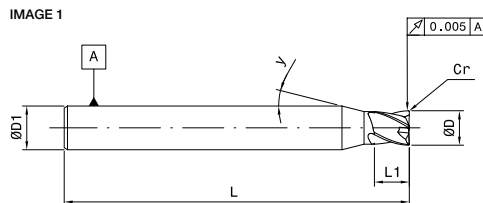
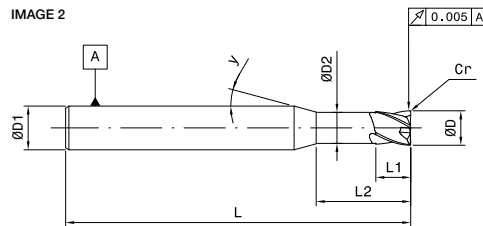


IMAGE 2

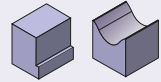


Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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

4 Flute

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



HSM



H3-H4

IMAGE 1

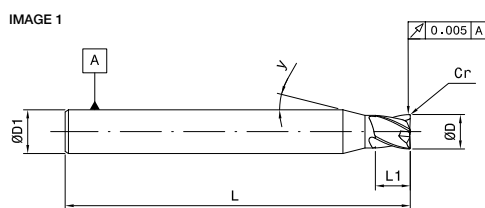
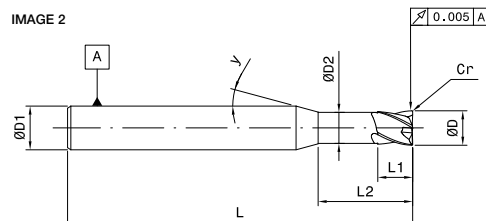


IMAGE 2



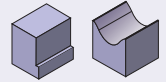
Unit : mm

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°	
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 collision in projection length area
Application data on page no 2.026

4 Flute

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



H3-H4

IMAGE 1

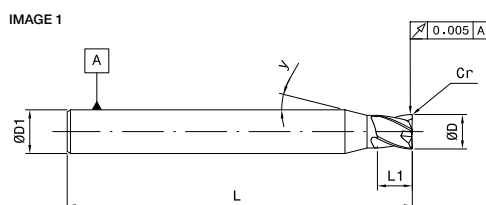
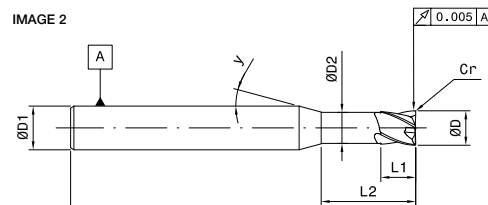


IMAGE 2

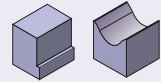


Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	Cr (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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

4 Flute

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



HSM



30°



f7

6535 HA

h5

TiAlN



H3-H4

IMAGE 1

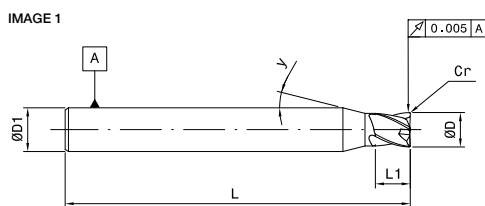
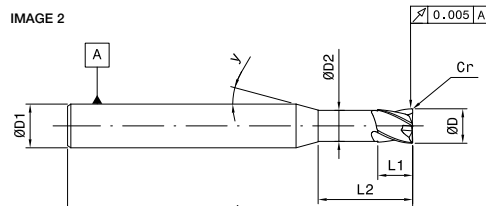


IMAGE 2

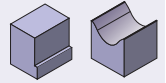


Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
										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

4 Flute

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



H3-H4

IMAGE 1

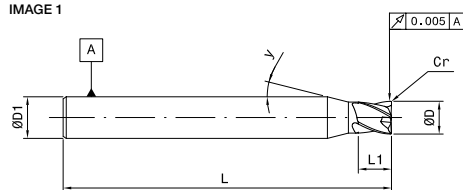


IMAGE 2

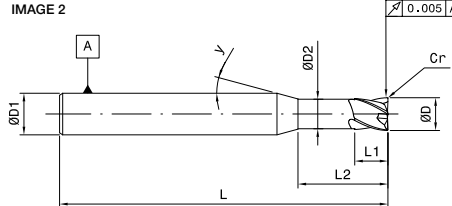
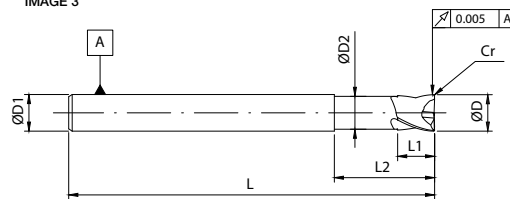


IMAGE 3



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				EDP No
										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				
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			
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 mm³/min	0.75 mm³/min
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Finishing application

6 times faster than competitor

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(V_f mm/min) X α = Corrected V_f (mm/min)

Disclaimer

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

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

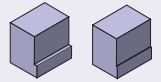
Q	21.52 mm³/min	37.44 mm³/min
---	---------------	---------------

Finishing application

42% Higher MRR

Multi Flute

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



END MILLS

Regular

Extra Teeth

H3-H4

IMAGE 1

IMAGE 2

Regular

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

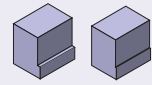
Extra Teeth

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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 collision 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



Regular

Extra Teeth

H3-H4

IMAGE 1

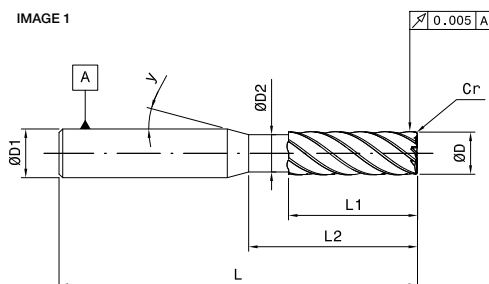
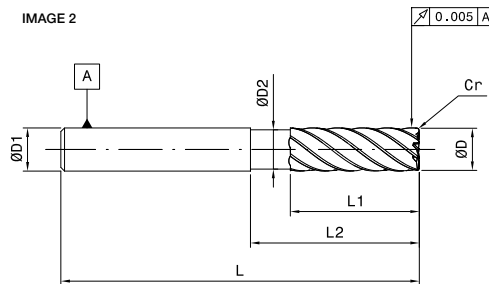


IMAGE 2



Regular

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

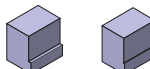
ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
8.00	18.00	7.60	25.00	78.00	8.00	0.50	8	-	2	FBK0504474
10.00	22.00	9.40	30.00	78.00	10.00	0.50	10	-	2	FBK0504475
12.00	26.00	11.40	35.00	89.00	12.00	0.50	12	-	2	FBK0504476
16.00	34.00	15.40	40.00	89.00	16.00	0.50	16	-	2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

Remark ∞ means no collusion in projection length area

Application data on page no 2.029

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(V_f mm/min) X α = Corrected V_f (mm/min)

Disclaimer

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



End mills for hardened steels 45-70 HRc

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

Program

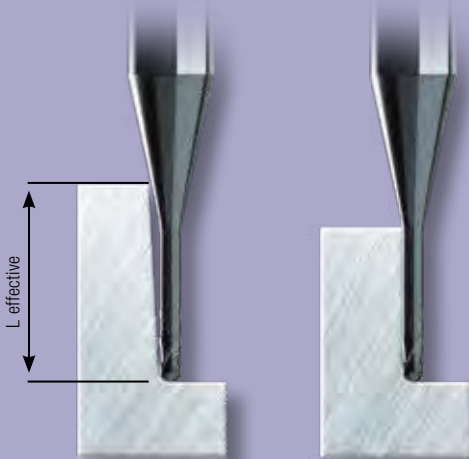
- Centre cutting high performance ball nose 2 flute for 45-70 HRc
- Centre cutting high performance ball nose 4 flute for 45-70 HRc
- Centre cutting high performance torus 2 flute for 45-70 HRc
- Centre cutting high performance torus 4 flute for 45-70 HRc
- Centre cutting high performance multi flute 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 mm³/min	0.75 mm³/min
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Higher productivity



2 Flute

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

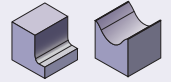


IMAGE 1

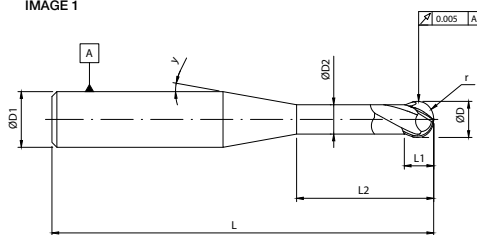
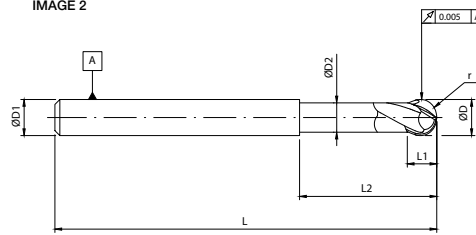


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

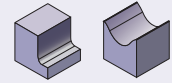


IMAGE 1

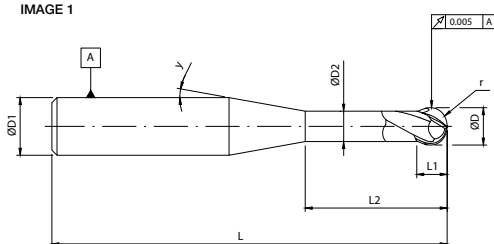
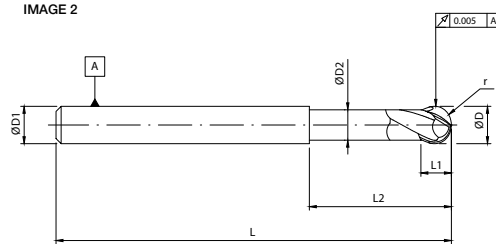


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

Cutting parameters

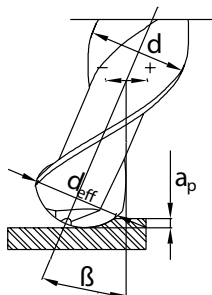
- Centre cutting high performance ball nose 2 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm
- Centre cutting high performance ball nose 4 flute for 45-70 HRc (Roughing+ Finishing) - 1.0 mm to 5.0 mm

Material Group			Cutting Speed (Vc) m/min		Lubrication	Cutting Speed (Vc) m/min	Recommended Feed/Tooth (fz)													
			Shoulder Milling	Profile Milling			Diameter in mm													
			Rough Milling	Finish Milling																
							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	
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%	MQL/ Cold Air	Cutting Speed (Vc) m/min	mm	1.0	1.5	2.0	3.0	4.0	5.0							
Hardened Steel	H	1	120	150		min	max	Range	min	max	min	max	min	max	min	max	min	max		
		2	150	180		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
		3	200	220		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
		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		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)										
			Shoulder Milling	Profile Milling				Diameter in mm										
			Rough Milling	Finish Milling														
								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
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%	MQL/ Cold Air	Cutting Speed (Vc) m/min		mm	6.0		8.0		10.0		12.0		16.0	
Hardened Steel	H		min	max		Range	min	max	min	max	min	max	min	max	min	max	min	max
		1	120	150		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

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

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)

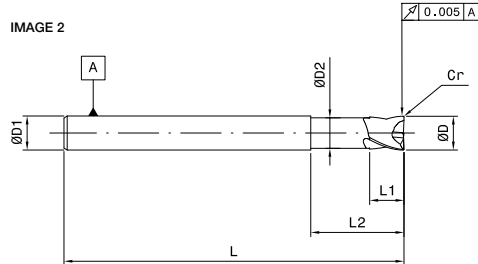
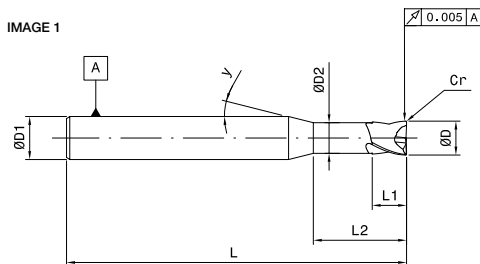
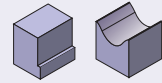
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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

2 Flute

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



P5-P6

H1-H4

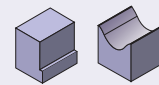
Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

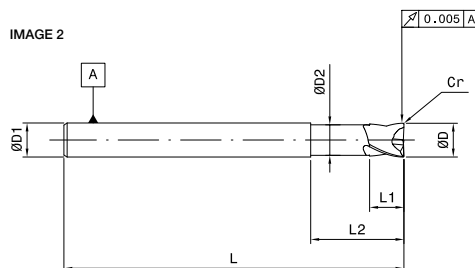
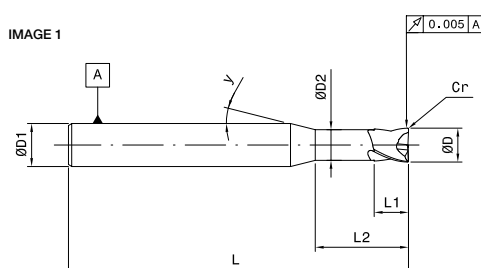
Application data on page no 2.038

2 Flute

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



END MILLS



P5-P6

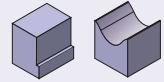
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

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



P5-P6

H1-H4

IMAGE 1

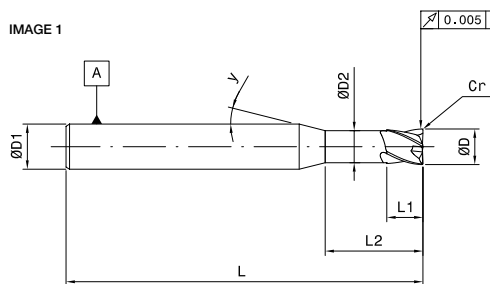
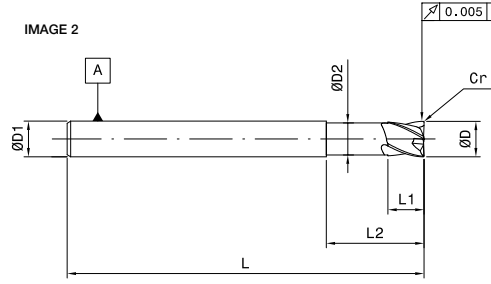


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

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

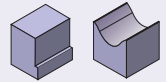


IMAGE 1

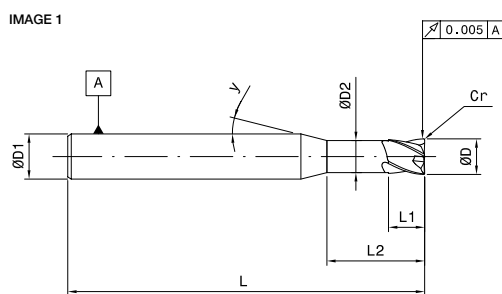
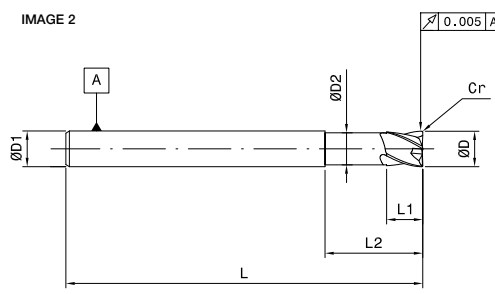


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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	Profile Milling				Diameter in mm												
			(Rough Milling)	(Finish Milling)																
																				
			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	Profile Milling				Diameter in mm										
			(Rough Milling)	(Finish Milling)														
																		
			ap 1D ae/D 30%	ap 1D ae/D 10%				min	max	Range	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(V_f mm/min) X α = Corrected V_f (mm/min)

Disclaimer

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

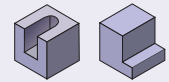


Tips:

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

4 Flute

Centre cutting high performance torus cutter for high feed machining



P3-P4

H1

IMAGE 1

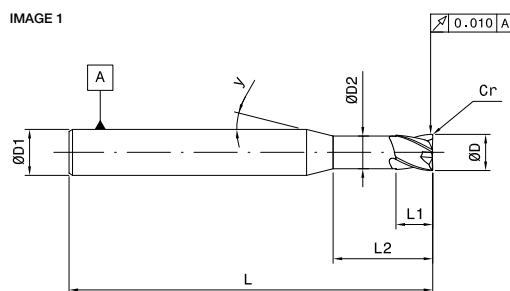
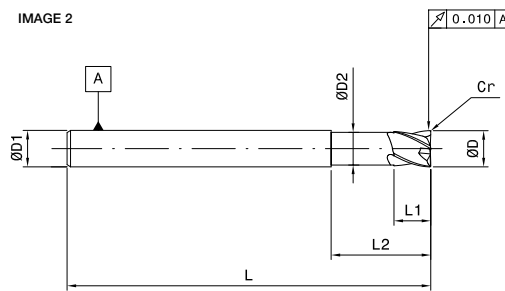


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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 ØD1-h5	Cutting diameter ØD-e8	Cutting diameter ØD-f7	Cutting diameter ØD-g7	Cutting diameter 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	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
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	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	min
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

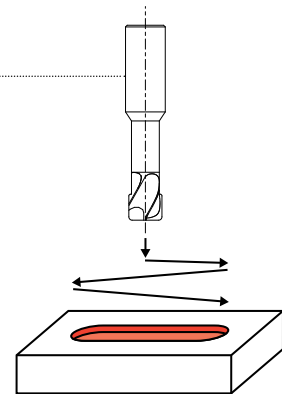
	Totem
Ø	8mm
Z	4 Flute
vc	150 m/min
n	6000 rpm
fz	0.,70 mm/t
vf	16800 mm/min
ap	0.,5 mm
ae	8.0 mm
Coolant	emulsion

Q	67.2 cm³/min
---	--------------

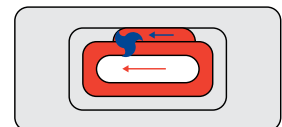
Advantages

- High feed rates
- Lower cycle time for roughing

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.



Note

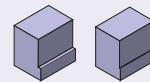
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

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

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


END MILLS



IMAGE 1

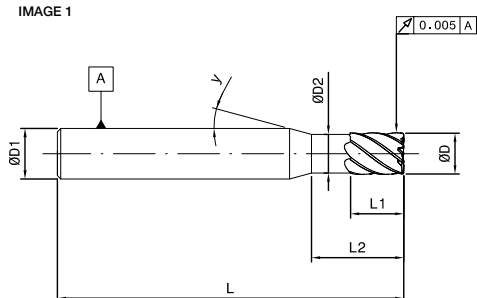
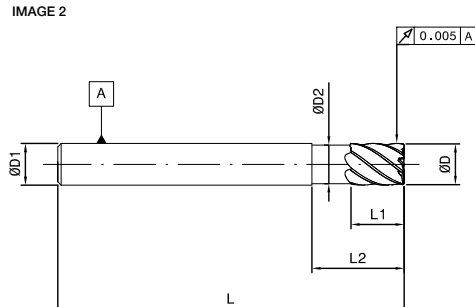


IMAGE 2



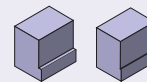
P5-P6

H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

Multi Flute

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


P5-P6

H1-H4

IMAGE 1

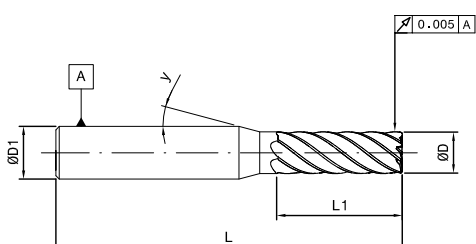
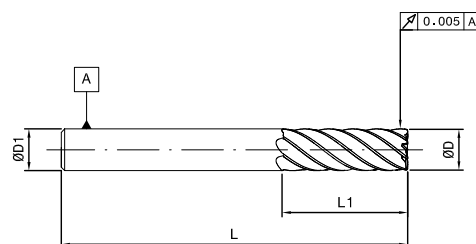


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																		
			(Finish Milling)																						
																									
							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.



Contact our Mould & Die experts
 at sales@forbes.co.in

Multi Flute

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

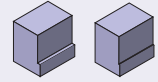


IMAGE 1

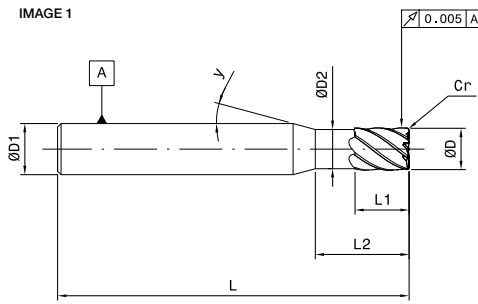
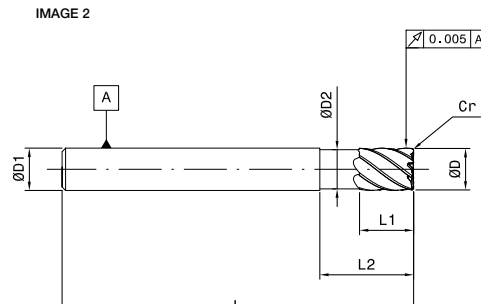


IMAGE 2



P5-P6

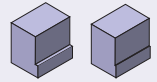
H1-H4

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

Multi Flute

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



P5-P6

H1-H4

IMAGE 1

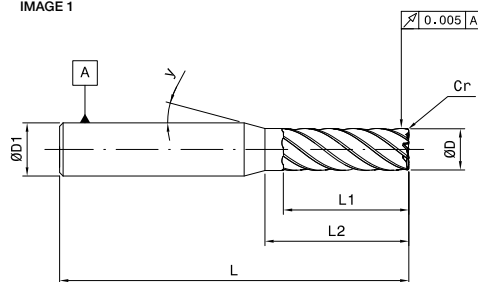
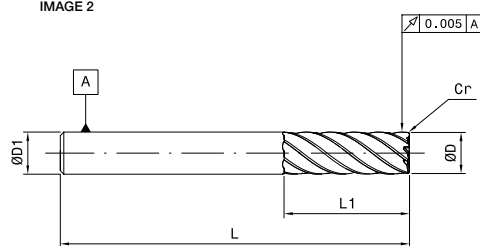


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)										
			Shoulder Milling	Shoulder Milling				Diameter in mm										
			Semi Finish Milling	Finish Milling														
																		
			ap 2D ae/D 10%	ap 2D ae/D 10%				min	max	Range	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		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)								
			Shoulder Milling	Shoulder Milling												
			Semi Finish Milling	Finish Milling												
																
			ap 2D ae/D 10%	ap 2D ae/D 10%				min	max	Range	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(V_f mm/min) X α = Corrected V_f (mm/min)

Disclaimer

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

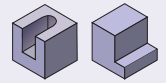
Multi flute finisher
Recommended for Side milling.

Multi flute finisher with corner radius
Recommended for Shoulder milling.



2 Flute

Centre cutting high performance 2 flute micro end mill



END MILLS



IMAGE 1

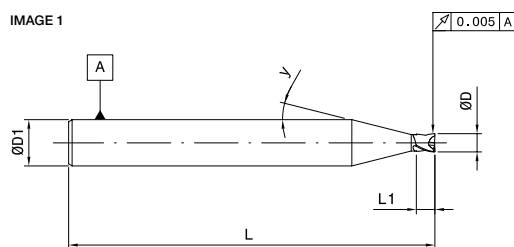
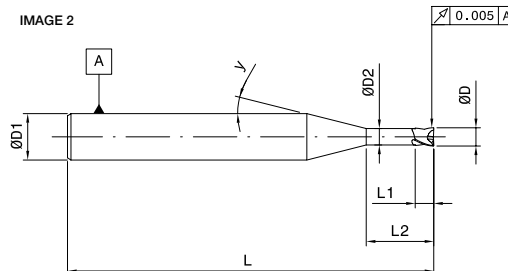


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

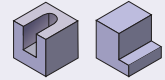
H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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

2 Flute

Centre cutting high performance 2 flute micro end mill



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
										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 collision in projection length area
Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill

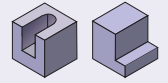


IMAGE 1

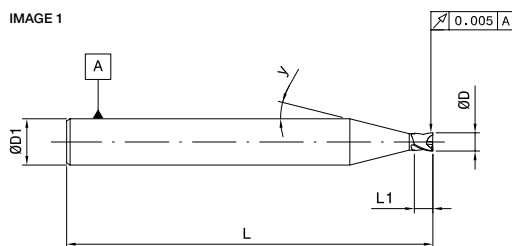
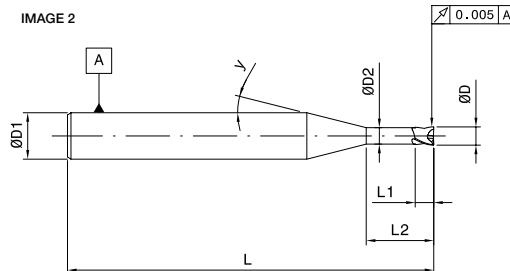


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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 collision in projection length area
Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro end mill

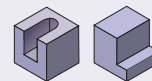


IMAGE 1

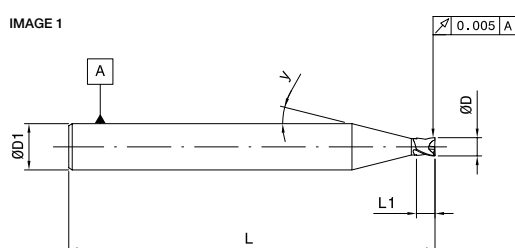
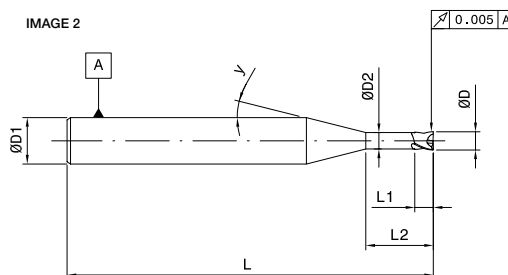


IMAGE 2



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

2 Flute

Centre cutting high performance 2 flute micro end mill

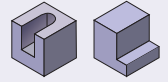


IMAGE 1

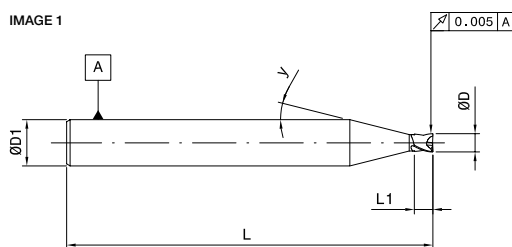
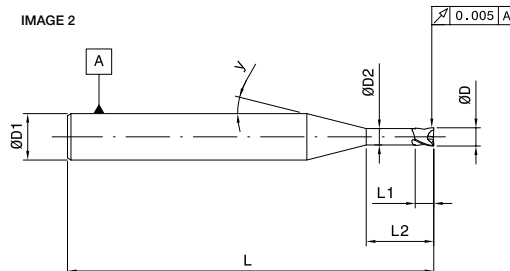


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

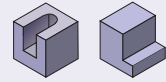
H1-H4

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

2 Flute

Centre cutting high performance 2 flute micro end mill



P5-P6

K1

M1-M3

S1-S4

H1-H4

IMAGE 1

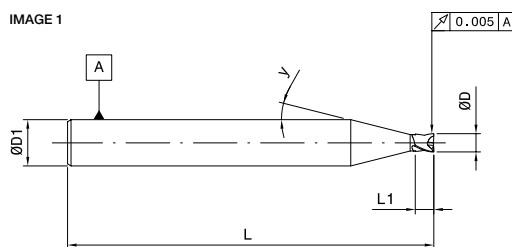
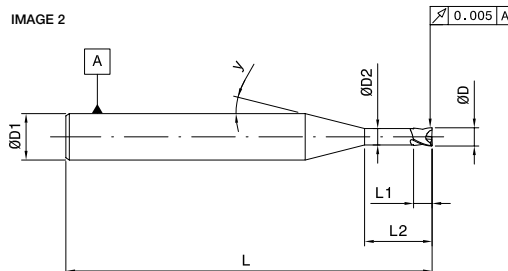


IMAGE 2

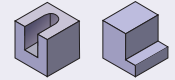


Unit : mm

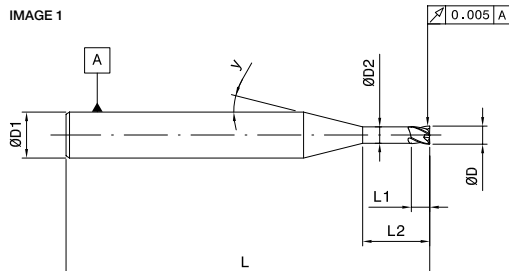
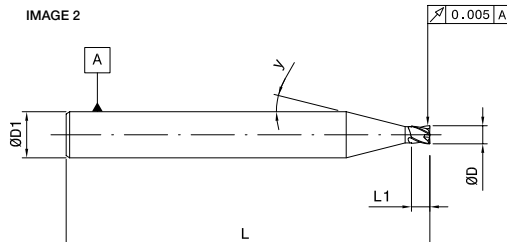
ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		0.5°	1°	2°	3°	
2.00	3.00	1.90	8.00	64.00	6.00	-	2	14	2	9.134	9.478	10.250	11.160	FBK0505200
2.00	3.00	1.90	10.00	64.00	6.00	-	2	15	2	11.210	11.601	12.470	13.482	FBK0503709
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

4 Flute

Centre cutting high performance 4 flute micro end mill



END MILLS

										P5-P6 K1 M1-M3 S1-S4 H1-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	0.25	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			

4 Flute

Centre cutting high performance 4 flute micro end mill

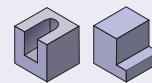


IMAGE 1

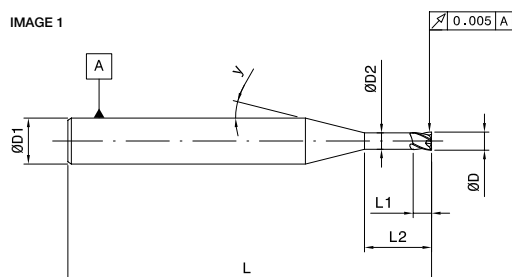
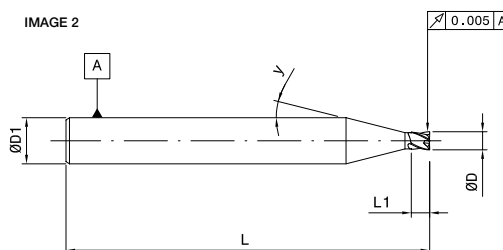


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

H1-H4

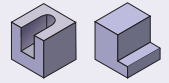
Unit : mm

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

4 Flute

Centre cutting high performance 4 flute micro end mill



END MILLS



P5-P6

K1

M1-M3

S1-S4

H1-H4

IMAGE 1

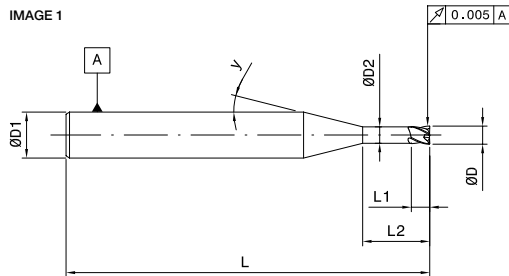
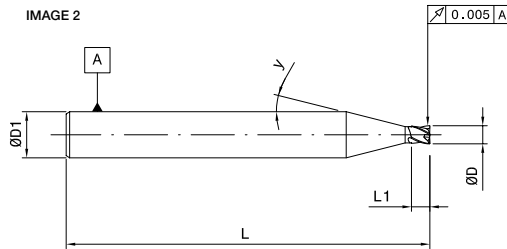


IMAGE 2



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	0.30	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

4 Flute

Centre cutting high performance 4 flute micro end mill

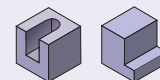


IMAGE 1

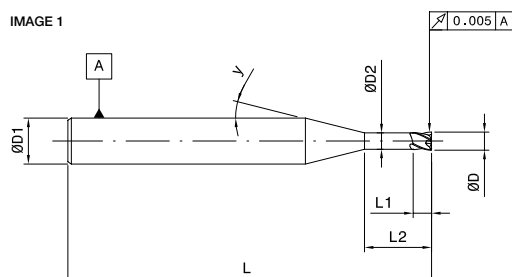
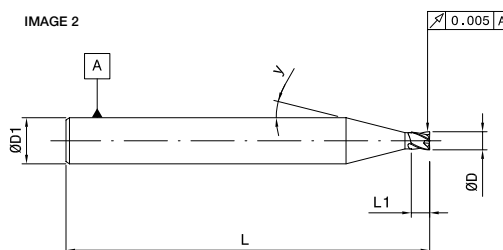


IMAGE 2



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

2 Flute

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

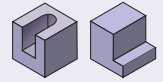


IMAGE 1

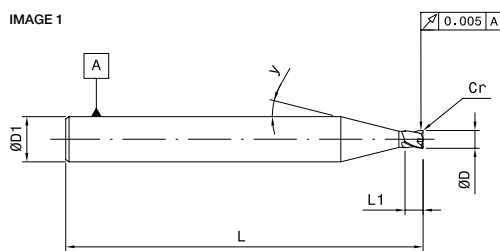
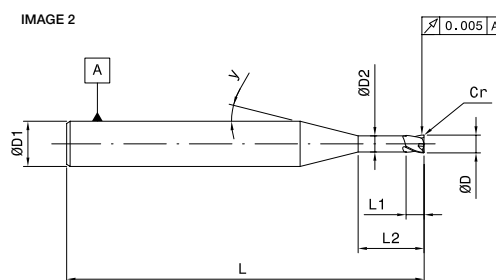


IMAGE 2



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				EDP No
										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

2 Flute

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

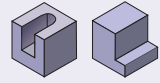


IMAGE 1

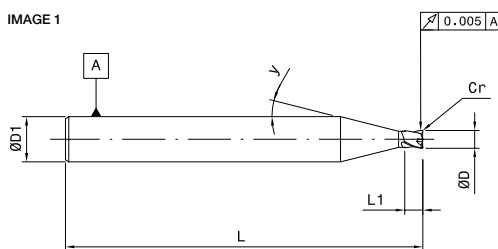
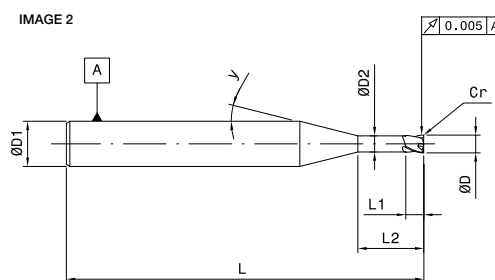


IMAGE 2



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

2 Flute

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

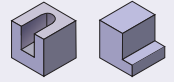


IMAGE 1

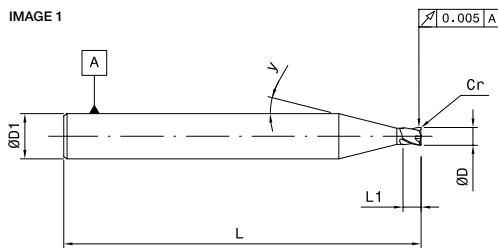
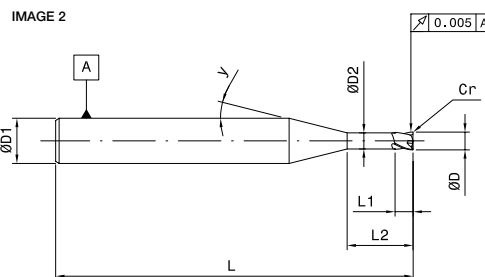


IMAGE 2



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				EDP No
										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 collision 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

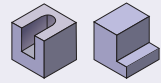


IMAGE 1

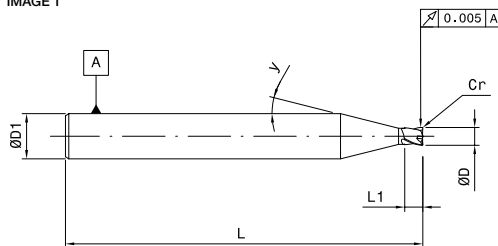
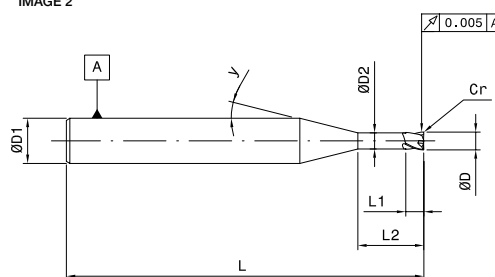


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

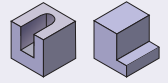
H1-H4

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

2 Flute

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



END MILLS

IMAGE 1

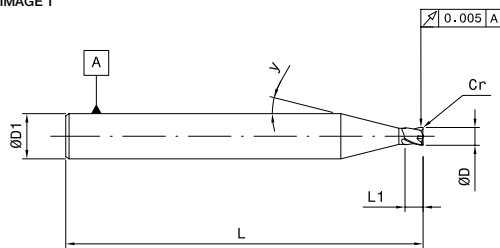
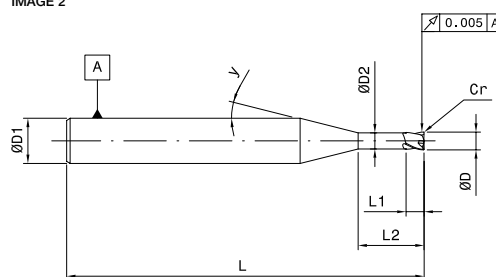


IMAGE 2



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				EDP No
										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

2 Flute

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

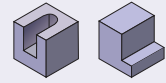


IMAGE 1

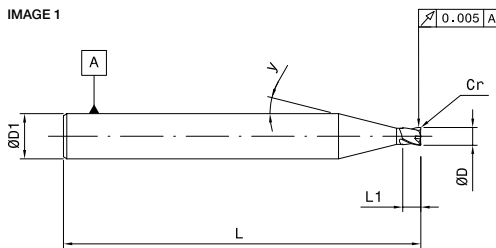
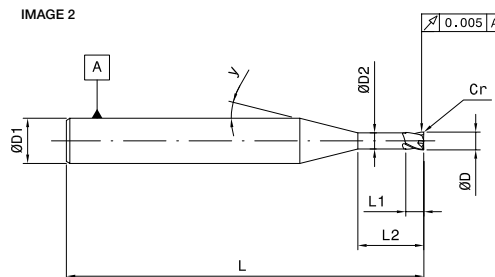


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

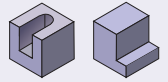
H1-H4

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

4 Flute

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



END MILLS



P5-P6

K1

M1-M3

S1-S4

H1-H4

IMAGE 1

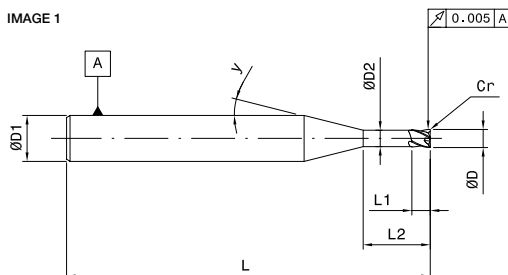
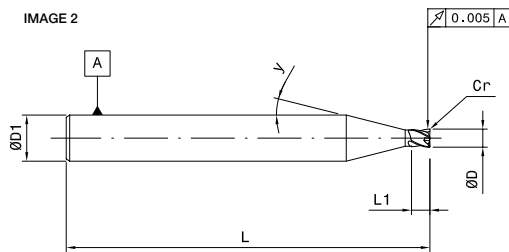


IMAGE 2



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	0.25	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

4 Flute

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

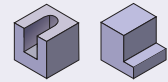


IMAGE 1

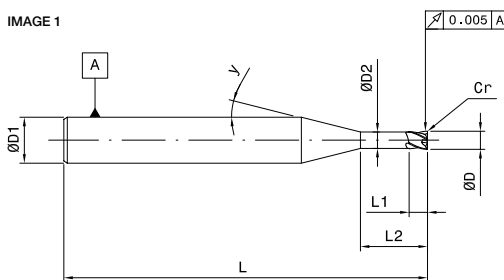
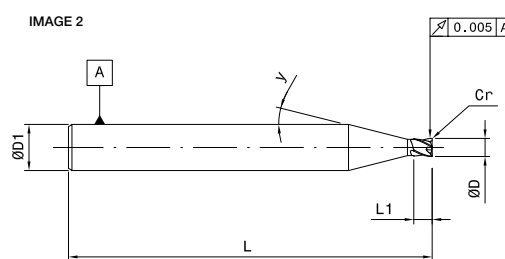


IMAGE 2



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 collision in projection length area
Application data on page no 2.073 & 2.074

4 Flute

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

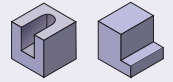


IMAGE 1

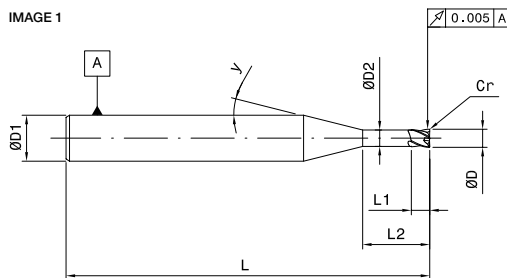
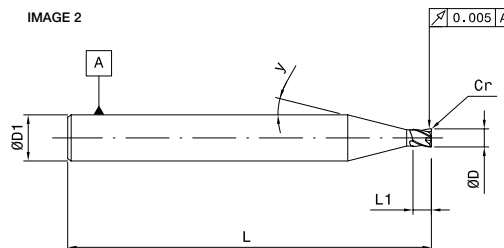


IMAGE 2



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				EDP No
										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

4 Flute

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

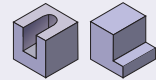


IMAGE 1

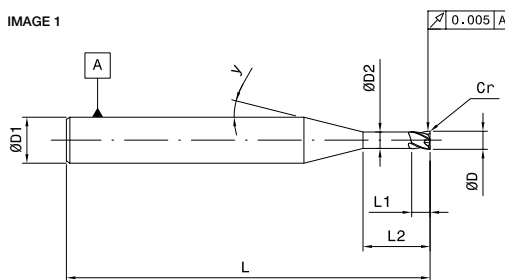
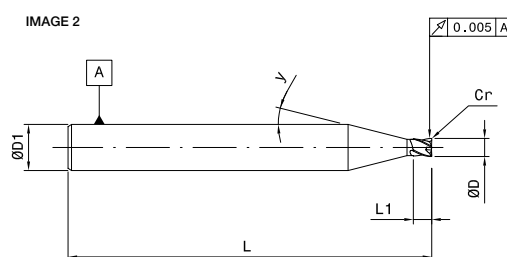


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

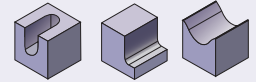
H1-H4

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

2 Flute

Centre cutting high performance 2 flute micro ball nose



END MILLS



IMAGE 1

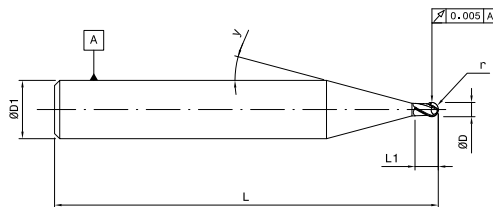
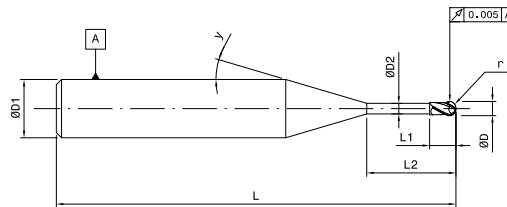


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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

2 Flute

Centre cutting high performance 2 flute micro ball nose

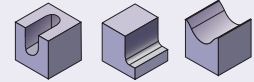


IMAGE 1

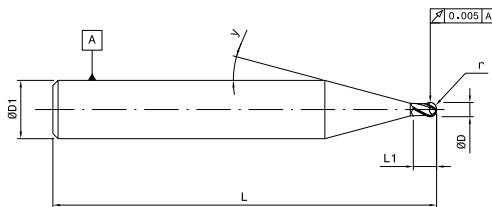
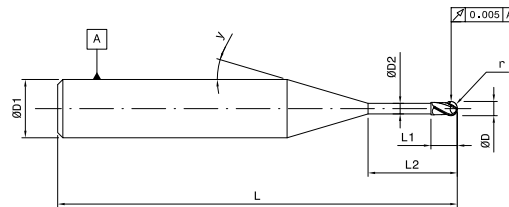


IMAGE 2



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	1.20	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

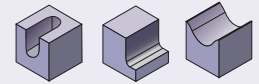
Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Remark ∞ means no collision in projection length area

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro ball nose



END MILLS



IMAGE 1

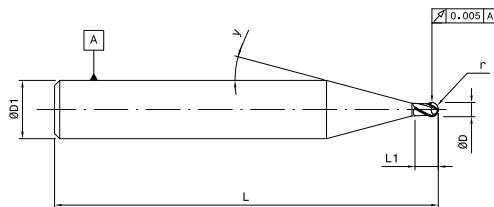
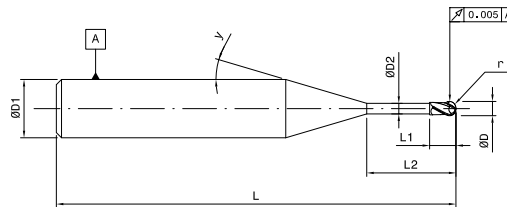


IMAGE 2



P5-P6

K1

M1-M3

S1-S4

H1-H4

Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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 collision in projection length area

Application data on page no 2.073 & 2.074

2 Flute

Centre cutting high performance 2 flute micro ball nose

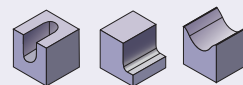


IMAGE 1

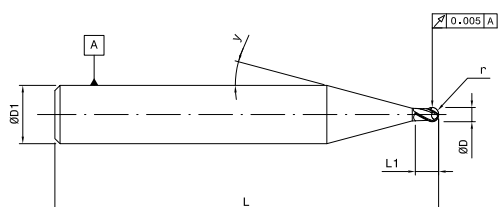
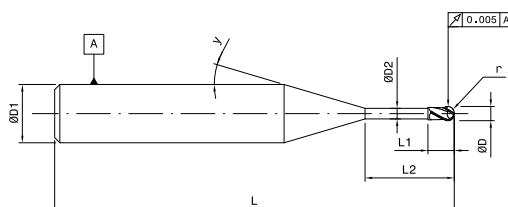


IMAGE 2



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

2 Flute

Centre cutting high performance 2 flute micro ball nose

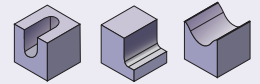


IMAGE 1

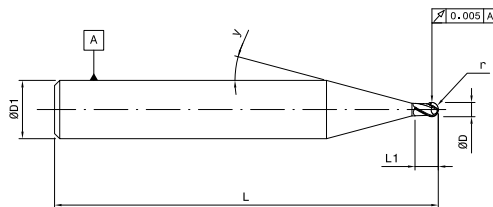
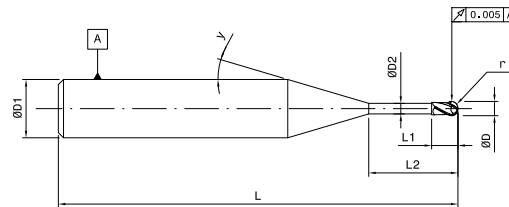


IMAGE 2



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

2 Flute

Centre cutting high performance 2 flute micro ball nose end mill

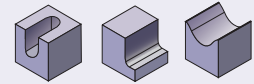


IMAGE 1

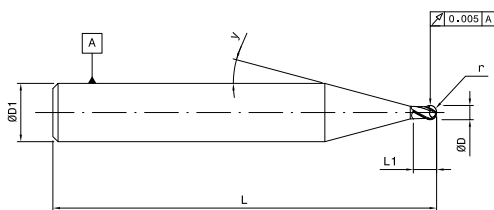
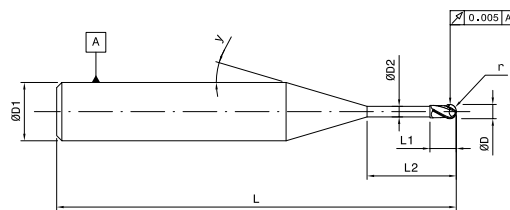


IMAGE 2



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	FBK0503861
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

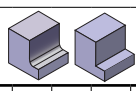
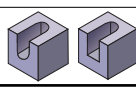
Machining with a Tilt Angle will help in better tool life as the cutting speed at the center of a ball nose tool is 0

Remark ∞ means no collision in projection length area

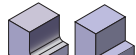
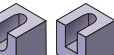
Application data on page no 2.073 & 2.074

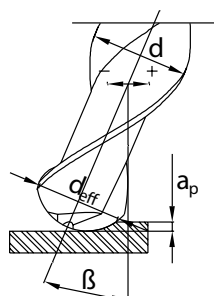
Cutting parameters

- 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									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.																	
									Lubrication		Diameter in mm																	
											Cutting Speed (Vc) m/min		mm		0.1		0.2		0.3		0.4		0.5		0.6		0.8	
											ap< 0.6D		ap< 0.6D		ap< 0.6D		ap< 0.5D		ap< 0.4D		ap< 0.3D		ap< 0.3D		ap< 0.3D		ap< 0.3D	
											ae/D 1%		ae/D 2%		ae/D 5%		ae/D 10%		ae/D 20%		ae/D 30%		ae/D 50%		ae/D 100%			
Steel	P	5	150	129	118	107	97	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	
		2	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	
Super Alloys	S	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	
		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									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	Lubrication	Cutting Speed (Vc) m/min		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%			mm		1.0		1.2		1.5		2.0		2.5		3.0	
		min	max	min	max	min	max	min	max	min	max	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	0.009	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	Emulsion	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	Emulsion	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
		2	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
Super Alloys	S	2	70	60	55	50	45	44	42	34	Emulsion	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
		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)

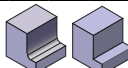
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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

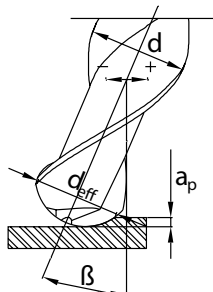
Cutting parameters

- 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												Recommended Feed/Tooth (fz=mm/th) for shoulder milling/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.																																					
Hardened Steel		H		1		ap < 0.45D		ap < 0.45D		ap < 0.4D		ap < 0.35D		ap < 0.3D		ap < 0.3D		Lubrication		Cutting Speed (Vc) m/min		mm		Diameter in mm																											
						ap < 0.3D		ap < 0.3D		ap < 0.3D		ap < 0.3D		ap < 0.3D		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					
						1		190		163		149		136		122		118		113		91		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	
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	
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	
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								Recommended Feed/Tooth (fz=mm/th) for shoulder milling/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 < 0.45D	ap < 0.45D	ap < 0.45D	ap < 0.4D	ap < 0.35D	ap < 0.3D	ap < 0.3D	ap<0.3D	Lubrication	Cutting Speed (Vc) m/min		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	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
		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
		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
		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

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

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 finish.
- Save a polishing operation.

Coolant

Keep the tool cool!

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

- ❶ From the front into the flutes for direct cooling.
- ❷ Pointed from the right hand side in the flutes to evacuate the chips.

When to use, what kind of coolant:*

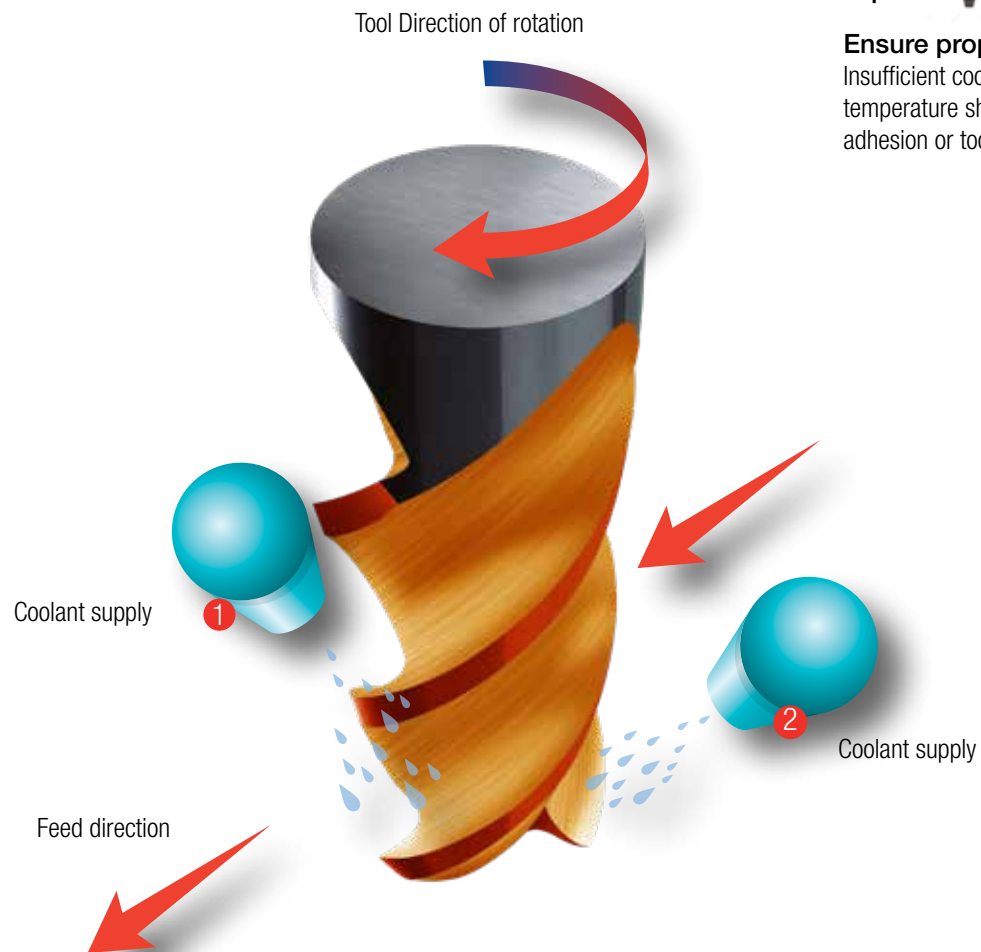
Emulsion	Minimum lubrication (Preference) Or Air
Vc < 200 m/min	Vc > 200 m/min
Aluminium	Graphite
Copper	Synthetics
Exotic materials (Stainless Steel, Titanium, Hastelloy)	Hardness over 50 HRc
Hardness less than 50 HRc	

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

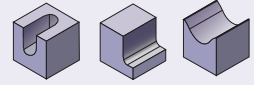


IMAGE 1

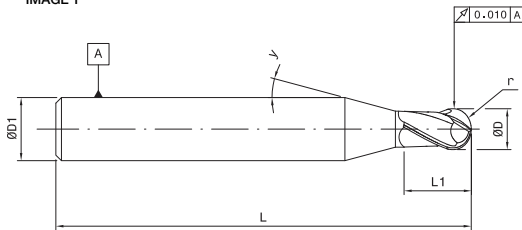
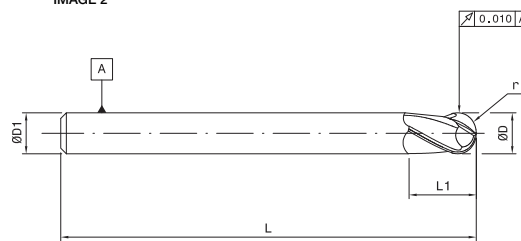


IMAGE 2



* For endmills L ≤ 100 mm.

P5-P6

K1-K2

M1-M3

S1-S4

H1

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

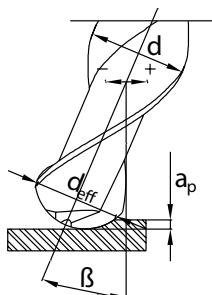
Cutting parameters

- 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	Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%															
				Shoulder Milling	Slot Milling																	
							Diameter in mm															
				Cutting Speed (Vc) m/min	mm		0.4		0.5		0.6		0.8		1.0		1.5		2.0			
							min	max	Range	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			Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%														
			Shoulder Milling	Slot Milling				Diameter in mm														
																						
			ap<1.5D ae/D<30%	ap<1.5D ae/D<10%		Cutting Speed (Vc) m/min	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		
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

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

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.

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
---	-----------

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 tool life
- 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
f _z	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

2 Flute

Centre cutting high performance diamond tipped end mill with corner radius



END MILLS



N1-N7

IMAGE 1

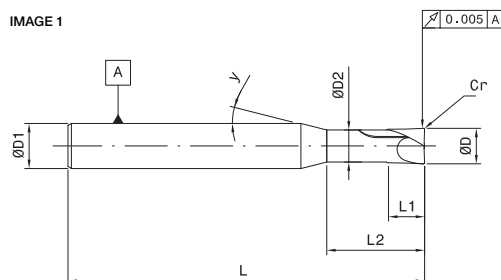
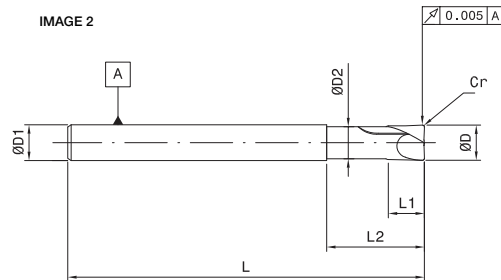


IMAGE 2



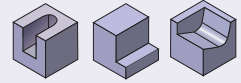
Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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



N1-N7

IMAGE 1

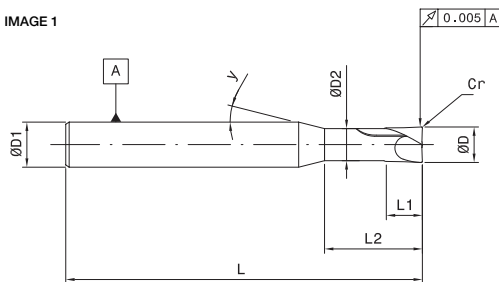
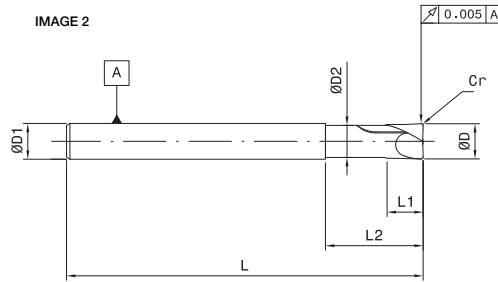


IMAGE 2

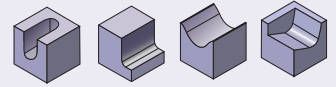


Unit : mm

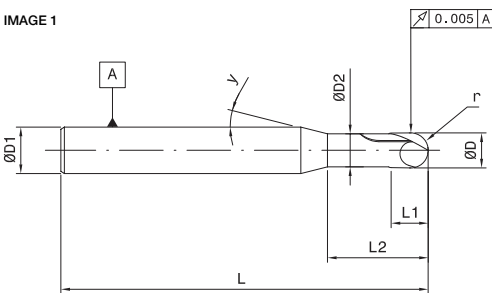
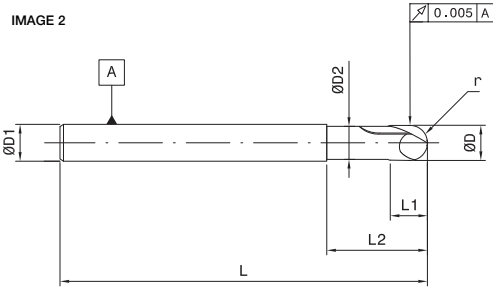
ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
Long										
3.00	3.00	2.80	9.00	78.00	6.00	0.30	2	15	1	FBK0506002
3.00	3.00	2.80	9.00	78.00	6.00	0.50	2	15	1	FBK0506003
4.00	4.00	3.80	12.00	78.00	6.00	0.30	2	15	1	FBK0506004
4.00	4.00	3.80	12.00	78.00	6.00	0.50	2	15	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

2 Flute

Centre cutting high performance diamond tipped ball nose end mill



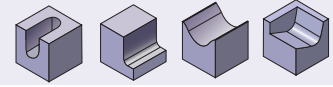
END MILLS

										N1-N7
IMAGE 1  IMAGE 2 										Unit : mm
ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

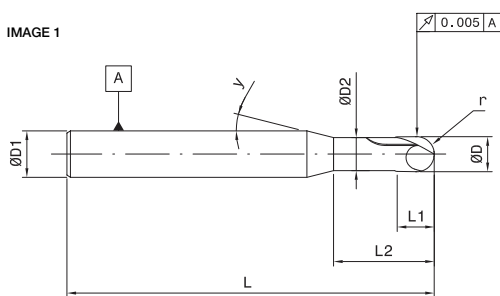
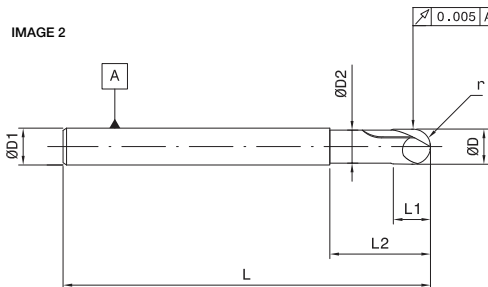


IMAGE 2

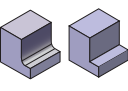


Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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

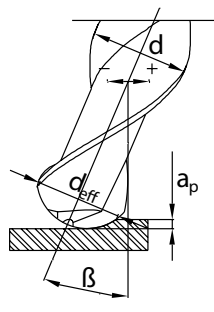
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)														
							Diameter in mm														
							mm	3.0		4.0		5.0		6.0		8.0		10.0		12.0	
			ap <0.65D ae/D 40%	min	max	Range	min	max	min	max	min	max	min	max	min	max	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		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	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
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



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

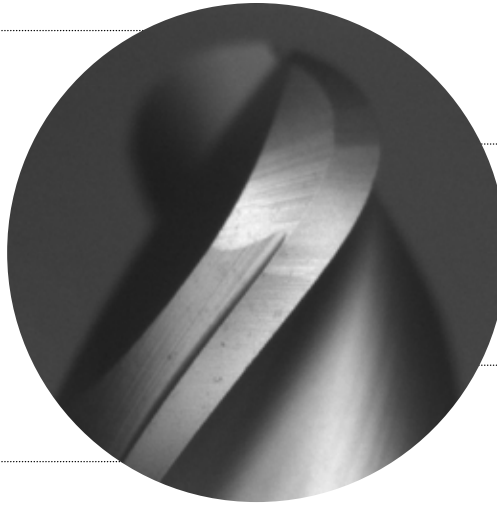
Challenge	Reduction in Cycle time
Component	Semiconductor - Reppler
Competiton	Cogo
Solution	BEM 6.00(+0.01)MMX15X100 SH6 2FLT DI
Cutting data	Machine : Okuma- VMC, Shrinkfit- Totem, Coolant – Vacuum RPM 6000, Feed 2500 Existing Tool Life – 10Hours Achieved Tool Life – 10 Hours
Result	Similar Tool life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

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

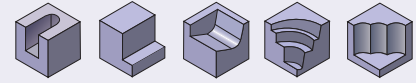
Q	72 cm ³ /min	288 cm ³ /min
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Higher productivity



2 Flute

Centre cutting high performance
2 flute rougher for graphite



HVM



N5-N7

IMAGE 1

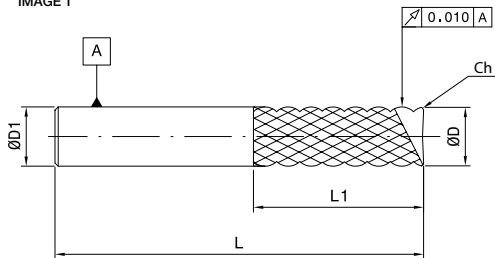
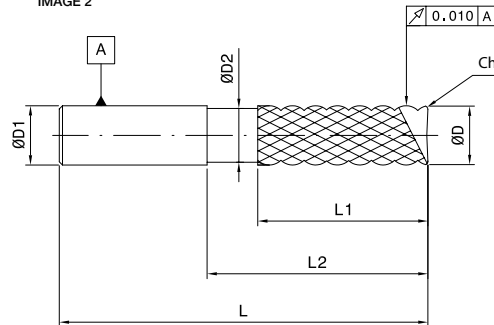


IMAGE 2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Ch	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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													
			ap 2.5D ae/D 10%	ap 2D ae/D 25%	ap 1D ae/D 50%	ap 1D ae/D 100%				mm	4.0		6.0		8.0		10		12		16		
			min	max	min	max		min	max	min	max	min	max	min	max	min	max	min	max				
Non Ferrous	N	5					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	600	550	525	500		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 cm³/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)

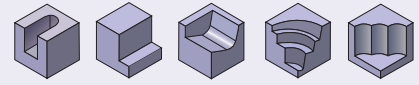
Feed of Recommended Milling Condition(V_f mm/min) X α = Corrected V_f (mm/min)

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



N5-N7

IMAGE 1

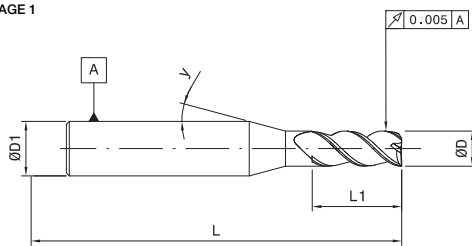
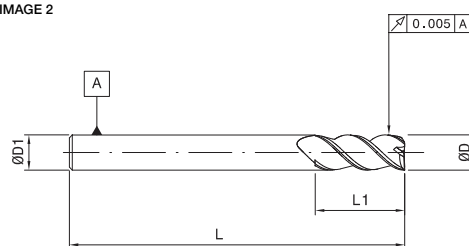


IMAGE 2

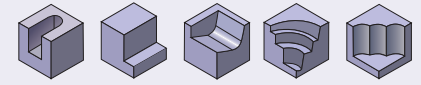


Unit : mm

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

Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite



END MILLS



N5-N7

IMAGE 1

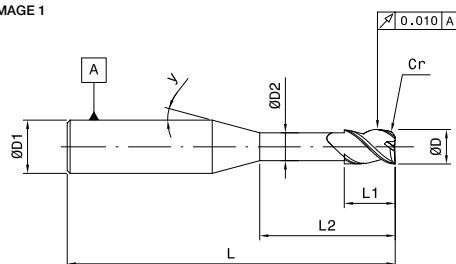
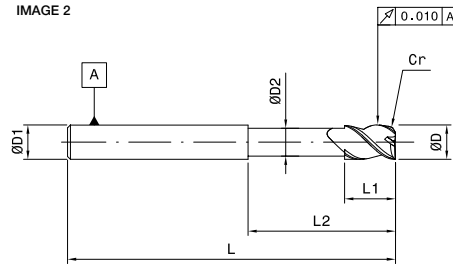


IMAGE 2

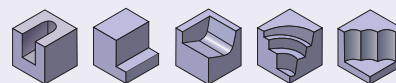


Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

Optimum Flutes

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



N5-N7

IMAGE 1

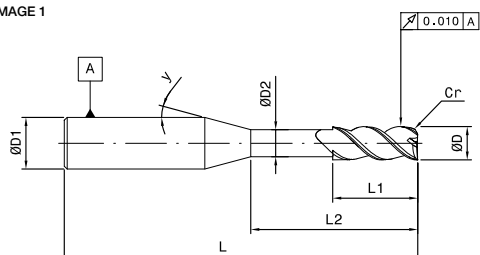


IMAGE 2

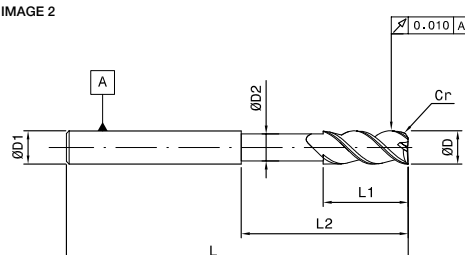


IMAGE 3

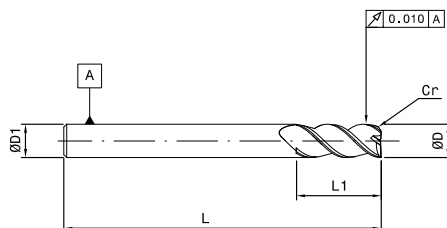
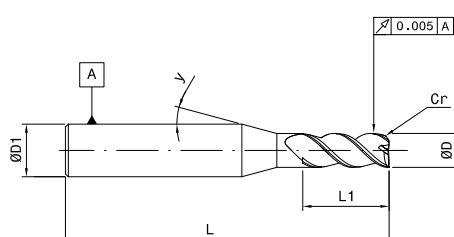


IMAGE 4

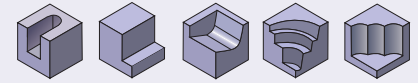


Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

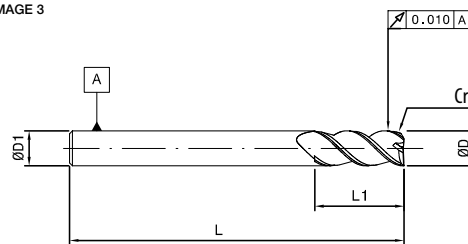
Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite



N5-N7

IMAGE 3



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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											
																	
	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	max
Non Ferrous N	5					500	<600	fz	0.010	0.030	0.015	0.040	0.025	0.050	0.035	0.060	
	6	600	550	525	500	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											
																	
	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	max
Non Ferrous N	5					500	<600	fz	0.045	0.080	0.055	0.100	0.075	0.120	0.090	0.140	
	6	600	550	525	500	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 cm³/min	3.00 cm³/min
Tool life	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 cm³/min
---	--------------

Higher MRR

Note

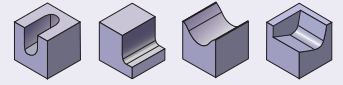
When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.
 $(\text{Maximum Spindle Speed of Spindle}) / (\text{Spindle Speed of Recommended Milling Condition}) = \text{Conversion Rate}(\alpha)$

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.

Optimum
Flutes

Centre cutting high performance ball
nose for graphite

HPM
HSM

2-3

40°

FHC

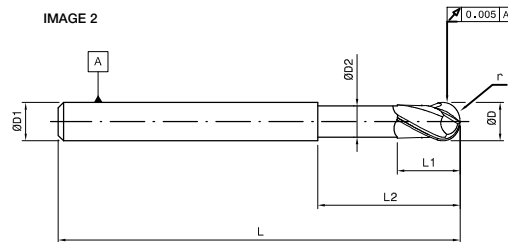
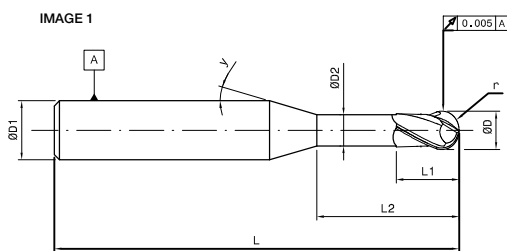
6535 HA

h5

D

END MILLS

N5-N7

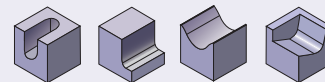


Unit : mm

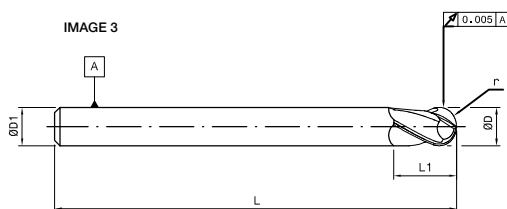
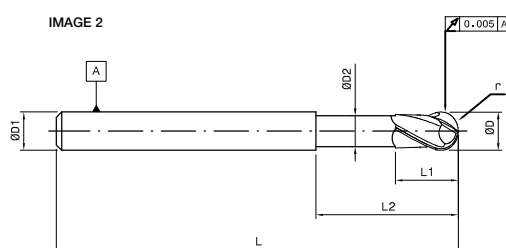
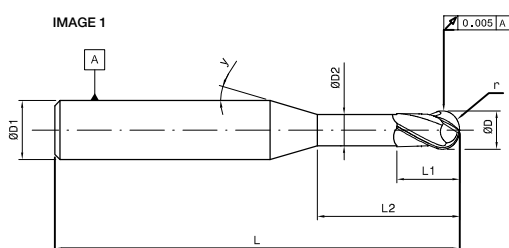
ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
Short										
2.00	3.00	1.80	10.00	50.00	3.00	1.00	2	15	1	FBK0504272
3.00	4.00	2.80	10.00	51.00	6.00	1.50	2	15	1	FBK0504273
4.00	4.00	3.80	10.00	51.00	6.00	2.00	4	15	1	FBK0504274
5.00	5.00	4.70	10.00	51.00	6.00	2.50	4	15	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

Optimum Flutes

Centre cutting high performance ball nose for graphite



N5-N7

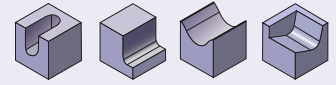


Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

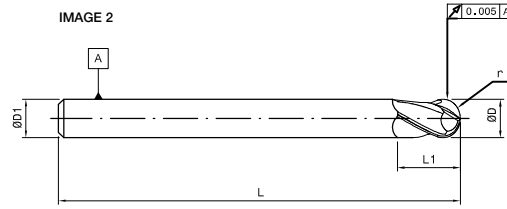
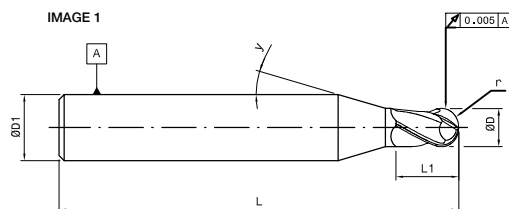
Optimum Flutes

Centre cutting high performance ball nose for graphite



END MILLS

N5-N7



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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										
																	
		ap 2D ae/D 20%			ap 2D ae/D 10%		min	max	Range	2.0		3.0		4.0		5.0	
		mm	2.0		3.0		4.0		5.0								
						min	max	Range	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

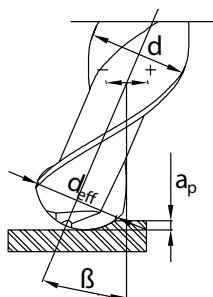
Material Group		Cutting Speed (Vc) m/min for Shoulder Milling		Lubrication	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)										
		Roughing	Finishing				Diameter in mm										
																	
		ap 2D ae/D 20%					ap 2D ae/D 10%		mm	6.0		8.0		10.0		12.0	
		min	max				Range	min	max	min	max	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

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

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)

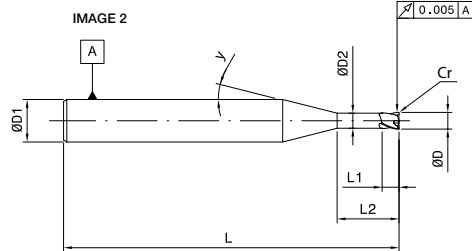
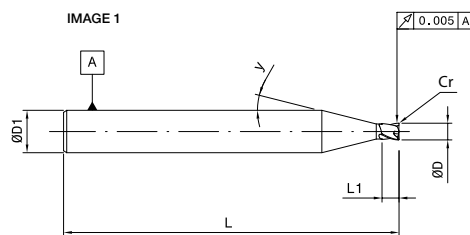
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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

2 Flute

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



N5-N7

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	γ	Image	Effective length compared with Inclined Angle				EDP No
										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

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	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
			ap 2D ae/D 10%	min	max	Range	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	
		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	
		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	

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	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
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
		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	
		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 tool life

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)

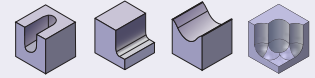
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

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

2 Flute

Centre cutting high performance micro ball nose for graphite



N5-N7

IMAGE 1

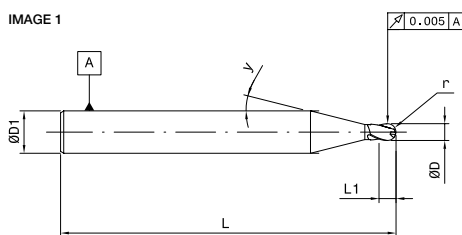
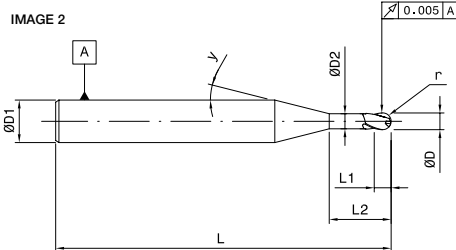


IMAGE 2



Unit : mm

ØD (mm)	L1 (mm)	ØD2 (mm)	L2 (mm)	L (mm)	ØD1 (mm)	r (mm)	z	γ (°)	Image	Effective length compared with Inclined Angle				EDP No
										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

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
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

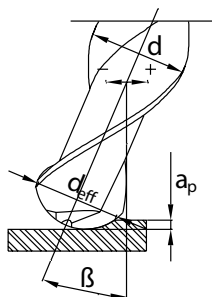
Q	4.0 mm³/min	5.0 mm³/min
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Excellent surface finish

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.

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

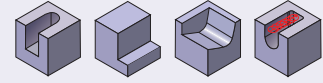
Workpiece material: ISO 63

	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


P5-P6

H1-H4

IMAGE 1

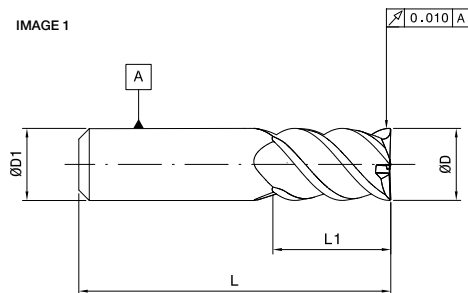
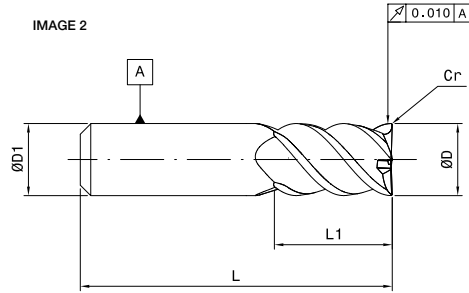


IMAGE 2

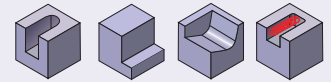


Unit : mm

ØD	L1	L	Ø D1	Cr	z	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)			
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

4 Flute

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



Carbide



LONG



6535 HA


Above
45 HRC


Proton Plus

END MILLS



P5-P6

H1-H4

IMAGE 1

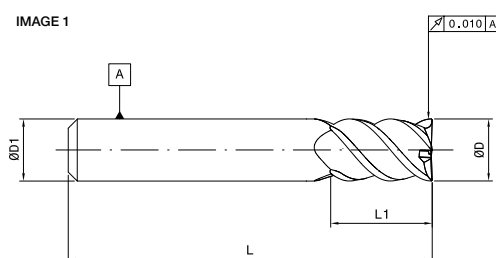
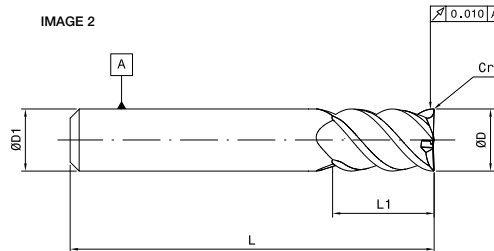


IMAGE 2

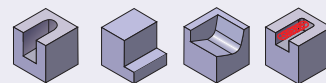


Unit : mm

ØD	L1	L	Ø D1	Cr	z	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)			
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

4 Flute

Centre cutting proton plus end mill for 45-62 HRC



Carbide



LONG REACH

30°

6535 HA

0.1X45°



Above 45 HRC

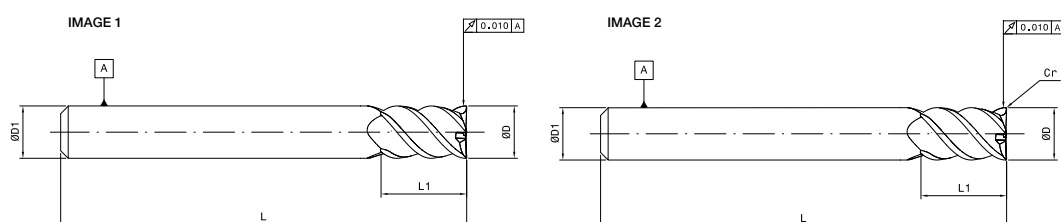


Proton Plus



P5-P6

H1-H4

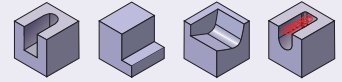


Unit : mm

ØD	L1	L	ØD1	Cr	z	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)			
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

4 Flute

Centre cutting proton plus end mill for 45-62 HRC with 50° helix



Carbide



REG



6535 HA



Above 45 HRC



Proton Plus

END MILLS



P5-P6

H1-H4

IMAGE 1

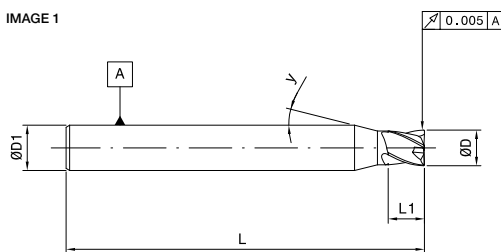
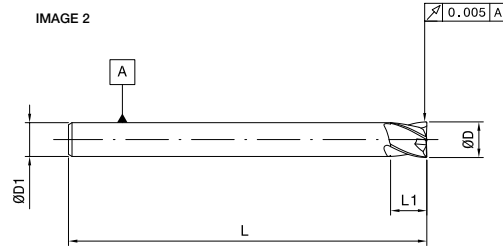


IMAGE 2

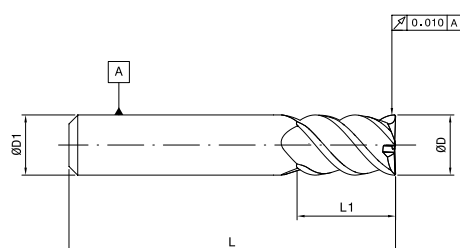
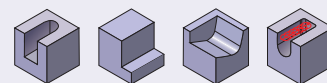


Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

Centre cutting proton plus end mill for 45-62 HRc with 50° helix



P5-P6

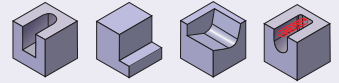
H1-H4

Unit : mm

ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		
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

4 Flute

Centre cutting proton plus end mill for 45-62 HRc with 50° helix



Carbide



REG

50°

6535 HA



Above 45 HRC



Proton Plus

END MILLS



IMAGE 1

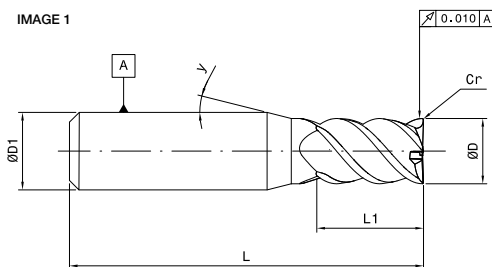
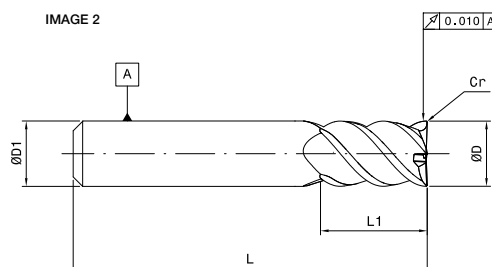


IMAGE 2



P5-P6

H1-H4

Unit : mm

ØD	L1	L	ØD1	Cr	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

2 Flute

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

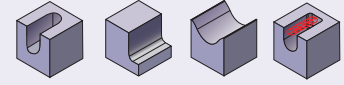


IMAGE 1

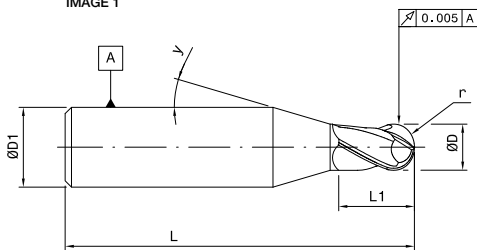
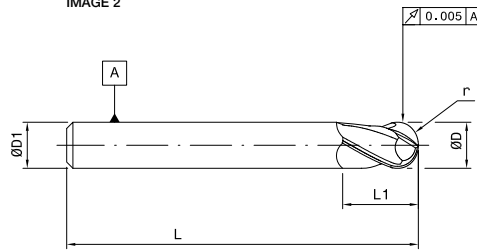


IMAGE 2



P5-P6

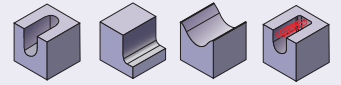
H1-H4

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)			(°)		
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

2 Flute

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



Carbide



LONG


Above
45 HRC

Proton
Plus

END MILLS



P5-P6

H1-H4

IMAGE 1

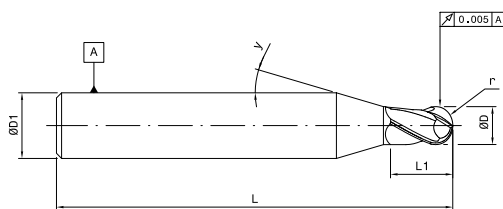


IMAGE 2

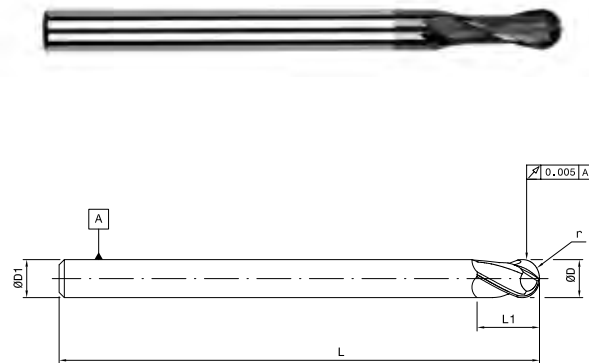
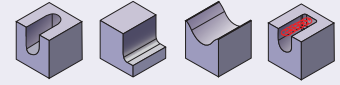


Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)			(°)		
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

2 Flute

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



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

Cutting parameters

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

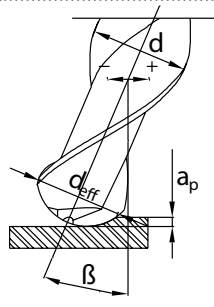
Material Group			Cutting Speed (Vc) m/min for Profile Milling		 Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)																			
			Diameter in mm																							
			mm	1.0			1.5		2.0		3.0		4.0		5.0		6.0		8.0		10.0		12.0			
			ap 0.02D ae/D 5%	min			max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
			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
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		
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		
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

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

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.

HSM series (32-45 HRc)

END MILLS



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

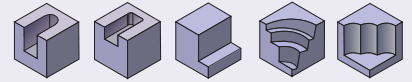
- Operates at high cutting speeds on Moulds

Benefits

- Higher Tool Life and consistency

4 Flute

Centre cutting HSM end mill for 32-45 HRc steel



END MILLS



P3-P4

M1

IMAGE 1

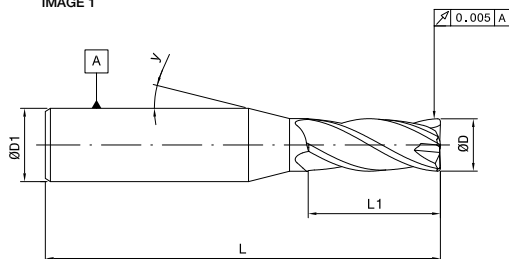
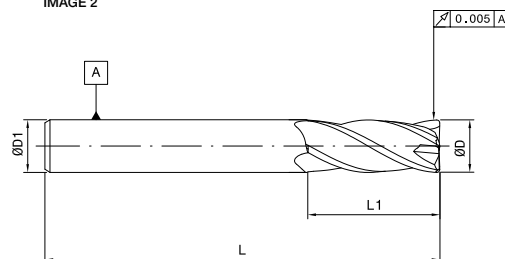


IMAGE 2

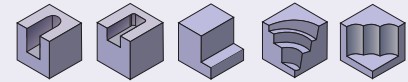


Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		
1.00	3.00	38.00	3.00	4	10	1	FBK0501970
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

2 Flute

Centre cutting HSM end mill for 32-45 HRC Steel



P3-P4

M1

IMAGE 1

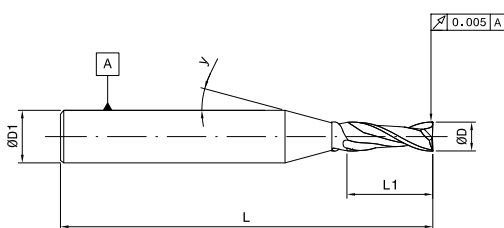
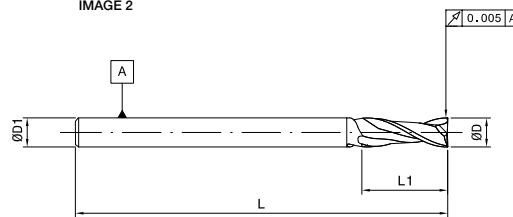


IMAGE 2

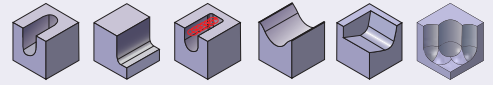


Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
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1.00	3.00	38.00	3.00	2	10	1	FBK0501982
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

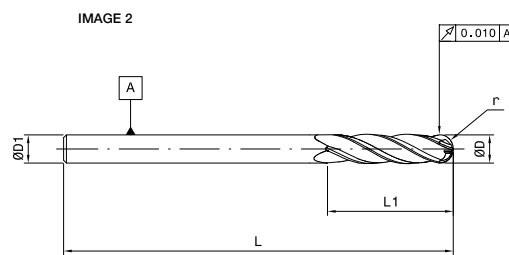
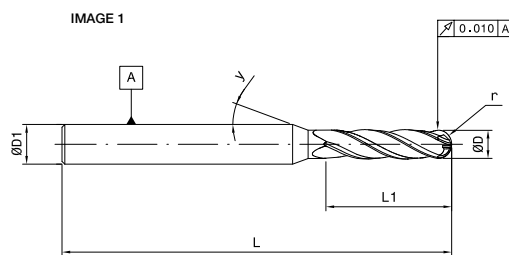
4 Flute

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



P3-P4

M1

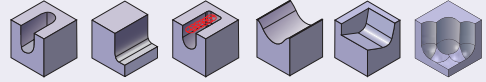


Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

2 Flute

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



Carbide



REG

30°

6535 HA


30-45
HRC


TiAlN



IMAGE 1

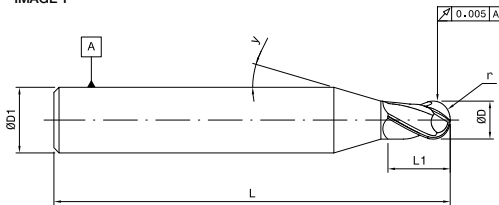
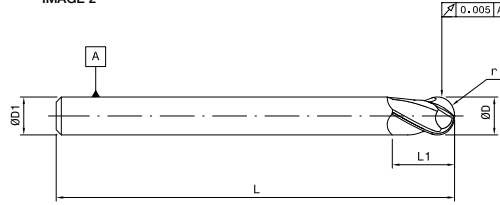


IMAGE 2



P2-P4

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

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	0.025	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

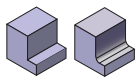
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling	Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)															
						Diameter in mm															
						mm	1.0		1.5		2.0		3.0		4.0		5.0		6.0		
						ap 1D ae/D 10%	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	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	
Steel	P	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

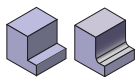
Material Group			Cutting Speed (Vc) m/min for Shoulder Milling		Cutting Speed (Vc) m/min		Recommended Feed/Tooth (fz)												
							Diameter in mm												
							mm	8.0		10.0		12.0		14.0		16.0		20.0	
								ap 1D ae/D 10%	min	max	Range	min	max	min	max	min	max	min	max
Steel	P	3	90	90	120	fz	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	

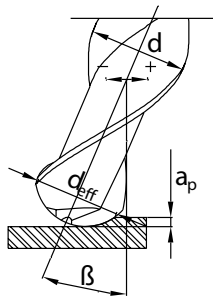
Cutting parameters

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	
								Range	min	max	min	max	min	max	min	max	min	max	min	max	min
Steel	P	3	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	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	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
Steel	P	3	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	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	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.

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

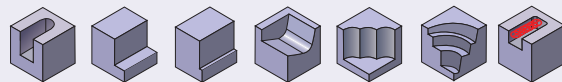
- Variable pitch and Variable helix
- Stable core geometry
- Optimized centre cutting geometry
- New generation coating
- Available in 4 flutes, 5 flutes, 6 flutes and 7 flutes
- Available with neck options

Functions & Benefits

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

4 Flute

Centre cutting high performance end mill
for roughing & finishing



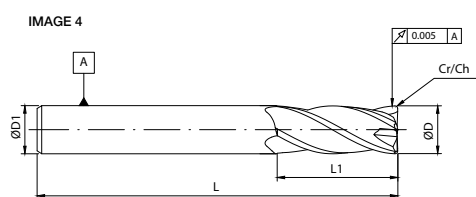
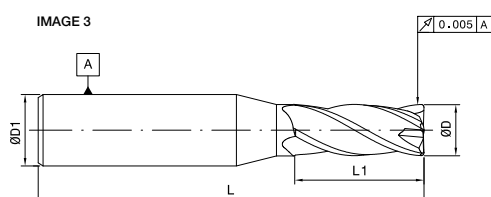
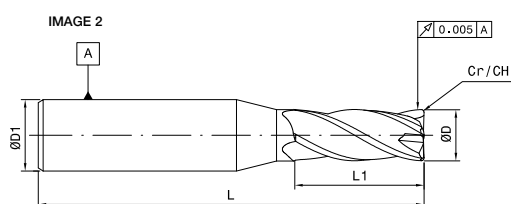
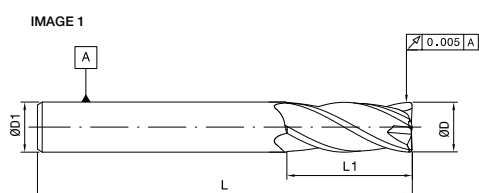
P1-P6

K1-K3

S1-S4

M1-M3

H1

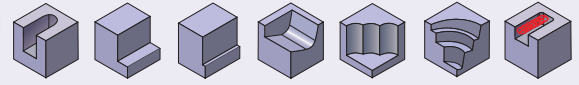


Unit : mm

ØD	L1	L	ØD1	Cr	CH	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

Centre cutting high performance end mill
for roughing & finishing



END MILLS



IMAGE 1

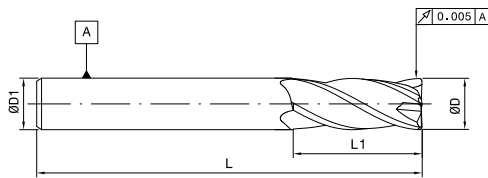
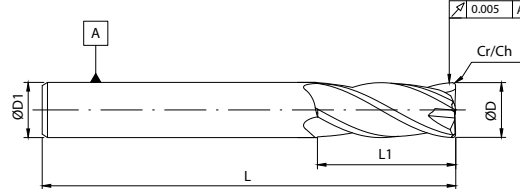


IMAGE 2



P1-P6

K1-K3

S1-S4

M1-M3

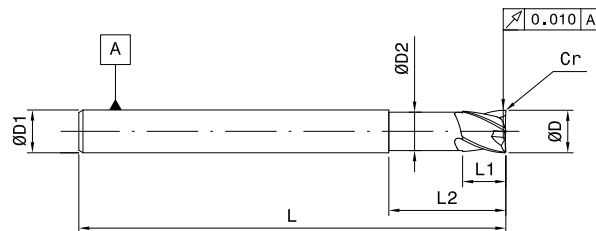
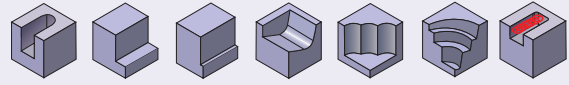
H1

Unit : mm

ØD	L1	L	ØD1	Cr	CH	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

Centre cutting high performance end mill for roughing & finishing



P1-P6

K1-K3

S1-S4

M1-M3

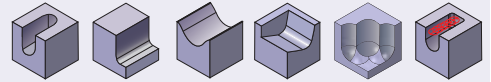
H1

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	ØCr	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
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

4 Flute

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



END MILLS



IMAGE 1

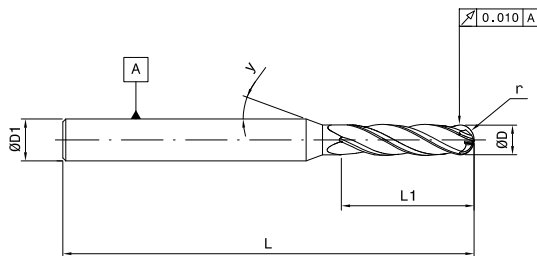
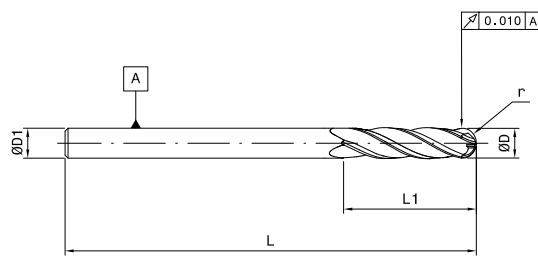


IMAGE 2



P1-P6

K1-K3

S1-S4

M1-M3

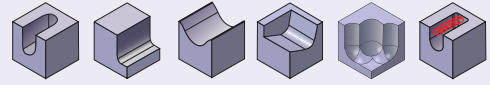
H1

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		
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

4 Flute

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



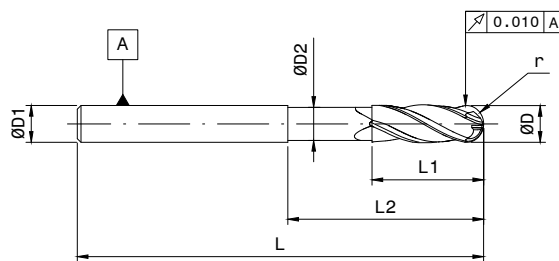
Carbide



LONG



Cr Base



P1-P6

K1-K3

S1-S4

M1-M3

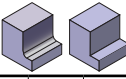
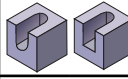
H1

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	r	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
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

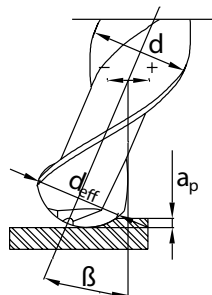
Cutting parameters

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	min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max			
ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	ae/D 100%					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	4 Flute	4 Flute
		Flat	Flat/ Neck	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

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

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)

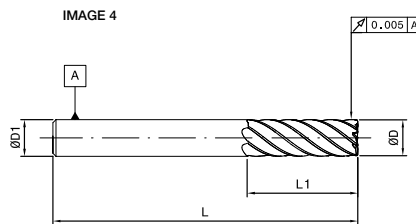
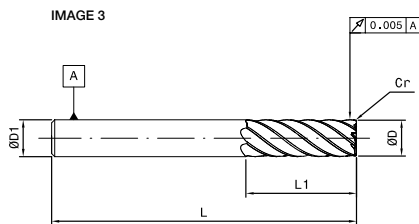
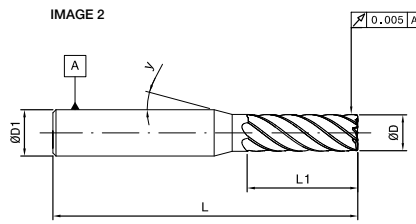
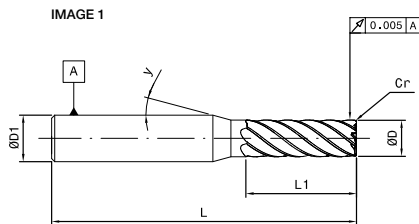
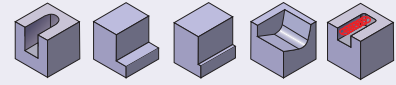
Feed of Recommended Milling Condition(V_f mm/min) X α = Corrected V_f (mm/min)

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



P1-P6

K1-K3

S1-S4

M1-M3

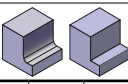
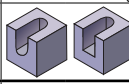
H1

Unit : mm

ØD	L1	L	ØD1	ØCr	z	γ	Image	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		BLACK	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	-

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															
		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		16.0		20.0			
		min	max	min	max	min	max	min	max	min	max	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 preference/ SuperAlloys, Cast Iron and Hard Steel as a second preference
F178TR Black to be used on Titanium and Super Alloys as a first preference/ Stainless Steel/ Steel/ Cast Iron and Hard Steel as the second preference

Note

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

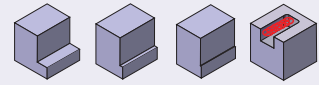
(Maximum Spindle Speed of Spindle)/(Spindle Speed of Recommended Milling Condition)= Conversion Rate(α)

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



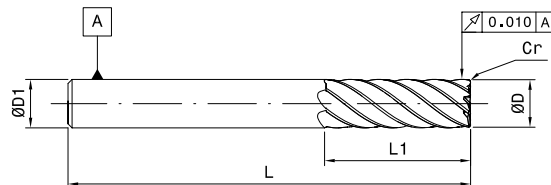
REG

35/38°

6535 HA



Cr Base



P1-P6

S1-S4

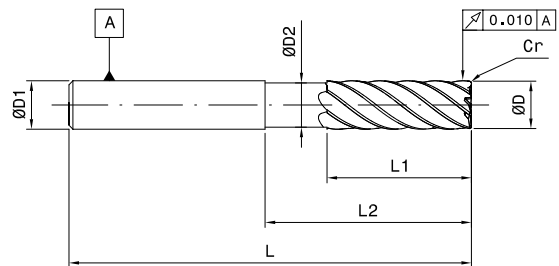
M1-M3

H1-H2

F180TR

Unit : mm

ØD	L1	L	ØD1	ØCr	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		
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

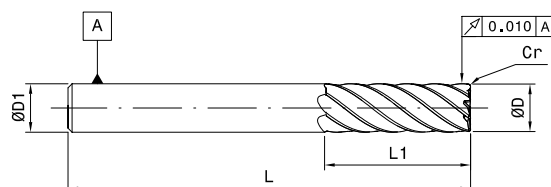
M1-M3

H1-H2

NF180TR

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Corner Radius	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Ø Cr		
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

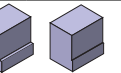
F180TRL

Unit : mm

ØD	L1	L	ØD2	Corner Radius	z	EDP No
(mm)	(mm)	(mm)	(mm)	ØCr		
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

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 ae/D 1%	ap Max ae/D 6%	mm Range	10.0		12.0		16.0		
						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(V_f mm/min) X α = Corrected V_f (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
- Multi-flutes for High Productivity
- Available with alternate coating

Functions

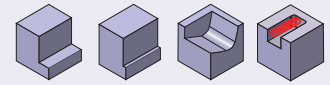
- Operates at high cutting speeds
- Geometry programmed to suit adequate material removal at various engagement angles

Benefits

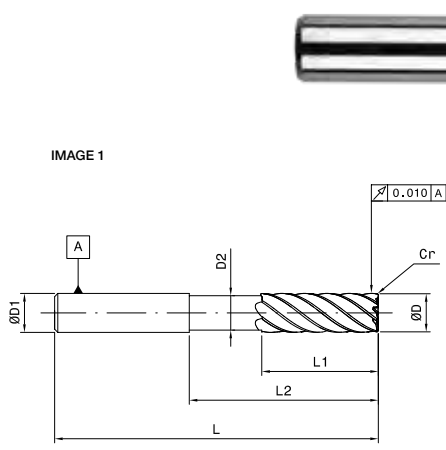
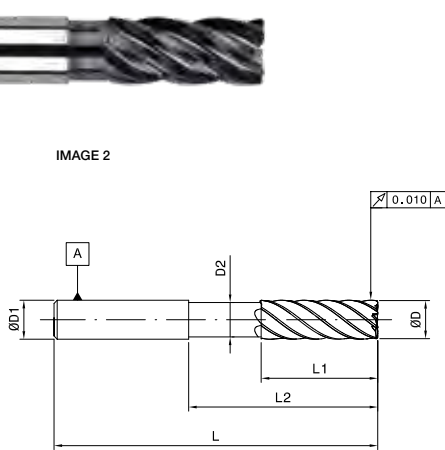
- Highest dynamic speed rates
- Highest material removal rate
- Least cutting forces
- Prolonged tool life due to reduced shock
- High savings in cycle time when compared to the conventional milling strategy

5 Flute

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



END MILLS

 									P1-P6 K1-K3 S1-S4 M1-M3 H1
									Unit : mm
ØD	L1	ØD2	L2	L	ØD1	ØCr	z	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)			
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

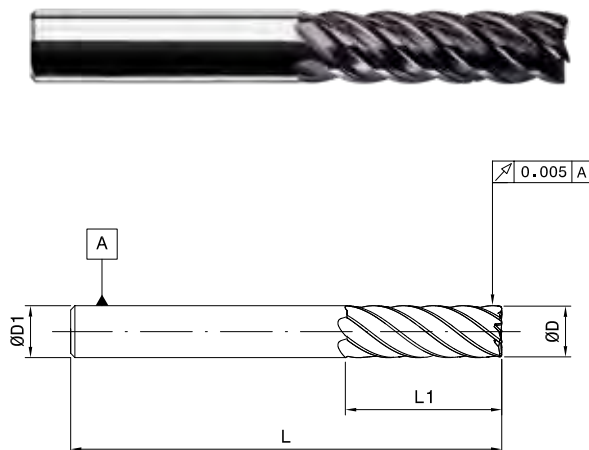
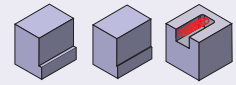
Benefits

- 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



P1-P6

K1-K3

S1-S4

M1-M3

H1

Unit : mm

ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		
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° 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

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		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		mm	4.0		6.0		8.0		10.0		12.0		16.0		20.0					
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												
min	max	Range			6.0			8.0		10.0		12.0		16.0		20.0				
			ae/D 1%	ae/D 5%				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.



High Performance Cutting Tools

RAZORCUT™

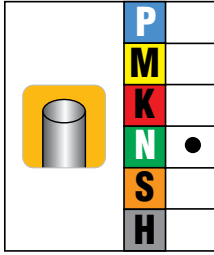
SOLID CARBIDE END MILLING SOLUTIONS
FOR MACHINING NON FERROUS MATERIALS
FOR AEROSPACE & AUTOMOBILE INDUSTRY



ROUGHER SERIES
CBC/ CBCH/ NCBC

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

ROUTER SERIES
1F



FEATURES, FUNCTIONS AND BENEFITS

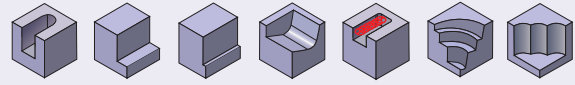
- Designed for Aluminium Alloys (Works excellent on Al6061 & Al7075)
- Designed to maximize metal removal rates and deliver superior wall and floor finishes on the part.
- Designed to be used in roughing, semi-finishing, finishing and super finishing applications
- Designed with a strong core geometry 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.

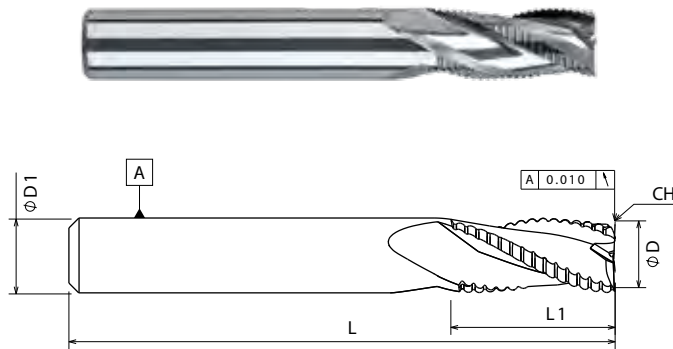
3 Flute

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



END MILLS

N1-N2



Unit : mm

ØD	L1	L	ØD1	CH	z	EDP Code
(mm)	(mm)	(mm)	(mm)	(mm)		
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

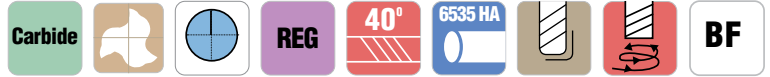
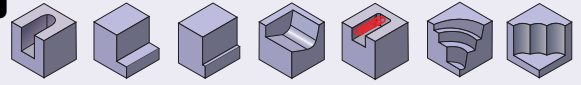
- High MRR
- Excellent for roughing and finishing of aluminium

Benefits

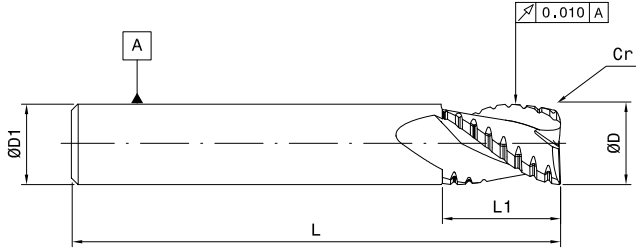
- Superior tool life

3 Flute

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



END MILLS

 						N1-N5
						Unit : mm
ØD	L1	L	ØD1	Cr	z	EDP Code
(mm)	(mm)	(mm)	(mm)	(mm)		
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



N1-N5

Technical drawing of the end mill showing dimensions: ØD1, L1, L2, L, ØD2, ØD, Cr, and surface finish 0.010 A.

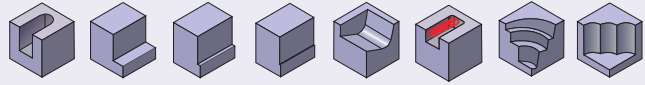
Razor cut - NCBCH

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	Cr	z	EDP Code
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
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

3 Flute

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



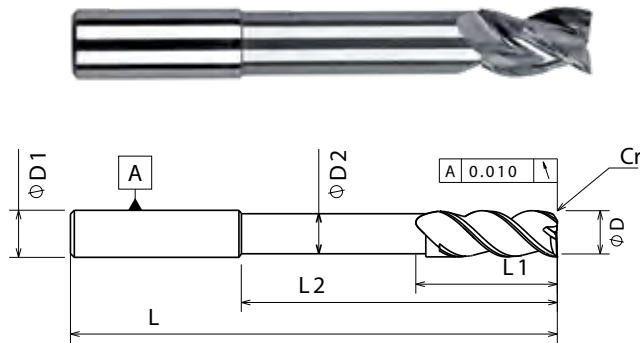
Carbide



LONG REACH



BF



N1-N2

Unit : mm

ØD	L1	ØD2	L2	L	ØD1	ØCr	z	EDP Code
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
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

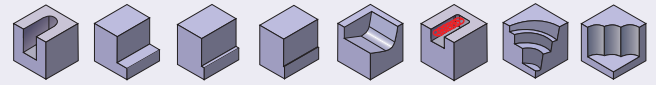
- High MRR
- Excellent for finishing of aluminium

Benefits

- Superior tool life
- Excellent floor finish

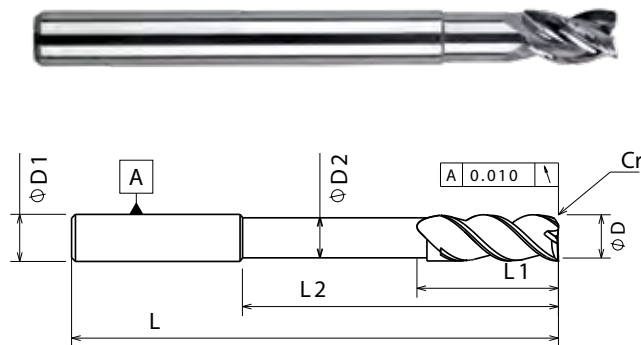
3 Flute

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



END MILLS

N1-N2



Unit : mm

ØD	L1	ØD2	L2	L	ØD1	ØCr	z	EDP Code
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
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

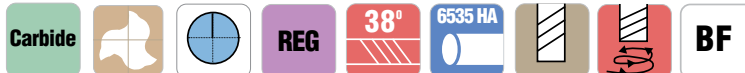
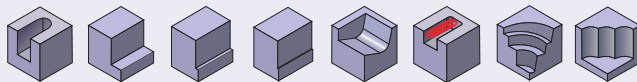
- High MRR
- Excellent for finishing of aluminium

Benefits

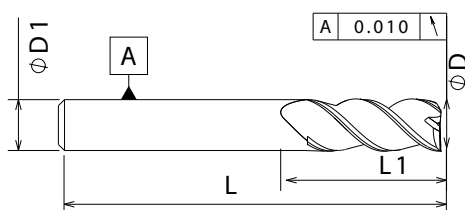
- Superior tool life
- Excellent floor finish

3 Flute

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



N1-N2



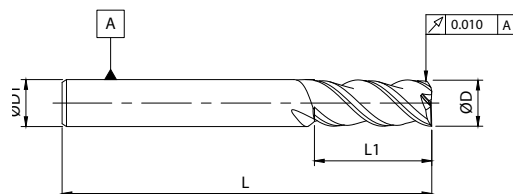
Razor cut - 3FWF
With Wiper Technology

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



N1-N2



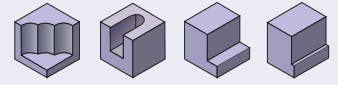
Razor cut - 3F
Without Wiper Technology

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

2 Flute

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



END MILLS

N1-N2



IMAGE 1

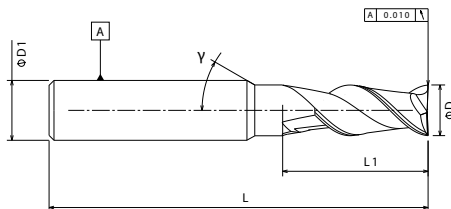
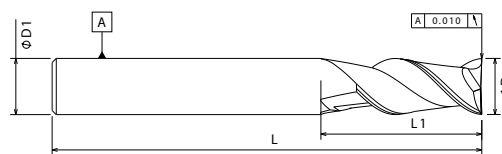


IMAGE 2



Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP Code
(mm)	(mm)	(mm)	(mm)		(°)		
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

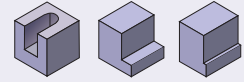
Functions

- High MRR
- Stable cutting at high cutting speeds

Benefits

- Superior tool life

1 Flute

Razor cut 1F for machining
aluminium and plastics


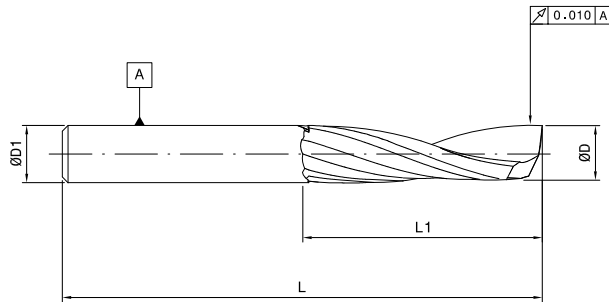
Carbide



REG



BF



N1-N2

Unit : mm

ØD	L1	L	ØD1	z	EDP Code
(mm)	(mm)	(mm)	(mm)		
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

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															
		ae 1%	ae 5%	ae 10%	ae 15%	ae 20%	ae 30%	ae 50%	0.75XD	1xD	min	max	Range	6.0		8.0		10.0		12.0		16.0		20.0		25.0			
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
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 aluminium 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%														
											Diameter in mm														
		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	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	0.070
		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	0.056

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(V_f mm/min) X α = Corrected V_f (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			
													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				
											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 excellent 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
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.
 $(\text{Maximum Spindle Speed of Spindle}) / (\text{Spindle Speed of Recommended Milling Condition}) = \text{Conversion Rate}(\alpha)$

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.

ROUGHER END MILLS (CHIP BREAKER)



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



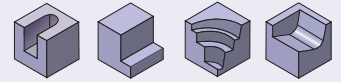
RANGE

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

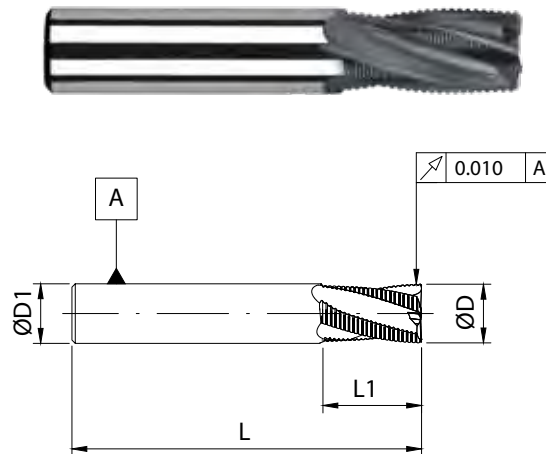


3/4 Flute

Sinusoidal regular length chip breaker end mill



END MILLS



P0-P6

K1-K3

S1-S4

M1-M3

H1-H2

Unit : mm

ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		
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

3/4 Flute

Sinusoidal regular length chip breaker end mill

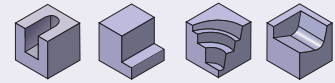


IMAGE 1

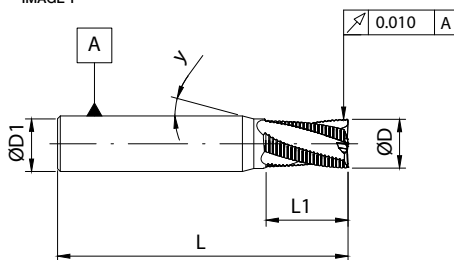
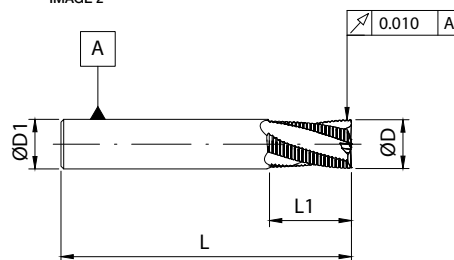


IMAGE 2



P1-P5

K1-K3

S1

S3

M1-M3

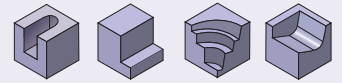
H1

Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		
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

3/4 Flute

Sinusoidal regular length chip breaker end mill



Carbide

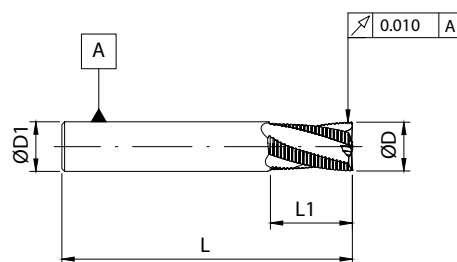


LONG



TiAlN

END MILLS



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

4/6 Flute

Flat pitch regular length chip breaker
end mill with corner radius

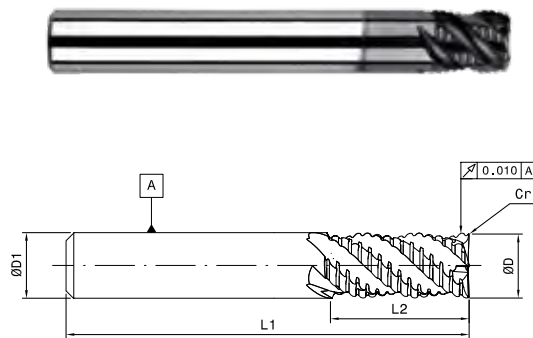

Carbide



REG



TiAlN



P3-P6

K1-K3

S1-S4

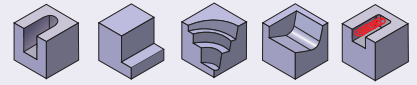
M1-M3

H1-H3

Unit : mm

ØD	L1	L	ØD1	z	Cr	EDP No
(mm)	(mm)	(mm)	(mm)		(mm)	
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

4/6 Flute

Flat pitch regular length chip breaker
end mill with corner radius


Carbide

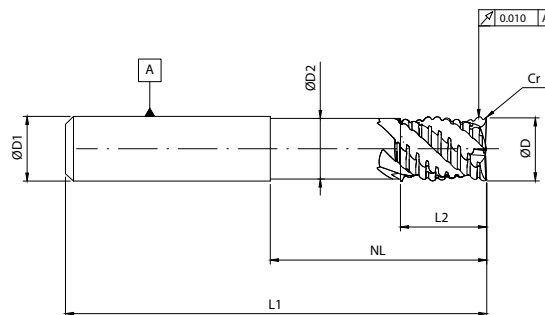


REG



TiAlN

END MILLS



NF193CB

P3-P6

K1-K3

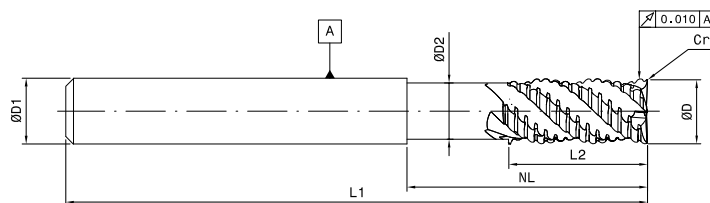
S1-S4

M1-M3

H1-H3

Unit : mm

ØD	L1	L	L2	ØD2	ØD1	z	Cr	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)	
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

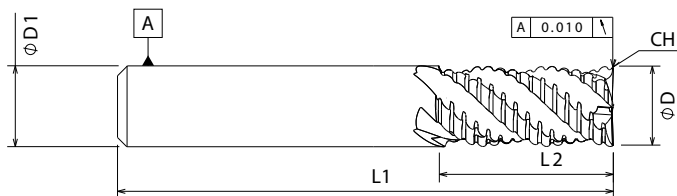
H1-H3

Unit : mm

ØD	L2	L1	NL	ØD2	ØD1	z	Cr	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)	
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

4/6 Flute

Flat pitch regular length chip breaker end mill with corner chamfer



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

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										Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%																
			Shoulder Milling / Rough and Semi Finish						Slot Milling																				
																													
			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	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
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											Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%															
		Shoulder Milling / Rough and Semi Finish							Slot Milling																			
																												
		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
Stainless Steel	M	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
		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
Cast Iron	K	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
		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
Super Alloys	S	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
		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
Hard Materials	H	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
		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
Hard Materials	H	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												Recommended Feed/Tooth (fz=mm/th) for shoulder milling/slot milling, reduce fz by 20%															
		Shoulder Milling / Rough and Semi Finish							Slot Milling																				
																													
		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	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	
Stainless Steel	M	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	
Cast Iron	K	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	
Super Alloys	S	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	
		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	
Hard Materials	H	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	
		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	
		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	0.055	0.056	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	0.051	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		



High Performance Cutting Tools



**GENERAL PURPOSE & ECONOMY
SERIES END MILLS**

GENERAL PURPOSE END MILLS

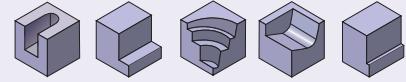
SERIES	FLUTE	LENGTH	CORNER STYLE	PAGES
F111 GP	4	Regular	Square End	2.162
F163 GP	4	Stub	Square End	2.163
F122 GP	4	Long Length	Square End	2.164
F187 GP	4	Extra Long	Square End	2.165
F181 GP	4	Long Reach	Square End	2.166
F116 GP	3	Regular	Square End	2.167
F164 GP	2	Stub	Square End	2.168
F121 GP	2	Regular	Square End	2.169
F123 GP	2	Long Length	Square End	2.170
F183 GP	2	Long reach	Square End	2.171
F165 GP	4	Stub	Ball Nose	2.172
F140 GP	4	Regular	Ball Nose	2.173
F184 GP	4	Long Reach	Ball Nose	2.174
F150 GP	2	Regular	Ball Nose	2.175
F166 GP	2	Stub	Ball Nose	2.176
F186 GP	2	Long Reach	Ball Nose	2.177
F125 GP	4	Long Length	Ball Nose	2.178
F126 GP	2	Long Length	Ball Nose	2.179
F188 GP	4	Extra Long	Ball Nose	2.180
F114 GP	4	Regular	Chip Breaker	2.183
F132 GP	4	Long Length	Chip Breaker	2.184

ECONOMY RANGE END MILLS

SERIES	FLUTE	LENGTH	CORNER STYLE	PAGES
F121 XL	2	Regular	Square End	2.186
F111 XL	4	Regular	Square End	2.187
F150 XL	2	Regular	Ball nose	2.188
F140 XL	4	Regular	Ball nose	2.189
F123 XL	2	Long Length	Square End	2.190
F122 XL	4	Long Length	Square End	2.191
F125 XL	4	Long Length	Ball nose	2.192

4 Flute

Centre cutting regular length end mill



Carbide



REG



TiAlN



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

M1-M3

Unit : mm

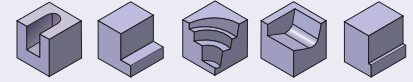
ØD	L1	L	ØD1	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	TiAlN Coated
1.00	3.00	38.00	3.00	4	10	1	FBK0500001	FBK0500002	FBK0500003
1.50	6.00	38.00	3.00	4	10	1	FBK0500004	FBK0500005	FBK0500006
2.00	9.00	38.00	3.00	4	10	1	FBK0500007	FBK0500008	FBK0500009
2.50	12.00	38.00	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 2.181

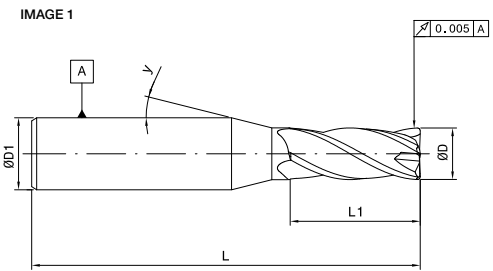
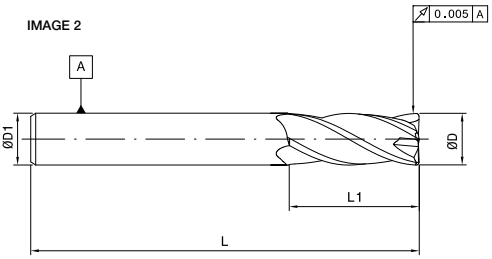
Also available in uncoated & TiN

4 Flute

Centre cutting stub length end mill

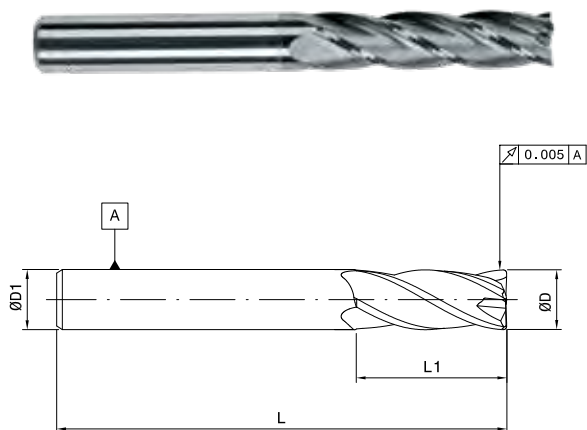
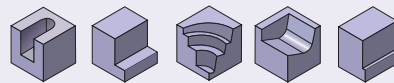


END MILLS

 IMAGE 1  IMAGE 2 								P0-P4 K1-K3 S1-S4 H1-H3 N1-N3 M1-M3
								Unit : mm
ØD	L1	L	ØD1	z	γ	Image	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	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

4 Flute

Centre cutting long length end mill



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

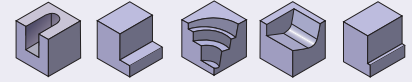
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		Uncoated	TiN Coated	TiAlN 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

4 Flute

Centre cutting extra long end mill



Carbide


EXTRA
LONG

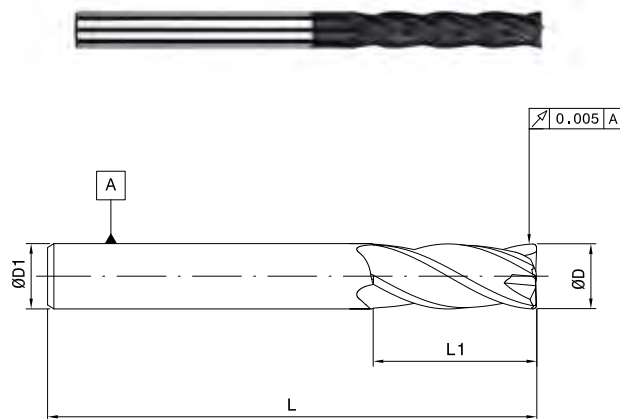
30°

6535 HA



TiAlN

END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

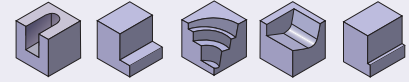
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		TiAlN 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

4 Flute

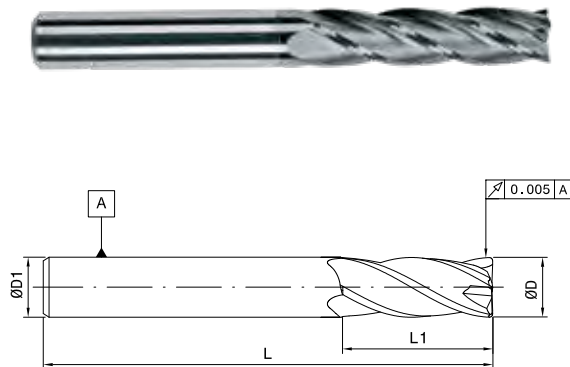
Centre cutting long reach end mill



Carbide


LONG
REACH


TiAlN



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

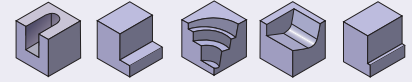
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		Uncoated	TiAlN 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

3 Flute

Centre cutting regular length end mill



END MILLS



IMAGE 1

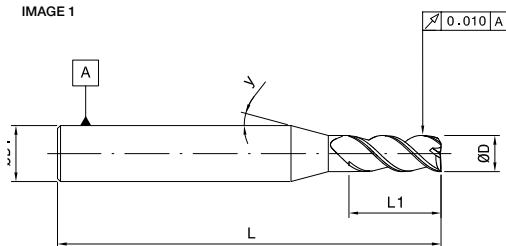
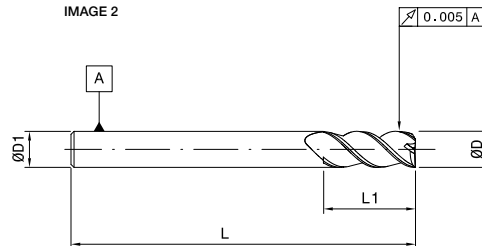


IMAGE 2



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

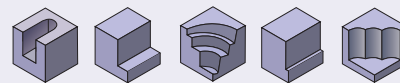
M1-M3

Unit : mm

ØD	L2	L1	ØD1	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	TiAlN 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

2 Flute

Centre cutting stub length end mill



Carbide



STUB



TiAlN



IMAGE 1

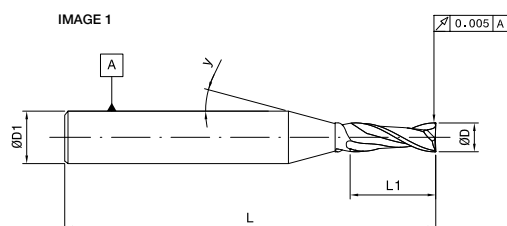
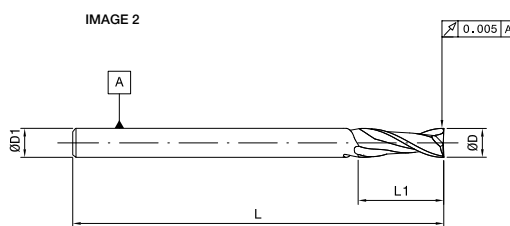


IMAGE 2



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

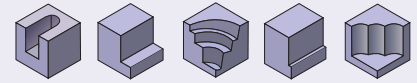
M1-M3

Unit : mm

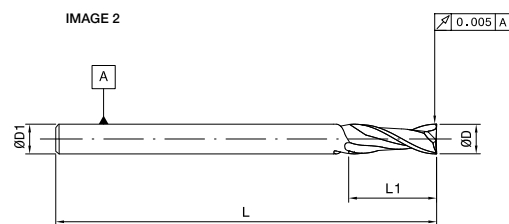
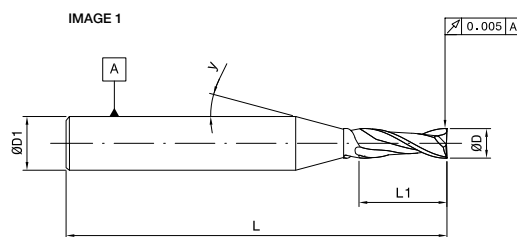
ØD	L1	L	ØD1	z	γ	Image	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiAlN Coated
1.00	2.00	38.00	3.00	2	10	1	FBK0502015	FBK0502016
1.50	3.00	38.00	3.00	2	10	1	FBK0500558	FBK0500559
2.00	4.00	38.00	3.00	2	10	1	FBK0500560	FBK0500561
2.50	5.00	38.00	3.00	2	10	1	FBK0500562	FBK0500563
3.00	6.00	38.00	3.00	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

2 Flute

Centre cutting regular length end mill



END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

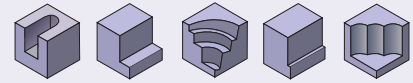
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	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

2 Flute

Centre cutting long length end mill



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

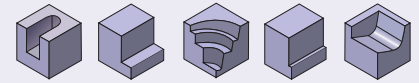
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	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

2 Flute

Centre cutting long reach end mill



Carbide


LONG
REACH

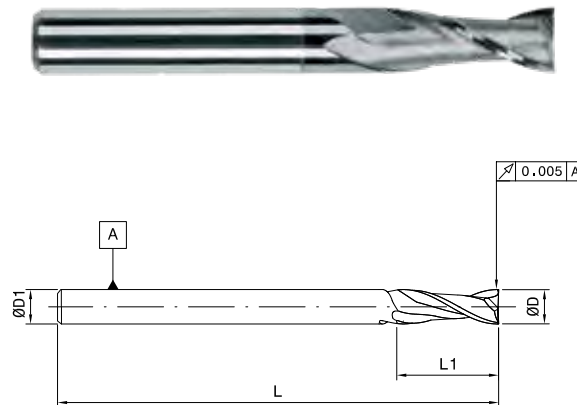
30°

6535 HA



TiAlN

END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

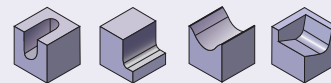
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		Uncoated	TiAlN 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

4 Flute

Centre cutting ball nose stub length end mill



Carbide



STUB



TiAlN



IMAGE 1

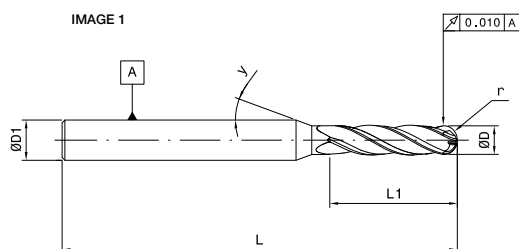
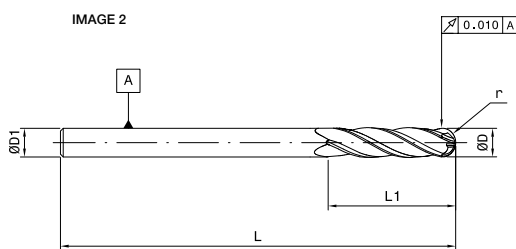


IMAGE 2



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

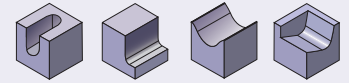
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiAlN 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

4 Flute

Centre cutting ball nose regular length end mill



Carbide

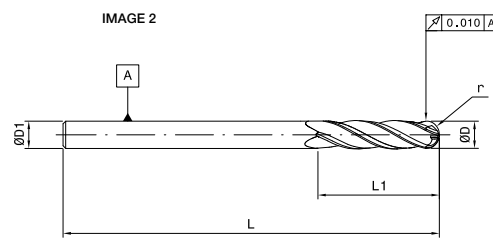
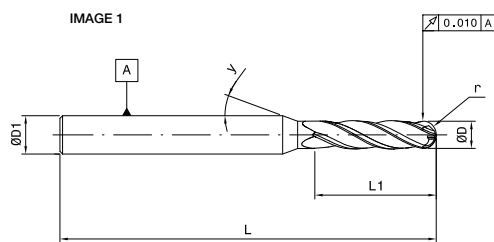


REG



TiAlN

END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

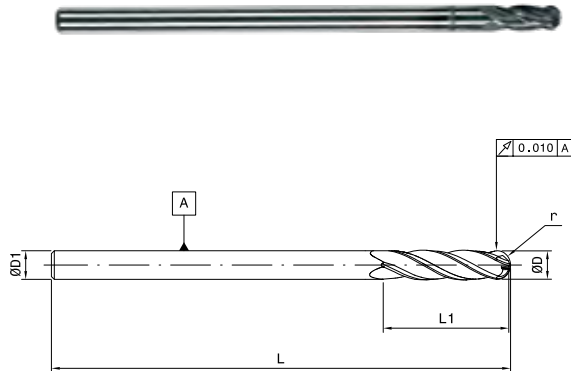
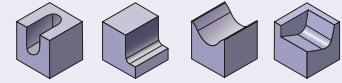
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	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

4 Flute

Centre cutting ball nose long reach end mill



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

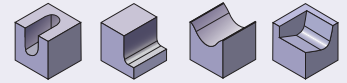
M1-M3

Unit : mm

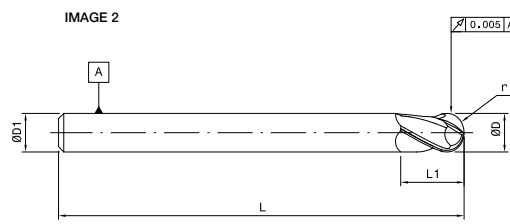
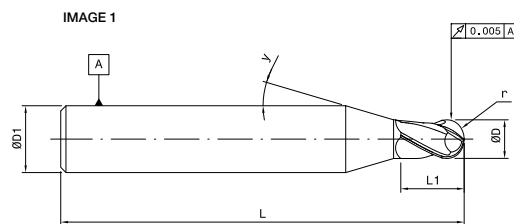
ØD	L1	L	ØD1	r	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		Uncoated	TiAlN Coated
3.00	6.00	64.00	3.00	1.50	4	FBK0500492	FBK0500493
4.00	9.00	76.00	4.00	2.00	4	FBK0500494	FBK0500495
5.00	15.00	76.00	5.00	2.50	4	FBK0500496	FBK0500497
6.00	15.00	76.00	6.00	3.00	4	FBK0500498	FBK0500499
8.00	20.00	101.00	8.00	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

2 Flute

Centre cutting ball nose regular length end mill



END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

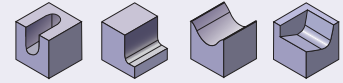
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiN Coated	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

2 Flute

Centre cutting ball nose stub length end mill



P0-P4

K1-K3

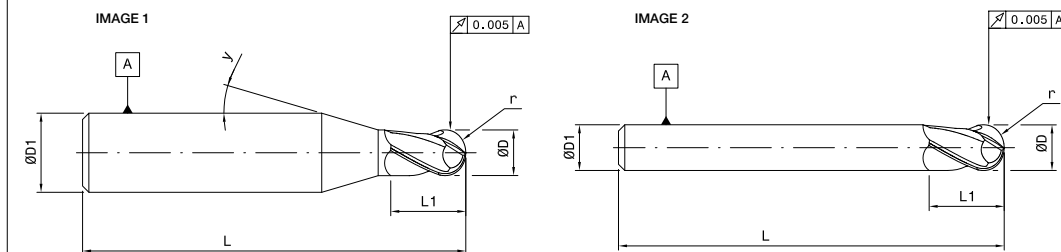
S1-S4

H1-H3

N1-N3

M1-M3

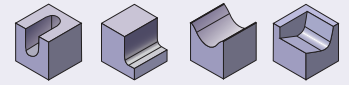
Unit : mm



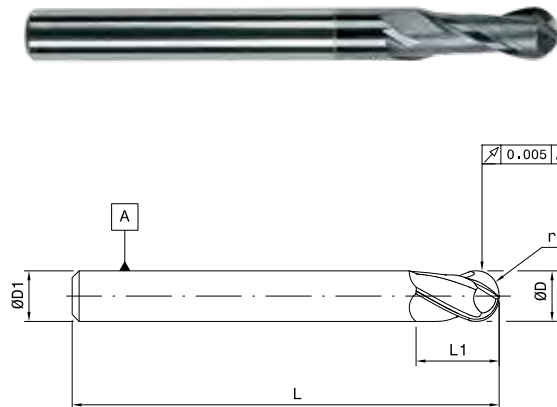
ØD	L1	L	ØD1	r	z	γ	Image	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		Uncoated	TiAlN Coated
1.00	2.00	38.00	3.00	0.50	2	10	1	FBK0502019	FBK0502020
1.50	3.00	38.00	3.00	0.75	2	10	1	FBK0500610	FBK0500611
2.00	4.00	38.00	3.00	1.00	2	10	1	FBK0500612	FBK0500613
2.50	5.00	38.00	3.00	1.25	2	10	1	FBK0500614	FBK0500615
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

2 Flute

Centre cutting ball nose long reach end mill



END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

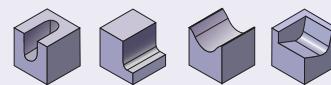
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		Uncoated	TiAlN 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

4 Flute

Centre cutting ball nose long length end mill



Carbide

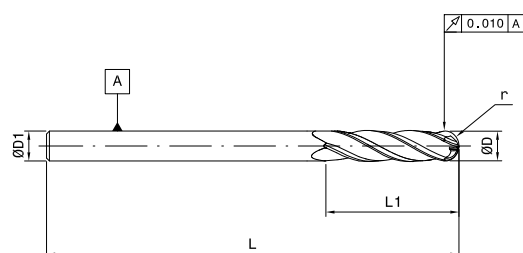

LONG
LENGTH

30°

6535 HA



TiAlN



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

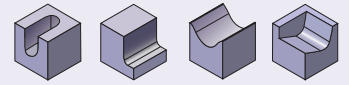
M1-M3

Unit : mm

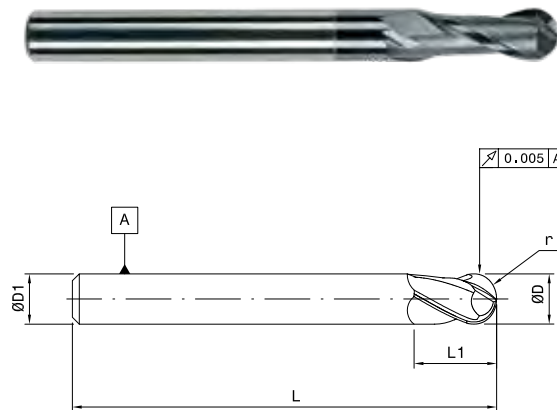
ØD	L1	L	ØD1	r	z	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		Uncoated	TiN Coated	TiAlN Coated
3.00	25.00	64.00	3.00	1.50	4	FBK0500399	FBK0500400	FBK0500401
4.00	25.00	64.00	4.00	2.00	4	FBK0500402	FBK0500403	FBK0500404
5.00	25.00	64.00	5.00	2.50	4	FBK0500405	FBK0500406	FBK0500407
6.00	30.00	76.00	6.00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

2 Flute

Centre cutting ball nose long length end mill



END MILLS



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

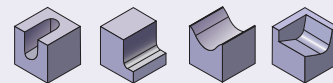
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	EDP No	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		Uncoated	TiN Coated	TiAlN 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

4 Flute

Centre cutting ball nose extra long end mill



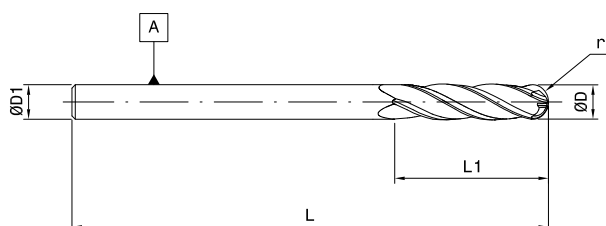
Carbide



EXTRA LONG



TiAlN



P0-P4

K1-K3

S1-S4

H1-H3

N1-N3

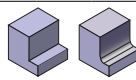
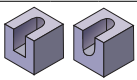
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		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

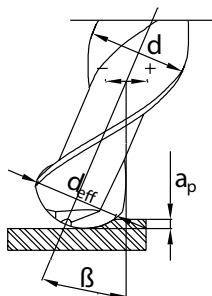
Cutting parameters

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										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																		
		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	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
Stainless Steel	M	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
		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
		3	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
Non-Ferrous	N	1	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
		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
Super Alloys	S	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
		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
Hard Materials	H	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%

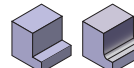
* For Uncoated Tools Decrease RPM by 20%

Disclaimer

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

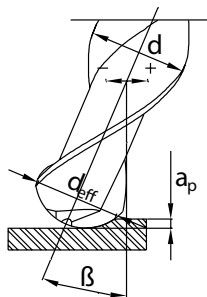
Cutting parameters

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	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	
Stainless Steel	M	4	150	118	107	100	96	93	89	86	79	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	
	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	
Cast Iron	K	3	75	59	54	50	48	46	45	43	39	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	
	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	
Non-Ferrous	N	3	100	79	71	67	64	62	60	57	52	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	
	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	74	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	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
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%

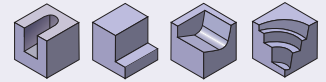
* For Uncoated Tools Decrease RPM by 20%

Disclaimer

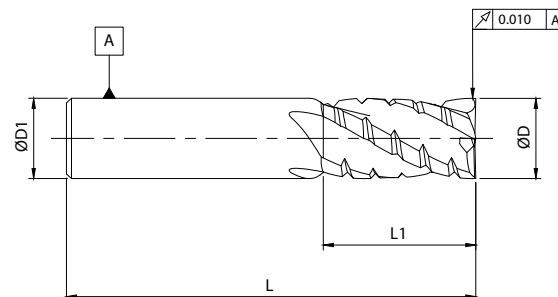
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

4 Flute

Centre cutting regular length chip breaker end mill



END MILLS



P0-P6

K1-K3

S1-S4

H1-H4

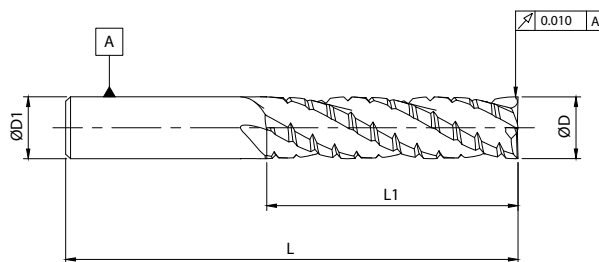
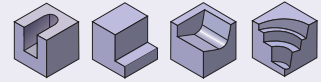
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		Uncoated	TiAlN 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

4 Flute

Centre cutting long length chip breaker end mill



P0-P6

K1-K3

S1-S4

H1-H4

M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No	EDP No
(mm)	(mm)	(mm)	(mm)		Uncoated	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

Cutting parameters

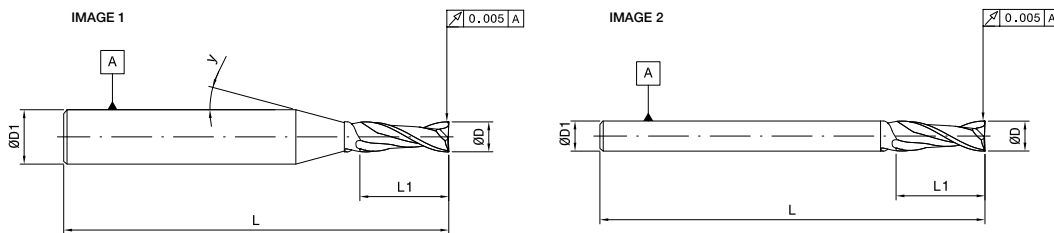
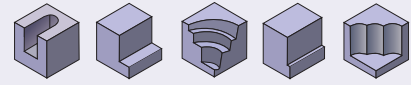
F114CB/132CB/ Metric - 1.0 mm to 8.0 mm

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	100	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
Stainless Steel	M	0	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
		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	0	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
		1	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
		2	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
		3	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
Non-Ferrous	N	0	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
		1	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
		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	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
Super Alloys	S	0	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
		1	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
		2	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
		3	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
Hard Materials	H	0	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
		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	
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	100	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												
Stainless Steel	M	0	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												
		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	0	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												
		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												
Non-Ferrous	N	0	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												
		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												
		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												
Super Alloys	S	0	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												
		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	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												
		3	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	0	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												
		1	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												
		2	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												
		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												

2 Flute F121 XL



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

M1-M3

Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		TiAlN 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

4 Flute

F111 XL



END MILLS



IMAGE 1

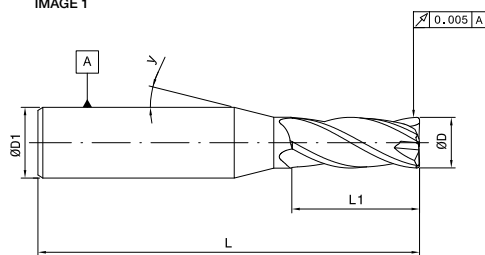
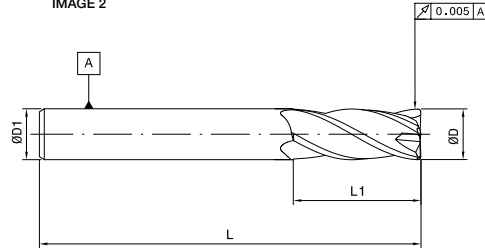


IMAGE 2



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

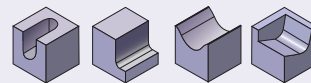
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)		(°)		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

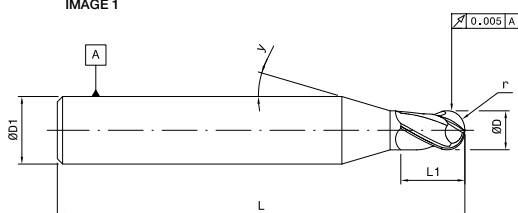
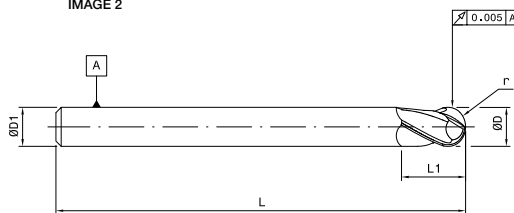
2 Flute

F150 XL


Carbide

REG
30°
6535 HA

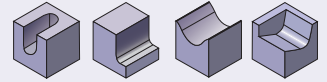
TiAlN

IMAGE 1

IMAGE 2

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

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		TiAlN 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

4 Flute

F140 XL



Carbide

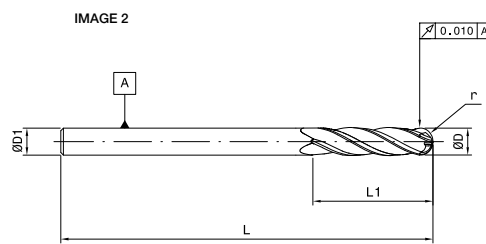
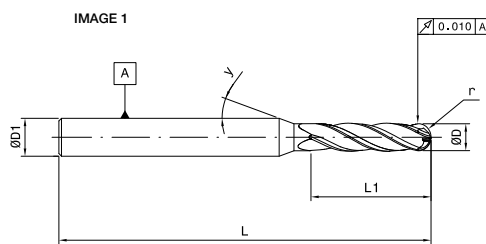


REG



TiAlN

END MILLS



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

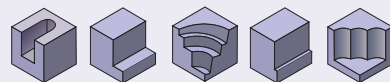
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	γ	Image	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		(°)		TiAlN 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

2 Flute

F123XL



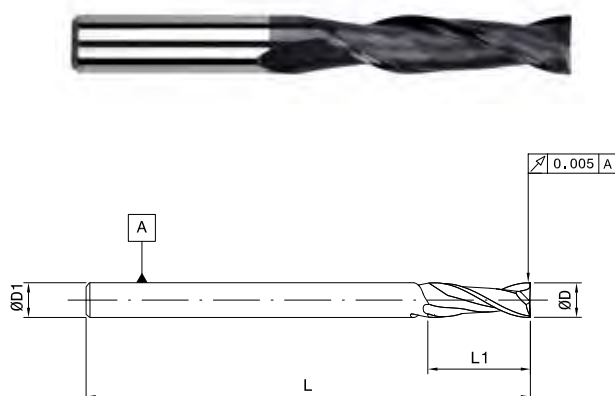
Carbide



LONG



TiAlN



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

M1-M3

Unit : mm

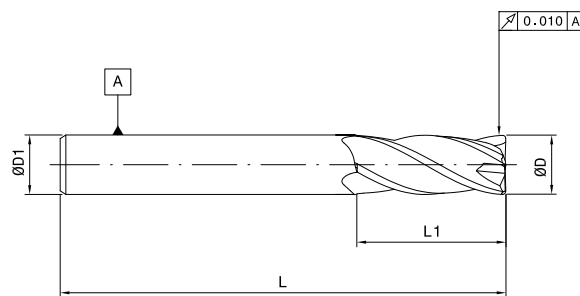
ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		TiAlN Coated
3.00	25.00	64.00	3.00	2	FBK0500757
4.00	25.00	64.00	4.00	2	FBK0500758
5.00	25.00	64.00	5.00	2	FBK0500759
6.00	30.00	76.00	6.00	2	FBK0500760
8.00	35.00	83.00	8.00	2	FBK0500761
10.00	40.00	89.00	10.00	2	FBK0500762
12.00	50.00	102.00	12.00	2	FBK0500763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

4 Flute

F122 XL



END MILLS



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

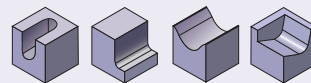
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	EDP No
(mm)	(mm)	(mm)	(mm)		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

4 Flute

F125 XL



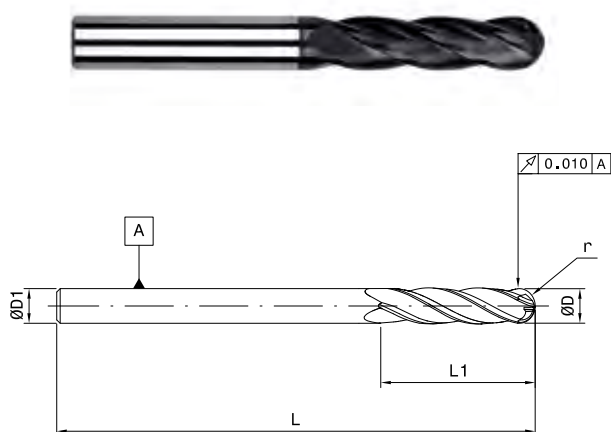
Carbide



LONG



TiAlN



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

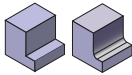
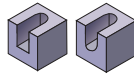
M1-M3

Unit : mm

ØD	L1	L	ØD1	r	z	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)		TiAlN 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

Cutting parameters

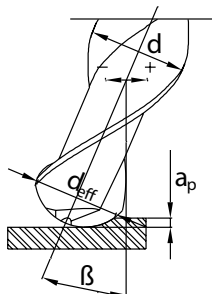
F121XL/F150XL/F111XL/F140XL/F123XL/F122XL/F125XL Metric - 1.0 mm to 8.0 mm

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)		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	1.0		2.0		3.0		4.0		5.0		6.0		8.0	
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



- * 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%

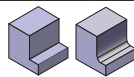
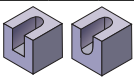
* For Uncoated Tools Decrease RPM by 20%

Disclaimer

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

Cutting parameters

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

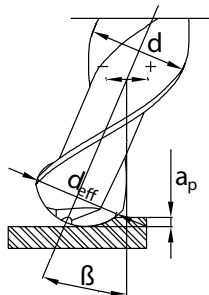
Material Group		Cutting Speed (Vc) m/min										Recommended Feed/Tooth (fz=mm/th) for shoulder milling / for slot milling, reduce fz by 20%																
		Shoulder Milling / Rough and Semi Finish							Slot Milling																			
																												
		CT NCT	CT NCT	CT NCT	CT NCT	CT 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)		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	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	
CT	Standard	Flat	Ball	Flat	Ball
NCT	Long Length	F121XL	F150XL	F111XL	F140XL
		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



- * 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)

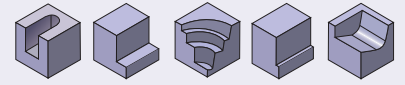
Feed of Recommended Milling Condition(Vf mm/min) X α = Corrected Vf (mm/min)

Disclaimer

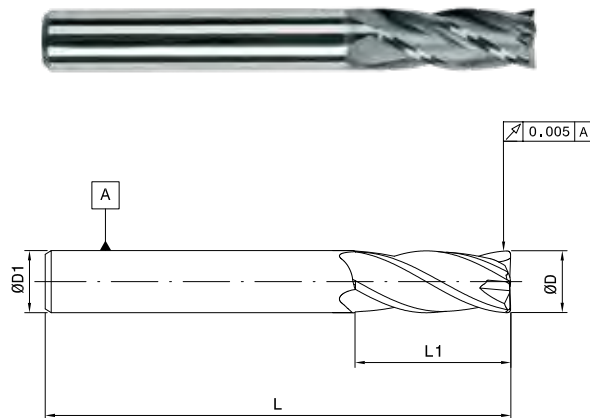
* Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

4 Flute

EXPRESS CARBIDE END MILLS



END MILLS



P0-P6

K1-K3

S1-S4

H1-H4

N1-N6

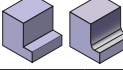
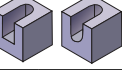
M1-M3

Unit : mm

ØD	L1	L	ØD1	z	Description	EDP No
(mm)	(mm)	(mm)	(mm)			TiAlN Coated
1	3	50	4	4	EM 1.00MMX3X50XSH4 4FLT TA EXP	FBK0512195
1.5	4	50	4	4	EM 1.50MMX4X50XSH4 4FLT TA EXP	FBK0512196
2	5	50	4	4	EM 2.00MMX5X50XSH4 4FLT TA EXP	FBK0512197
2.5	7	50	4	4	EM 2.50MMX7X50XSH4 4FLT TA EXP	FBK0512198
3	8	50	3	4	EM 3.00MMX8X50XSH4 4FLT TA EXP	FBK0512199
4	10	50	4	4	EM 4.00MMX10X50XSH4 4FLT TA EXP	FBK0512200
5	13	50	5	4	EM 5.00MMX13X50XSH5 4FLT TA EXP	FBK0512201
6	15	50	6	4	EM 6.00MMX15X50XSH6 4FLT TA EXP	FBK0512202
8	20	60	8	4	EM 8.00MMX20X60XSH8 4FLT TA EXP	FBK0512203
10	25	75	10	4	EM 10.00MMX25X75XSH10 4FLT TA EXP	FBK0512204
12	30	75	12	4	EM 12.00MMX30X75XSH12 4FLT TA EXP	FBK0512205
14	45	100	14	4	EM 14.00MMX45X100XSH14 4FLT TA EXP	FBK0512206
16	45	100	16	4	EM 16.00MMX45X100XSH16 4FLT TA EXP	FBK0512207
20	45	100	20	4	EM 20.00MMX45X100XSH20 4FLT TA EXP	FBK0512208

Cutting parameters

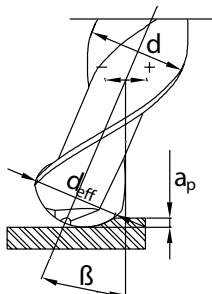
Totem Express Range

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)		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	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	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	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	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	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

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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)

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* For TiN Coated Tools Decrease RPM by 5%

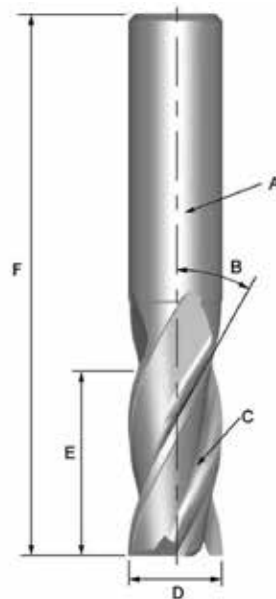
* For Uncoated Tools Decrease RPM by 20%

Disclaimer

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End mill nomenclature

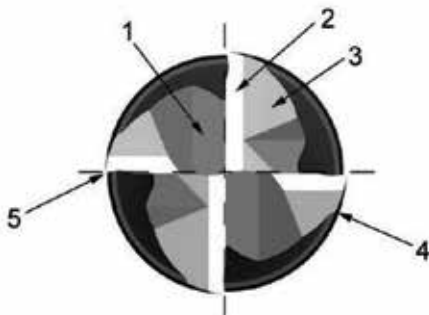
- A: Shank
- B: Helix Angle
- C: Flute
- D: Outside Diameter
- E: Cutting Length
- F: Overall Length



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%.



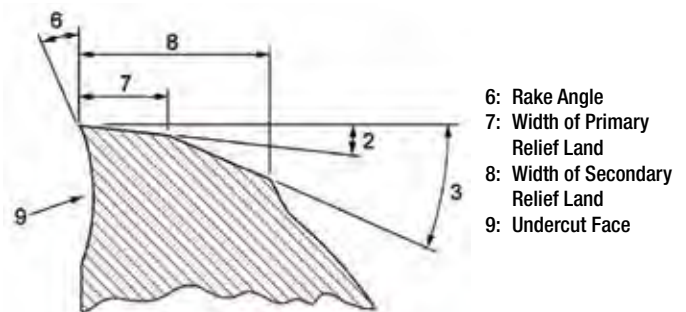
- 1: Gash
- 2: Primary Relief Angle
- 3: Secondary Relief Angle
- 4: Heel
- 5: Cutting Edge

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 radial 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 1/2" 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.

Surface treatment

STEAM OXIDE:

A black oxidized surface (Fe_3O_4) 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

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	GAISiCu4, GDAISi10Mg
	N3	—	G-ALSi12, G-AISi17Cu4, G-AISi21CuNiMg
	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, Stellite® 6,21,31
	S3	Astrolloy™, 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

END MILLS

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

$RPM = SFM \times 3.82 / \text{Tool Diameter}$

$IPM = RPM \times \text{number of teeth} \times (\text{inches/tooth})$

CONVERSION INCH TO METRIC

$Vc = SFM \times 0.3048$

$mm/min. = IPM \times 25.4$

METRIC

$RPM = Vc \times 318.057 / \text{Tool Diameter}$

$mm/min. = RPM \times \text{number of teeth} \times (mm/tooth)$

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.

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



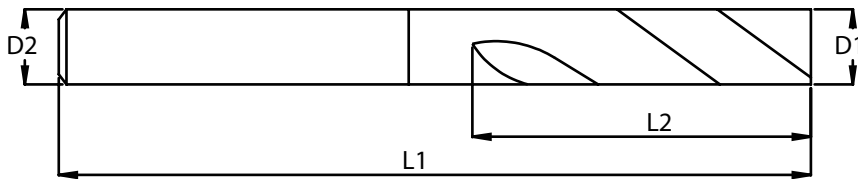
Custom tool request form

END MILLS

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 requirements.

Customer Name: _____

Phone: _____

* Work Material Machined:

Hardness: _____

Distributor: _____

Quantities: _____



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 PRECISION TOOLS AND MACHINE PARTS LIMITED

Authorised Signatory
CUSTOMER

Note: Trial tool/custom tool request form can be downloaded from our website www.forbesprecision.co.in

Milling formulas and definitions

Below are the compiled 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

Table feed, F (mm/min)

$$F = f_z \times n \times Z$$

Cutting speed, v_c (m/min)

$$V_c = \frac{\pi \times D \times n}{1000}$$

Spindle speed, n (r/min)

$$n = \frac{V_c \times 1000}{\pi \times D}$$

Feed per tooth, f_z (mm)

$$f_z = \frac{F}{n \times Z}$$

Feed per revolution, f_{rev} (mm/rev)

$$f_{rev} = \frac{F}{n}$$

Metal removal rate, Q (cm³/min)

$$Q = \frac{a_p \times a_e \times F}{1000}$$

Net power, P (kW)

$$Q = \frac{a_e \times a_p \times F \times K_c}{60 \times 10^6}$$

Torque, M_c (Nm)

$$M_c = \frac{P \times 30 \times 10^3}{\pi \times n}$$

IMPERIAL

Table feed, F (inch/min)

$$F = f_z \times n \times Z$$

Cutting speed, v_c (ft/min)

$$V_c = \frac{\pi \times D \times n}{12}$$

Spindle speed, n (rpm)

$$n = \frac{V_c \times 12}{\pi \times D}$$

Feed per tooth, f_z (inch)

$$f_z = \frac{F}{n \times Z}$$

Feed per revolution, f_{rev} (inch/rev)

$$f_{rev} = \frac{F}{n}$$

Metal removal rate, Q (inch³/min)

$$Q = a_p \times a_e \times F$$

Net power, P (HP)

$$Q = \frac{a_e \times a_p \times F \times K_c}{396 \times 10^3}$$

Torque, M_c (lbf ft)

$$M_c = \frac{P \times 16501}{\pi \times n}$$

Symbol	Designation/Definition	Metric	Imperial
a_e	Radial depth of cut	mm	inch
a_p	Axial depth of cut	mm	inch
D	Cutting diameter at cutting depth a_p	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_{bx}	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

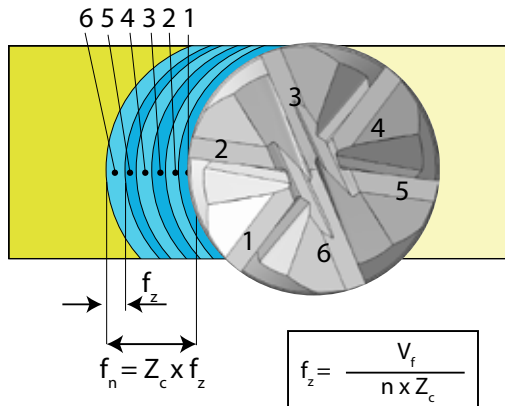
A configuration with cusps that occurs when producing sculptured surfaces.

Milling formulas and definitions

THE MILLING PROCESS - DEFINITIONS

Cutting speed, V_c

Indicates the surface speed at which the cutting edge machines the workpiece.



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

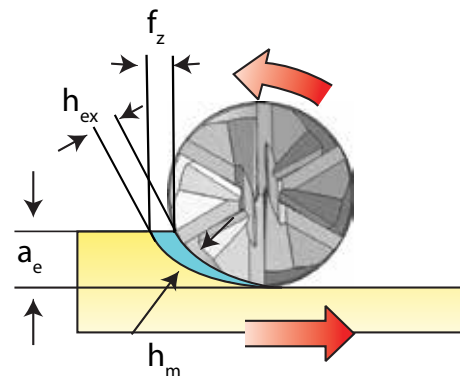
A useful value in determining the specific cutting force, used for net power calculations.

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 (z_n) 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), (a_e). 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 (cm³/min)

The volume of metal removed in cubic mm per minute (inch³/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/mm²

Machining time, T_c (min)

Machining length (l_m) divided by the table feed (F).

Net power, P and efficiency, η_{mt}

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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High Performance Cutting Tools



THREAD MILLS

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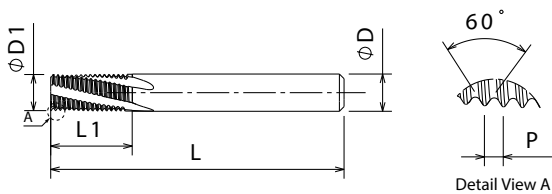
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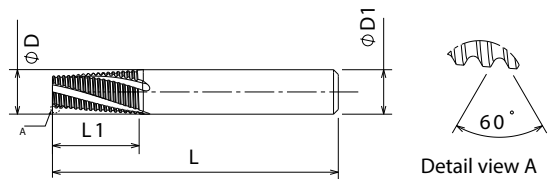
High Performance Cutting Tools

SOLID THREAD MILLING TOOLS

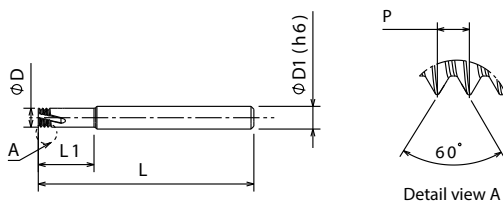
RHS: REGULAR HELICAL FLUTE SOLID



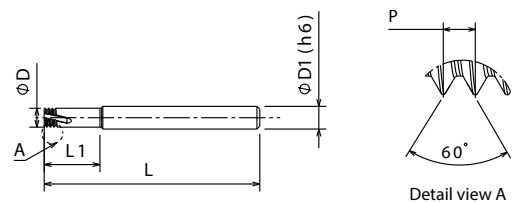
RHTS: REGULAR HELICAL FLUTE TAPER SOLID



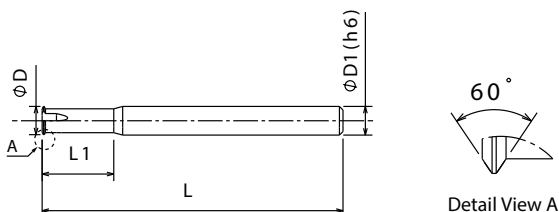
MTH2D: MULTI TOOTH 2D FOR HARD PART
MTH3D: MULTI TOOTH 3D FOR HARD PART



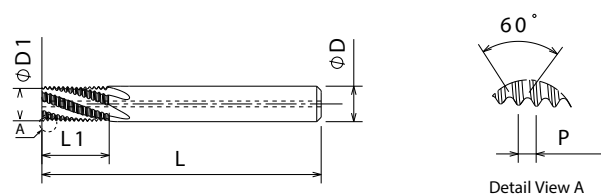
MT2D: MULTI TOOTH 2D
MT3D: MULTI TOOTH 3D
MT4D: MULTI TOOTH 4D



ST P60: SINGLE TOOTH PARTIAL PROFILE



RHC: REGULAR HELICAL FLUTE COOLANT



with coolant hole

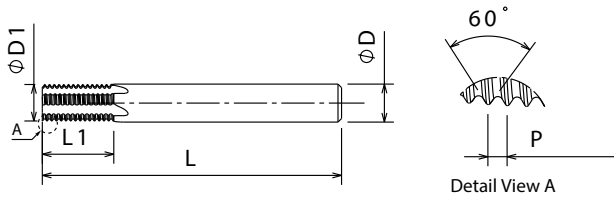




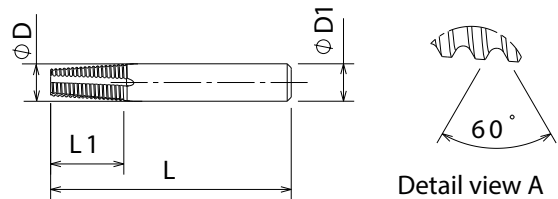
High Performance Cutting Tools

SOLID THREAD MILLING TOOLS

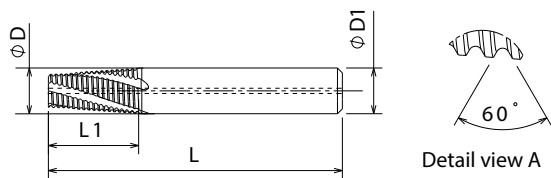
RSS: REGULAR STRAIGHT FLUTE SOLID



RSTS: REGULAR STRAIGHT FLUTE TAPER SOLID



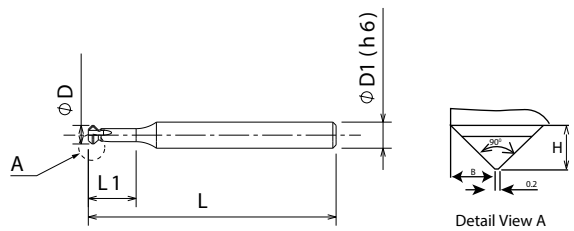
RHTC: REGULAR HELICAL FLUTE TAPER COOLANT



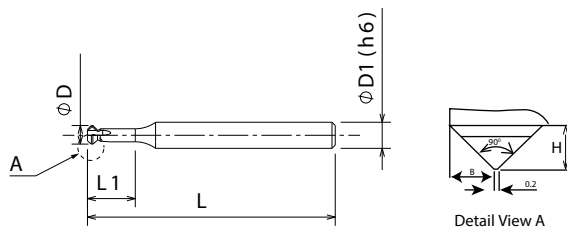
with coolant hole



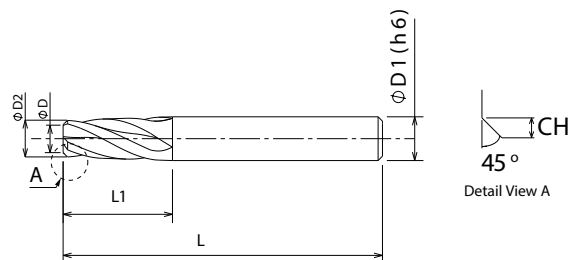
A90S: ANGLE 90 SHORT TOOL



A90L: ANGLE 90 LONG TOOL



CONIC PREPARATION TAPER END MILL



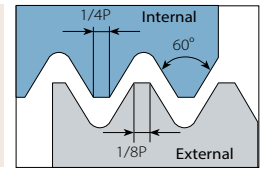


TOOL DESCRIPTION AND NOMENCLATURE

TMRHS-2.0ISO-11.9MMX27X84 SH12 4FL TA																							
TM		RHS		2.0		ISO		11.9MM			27		84	12		4FL		TA					
PRODUCT TYPE		DESIGN TYPE		PITCH		THREAD FORM		CUTTING TOOL DIA			CUTTING LENGTH		TOTAL LENGTH	SHANK DIA		NO OF FLUTES		COATING					
CT	CHAMFER TOOL	STP60	SINGLE TOOTH PARTIAL PROFILE	METRIC	TPI	ISO	ISO THREAD	0.60	2.45	4.75	7.90	1.5	8.0	15.6	25.0	39	73	3	10	2FL	2 FLUTES	TA	TAIIN
TP	TAPER PREPERATION	MT2D	MULTI TOOTH 2D	0.50	32	NPT	NATIONAL PIPE THREAD	0.72	2.46	4.80	7.95	1.8	8.1	15.8	25.5	51	83	4	12	3FL	3 FLUTES		
TM	THREAD MILL	MT3D	MULTI TOOTH 3D	0.75	28	UN	UNIFIED THREAD	0.90	2.50	4.85	8.00	2.0	8.4	16.0	26.0	57	84	6	16	4FL	4 FLUTES		
		MT4D	MULTI TOOTH 4D	0.80	24	NPTF	NATIONAL PIPE THREAD FINE	1.06	2.57	4.90	8.40	2.5	8.6	16.2	26.2	58	93	8	20	5FL	5 FLUTES		
		MTH2D	MULTI TOOTH 2D FOR HARD PART	1.00	20	UNJ	UNIFIED J THREAD	1.18	2.75	5.00	9.20	2.9	8.8	16.4	26.3	63	100			6FL	6 FLUTES		
		MTH3D	MULTI TOOTH 3D FOR HARD PART	1.25	18	MJ	MJ THREAD	1.20	3.10	5.10	9.30	3.0	9.3	16.5	26.4	64	105						
		RHS	REGULAR HELICAL FLUTE SOLID	1.50	16	BSP	BSP THREAD	1.40	3.15	5.20	9.40	3.1	9.8	16.6	27.0								
		RHTS	REGULAR HELICAL FLUTE TAPER SOLID	1.75	14	BSPT	BSPT THREAD	1.44	3.22	5.40	9.90	3.3	9.9	16.7	28.0								
		RHC	REGULAR HELICAL FLUTE COOLANT	2.00	13			1.50	3.30	5.70	9.95	3.8	10.0	17.3	28.5								
		RHTC	REGULAR HELICAL FLUTE TAPER COOLANT	2.50	12			1.54	3.31	5.90	10.00	3.9	10.1	17.5	29.0								
		RSS	REGULAR STRAIGHT FLUTE SOLID	3.00	11			1.63	3.55	5.95	10.60	4.4	10.2	18.0	29.7								
		RSTS	REGULAR STRAIGHT FLUTE TAPER SOLID		10			1.66	3.60	6.00	11.50	4.5	10.3	18.2	30.0								
		A90S	ANGLE 90 SHORT TOOL		9			1.88	3.70	6.40	11.90	4.6	10.4	18.5	31.0								
		A90L	ANGLE 90 LONG TOOL		8			1.95	3.80	6.65	11.95	4.8	10.5	19.0	31.1								
								1.96	3.90	6.70	12.00	4.9	10.6	19.3	32.1								
								2.00	4.00	6.80	14.30	5.0	10.7	19.4	33.0								
								2.10	4.20	6.90	15.90	5.1	10.8	19.5	34.0								
								2.12	4.50	7.70	19.70	5.3	10.9	19.7	35.2								
								2.40	4.70	7.80	19.90	5.4	11.3	20.0	36.0								
												5.8	11.5	20.5	36.3								
												5.9	12.0	20.8	36.8								
												6.0	12.2	21.0	37.0								
												6.1	12.4	21.8	38.1								
												6.2	12.5	22.0	39.1								
												6.4	12.7	22.5	39.7								
												6.8	13.0	22.7	40.4								
												7.1	13.7	23.0	40.5								
												7.3	14.0	23.5	40.9								
												7.4	14.4	24.0	42.0								
												7.6	14.5	24.2	42.8								
												7.7	15.0	24.3	43.0								
												7.8	15.3	24.4	48.0								
												7.9	15.5	24.5									

Multi Flute

ISO metric thread Internal threading



TM

RHS



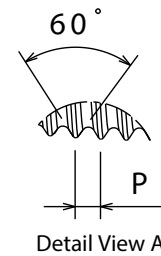
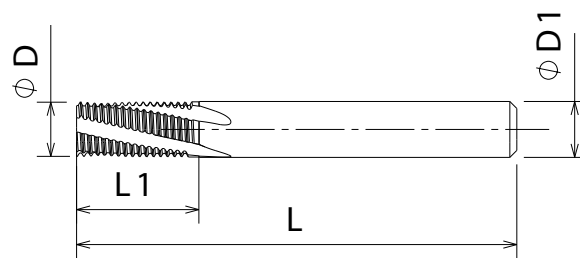
M

MF

IT

ISO

TiAlN

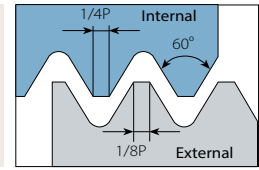


THREAD MILL

Thread Size		Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse	Fine			mm	mm	mm	mm		
	M5	0.5	TMRHS-0.5ISO-3.8MMX10.3X57 SH6 3FL TA	3.8	10.3	57	6	3	FBV0503000
	M7	0.5	TMRHS-0.5ISO-5.9MMX10.2X57 SH6 3FL TA	5.9	10.2	57	6	3	FBV0503001
M4.5	M5	0.75	TMRHS-0.75ISO-3.6MMX10.1X57 SH6 3FL TA	3.6	10.1	57	6	3	FBV0503002
	M8	0.75	TMRHS-0.75ISO-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503003
	M10	0.75	TMRHS-0.75ISO-7.9MMX15.3X63 SH8 4FL TA	7.9	15.3	63	8	4	FBV0503004
M5		0.8	TMRHS-0.8ISO-3.9MMX10X57 SH6 3FL TA	3.9	10	57	6	3	FBV0503005
M6	M7	1	TMRHS-1.0ISO-4.8MMX11.5X57 SH6 3FL TA	4.8	11.5	57	6	3	FBV0503006
M6	M7	1	TMRHS-1.0ISO-4.8MMX14.5X57 SH6 3FL TA	4.8	14.5	57	6	3	FBV0503007
	M8	1	TMRHS-1.0ISO-5.9MMX12.5X57 SH6 3FL TA	5.9	12.5	57	6	3	FBV0503008
	M10	1	TMRHS-1.0ISO-7.9MMX17.5X63 SH8 4FL TA	7.9	17.5	63	8	4	FBV0503009
	M12	1	TMRHS-1.0ISO-9.9MMX20.5X73 SH10 4FL TA	9.9	20.5	73	10	4	FBV0503010
M8	M9	1.25	TMRHS-1.25ISO-5.9MMX14.4X57 SH6 3FL TA	5.9	14.4	57	6	3	FBV0503011
M8	M9	1.25	TMRHS-1.25ISO-5.9MMX19.5X57 SH6 3FL TA	5.9	19.5	57	6	3	FBV0503012
M10	M11	1.5	TMRHS-1.5ISO-7.9MMX18.5X63 SH8 3FL TA	7.9	18.5	63	8	3	FBV0503013
	M13	1.5	TMRHS-1.5ISO-9.9MMX21.8X73 SH10 4FL TA	9.9	21.8	73	10	4	FBV0503014
	M15	1.5	TMRHS-1.5ISO-11.9MMX26.3X84 SH12 4FL TA	11.9	26.3	84	12	4	FBV0503015
	M20	1.5	TMRHS-1.5ISO-15.9MMX35.2X105 SH16 6FL TA	15.9	35.2	105	16	6	FBV0503016
M12		1.75	TMRHS-1.75ISO-9.2MMX21.8X73 SH10 3FL TA	9.2	21.8	73	10	3	FBV0503017
M14		2	TMRHS-2.0ISO-9.9MMX25X73 SH10 3FL TA	9.9	25	73	10	3	FBV0503018
M16		2	TMRHS-2.0ISO-11.9MMX27X84 SH12 4FL TA	11.9	27	84	12	4	FBV0503019
	M20	2	TMRHS-2.0ISO-15.9MMX37X105 SH16 5FL TA	15.9	37	105	16	5	FBV0503020
M20		2.5	TMRHS-2.5ISO-15.9MMX36.3X105 SH16 5FL TA	15.9	36.3	105	16	5	FBV0503021
M24	M27	3	TMRHS-3.0ISO-15.9MMX40.5X105 SH16 3FL TA	15.9	40.5	105	16	3	FBV0503022
M27		3	TMRHS-3.0ISO-19.9MMX43X105 SH20 4FL TA	19.9	43	105	20	4	FBV0503023

Multi Flute

ISO metric thread Internal threading



TM

RHC



M

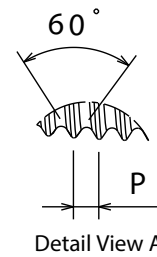
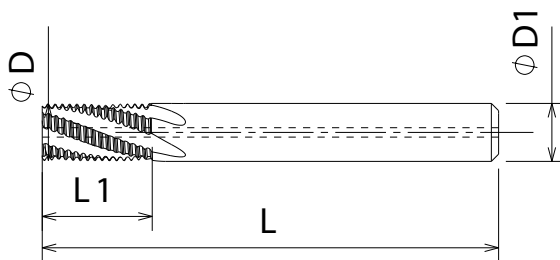
MF

IT

ISO

TiAlN

with coolant hole

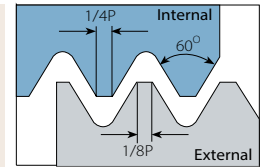


Detail View A

Thread Size		Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse	Fine			mm	mm	mm	mm		
	M5	0.5	TMRHC-0.5ISO-3.8MMX10.3X57 SH6 3FL TA	3.8	10.3	57	6	3	FBV0503024
	M7	0.5	TMRHC-0.5ISO-5.9MMX10.2X57 SH6 3FL TA	5.9	10.2	57	6	3	FBV0503025
M4.5	M5	0.75	TMRHC-0.75ISO-3.6MMX10.1X57 SH6 3FL TA	3.6	10.1	57	6	3	FBV0503026
	M8	0.75	TMRHC-0.75ISO-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503027
	M10	0.75	TMRHC-0.75ISO-7.9MMX15.3X63 SH8 4FL TA	7.9	15.3	63	8	4	FBV0503028
M5		0.8	TMRHC-0.8ISO-3.9MMX10X57 SH6 3FL TA	3.9	10	57	6	3	FBV0503029
M6	M7	1	TMRHC-1.0ISO-4.8MMX11.5X57 SH6 3FL TA	4.8	11.5	57	6	3	FBV0503030
M6	M7	1	TMRHC-1.0ISO-4.8MMX14.5X57 SH6 3FL TA	4.8	14.5	57	6	3	FBV0503031
	M8	1	TMRHC-1.0ISO-5.9MMX12.5X57 SH6 3FL TA	5.9	12.5	57	6	3	FBV0503032
	M10	1	TMRHC-1.0ISO-7.9MMX17.5X63 SH8 4FL TA	7.9	17.5	63	8	4	FBV0503033
	M12	1	TMRHC-1.0ISO-9.9MMX20.5X73 SH10 4FL TA	9.9	20.5	73	10	4	FBV0503034
M8	M9	1.25	TMRHC-1.25ISO-5.9MMX14.4X57 SH6 3FL TA	5.9	14.4	57	6	3	FBV0503035
M8	M9	1.25	TMRHC-1.25ISO-5.9MMX19.5X57 SH6 3FL TA	5.9	19.5	57	6	3	FBV0503036
M10	M11	1.5	TMRHC-1.5ISO-7.9MMX18.5X63 SH8 3FL TA	7.9	18.5	63	8	3	FBV0503037
	M13	1.5	TMRHC-1.5ISO-9.9MMX21.8X73 SH10 4FL TA	9.9	21.8	73	10	4	FBV0503038
	M15	1.5	TMRHC-1.5ISO-11.9MMX26.3X84 SH12 4FL TA	11.9	26.3	84	12	4	FBV0503039
	M20	1.5	TMRHC-1.5ISO-15.9MMX35.2X105 SH16 6FL TA	15.9	35.2	105	16	6	FBV0503040
M12		1.75	TMRHC-1.75ISO-9.2MMX21.8X73 SH10 3FL TA	9.2	21.8	73	10	3	FBV0503041
M14		2	TMRHC-2.0ISO-9.9MMX25X73 SH10 3FL TA	9.9	25	73	10	3	FBV0503042
M16		2	TMRHC-2.0ISO-11.9MMX27X84 SH12 4FL TA	11.9	27	84	12	4	FBV0503043
	M20	2	TMRHC-2.0ISO-15.9MMX37X105 SH16 5FL TA	15.9	37	105	16	5	FBV0503044
M20		2.5	TMRHC-2.5ISO-15.9MMX36.3X105 SH16 5FL TA	15.9	36.3	105	16	5	FBV0503045
M24	M27	3	TMRHC-3.0ISO-15.9MMX40.5X105 SH16 3FL TA	15.9	40.5	105	16	3	FBV0503046
M27		3	TMRHC-3.0ISO-19.9MMX43X105 SH20 4FL TA	19.9	43	105	20	4	FBV0503047

Multi Flute

(UNC, UNF, UNEF) unified thread Internal threading



TM

RHS

UNC

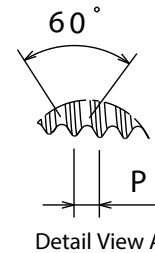
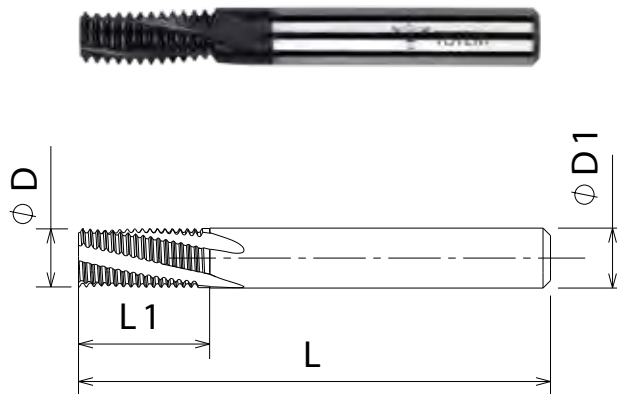
UNF

UNEF

IT

UNIFIED

TiAIN

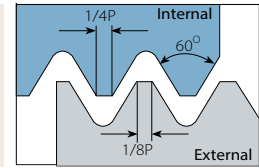


THREAD MILL

Thread Size			Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse UNC	Fine UNF	Extra Fine UNEF			mm	mm	mm	mm		
		5/16"	32	TMRHS-32UN-5.9MMX14X57 SH6 3FL TA	5.9	14	57	6	3	FBV0503048
		3/8"	32	TMRHS-32UN-7.9MMX18X63 SH8 3FL TA	7.9	18	63	8	3	FBV0503049
	1/4"		28	TMRHS-28UN-5.1MMX12.2X57 SH6 3FL TA	5.1	12.2	57	6	3	FBV0503050
		7/16"-1/2"	28	TMRHS-28UN-7.9MMX15.8X63 SH8 4FL TA	7.9	15.8	63	8	4	FBV0503051
	5/16"		24	TMRHS-24UN-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503052
	3/8"		24	TMRHS-24UN-7.9MMX15.3X63 SH8 4FL TA	7.9	15.3	63	8	4	FBV0503053
	9/16", 5/8"		24	TMRHS-24UN-11.9MMX22.7X84 SH12 4FL TA	11.9	22.7	84	12	4	FBV0503054
1/4"			20	TMRHS-20UN-4.8MMX12X57 SH6 3FL TA	4.8	12	57	6	3	FBV0503055
	7/16"		20	TMRHS-20UN-7.9MMX19.7X63 SH8 3FL TA	7.9	19.7	63	8	3	FBV0503056
	1/2"		20	TMRHS-20UN-9.9MMX22.5X73 SH10 4FL TA	9.9	22.5	73	10	4	FBV0503057
5/16"		3/4"-1"	20	TMRHS-20UN-11.9MMX26X84 SH12 4FL TA	11.9	26	84	12	4	FBV0503058
	9/16", 5/8"		18	TMRHS-18UN-5.7MMX16X57 SH6 3FL TA	5.7	16	57	6	3	FBV0503059
3/8"			18	TMRHS-18UN-9.9MMX23.5X73 SH10 4FL TA	9.9	23.5	73	10	4	FBV0503060
	3/4"		16	TMRHS-16UN-6.8MMX18.2X63 SH8 3FL TA	6.8	18.2	63	8	3	FBV0503061
7/16"			16	TMRHS-16UN-11.9MMX26.2X84 SH12 4FL TA	11.9	26.2	84	12	4	FBV0503062
	7/8"		14	TMRHS-14UN-7.8MMX20.8X63 SH8 3FL TA	7.8	20.8	63	8	3	FBV0503063
			14	TMRHS-14UN-11.9MMX24.5X84 SH12 4FL TA	11.9	24.5	84	12	4	FBV0503064
1/2"			13	TMRHS-13UN-9.3MMX24.4X73 SH10 3FL TA	9.3	24.4	73	10	3	FBV0503065
9/16"			12	TMRHS-12UN-10.6MMX26.4X84 SH12 4FL TA	10.6	26.4	84	12	4	FBV0503066
	1"		12	TMRHS-12UN-15.9MMX39.1X105 SH16 5FL TA	15.9	39.1	105	16	5	FBV0503067
5/8"			11	TMRHS-11UN-11.5MMX31.1X84 SH12 3FL TA	11.5	31.1	84	12	3	FBV0503068
3/4"			10	TMRHS-10UN-14.3MMX36.8X105 SH16 4FL TA	14.3	36.8	105	16	4	FBV0503069
7/8"			9	TMRHS-9UN-15.9MMX40.9X105 SH16 4FL TA	15.9	40.9	105	16	4	FBV0503070
1"			8	TMRHS-8UN-19.7MMX42.8X105 SH20 4FL TA	19.7	42.8	105	20	4	FBV0503071

Multi Flute

(UNC, UNF, UNEF) unified thread Internal threading



TM

RHC



UNC

UNF

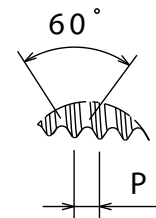
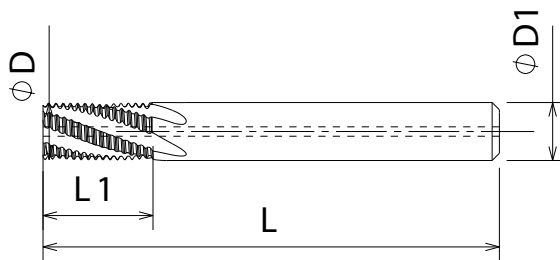
UNEF

IT

UNIFIED

TiAIN

with coolant hole

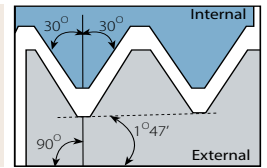


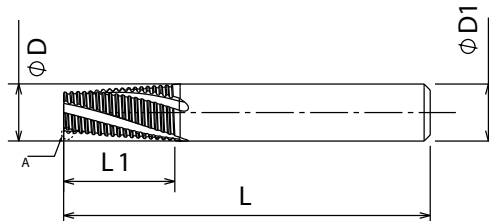
Detail View A

Thread Size			Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse UNC	Fine UNF	Extra Fine UNEF			mm	mm	mm	mm		
		5/16"	32	TMRHC-32UN-5.9MMX14X57 SH6 3FL TA	5.9	14	57	6	3	FBV0503072
		3/8"	32	TMRHC-32UN-7.9MMX18X63 SH8 3FL TA	7.9	18	63	8	3	FBV0503073
	1/4"		28	TMRHC-28UN-5.1MMX12.2X57 SH6 3FL TA	5.1	12.2	57	6	3	FBV0503074
		7/16"-1/2"	28	TMRHC-28UN-7.9MMX15.8X63 SH8 4FL TA	7.9	15.8	63	8	4	FBV0503075
	5/16"		24	TMRHC-24UN-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503076
	3/8"		24	TMRHC-24UN-7.9MMX15.3X63 SH8 4FL TA	7.9	15.3	63	8	4	FBV0503077
	9/16", 5/8"		24	TMRHC-24UN-11.9MMX22.7X84 SH12 4FL TA	11.9	22.7	84	12	4	FBV0503078
1/4"			20	TMRHC-20UN-4.8MMX12X57 SH6 3FL TA	4.8	12	57	6	3	FBV0503079
	7/16"		20	TMRHC-20UN-7.9MMX19.7X63 SH8 3FL TA	7.9	19.7	63	8	3	FBV0503080
	1/2"		20	TMRHC-20UN-9.9MMX22.5X73 SH10 4FL TA	9.9	22.5	73	10	4	FBV0503081
		3/4"-1"	20	TMRHC-20UN-11.9MMX26X84 SH12 4FL TA	11.9	26	84	12	4	FBV0503082
5/16"			18	TMRHC-18UN-5.7MMX16X57 SH6 3FL TA	5.7	16	57	6	3	FBV0503083
	9/16", 5/8"		18	TMRHC-18UN-9.9MMX23.5X73 SH10 4FL TA	9.9	23.5	73	10	4	FBV0503084
3/8"			16	TMRHC-16UN-6.8MMX18.2X63 SH8 3FL TA	6.8	18.2	63	8	3	FBV0503085
	3/4"		16	TMRHC-16UN-11.9MMX26.2X84 SH12 4FL TA	11.9	26.2	84	12	4	FBV0503086
7/16"			14	TMRHC-14UN-7.8MMX20.8X63 SH8 3FL TA	7.8	20.8	63	8	3	FBV0503087
	7/8"		14	TMRHC-14UN-11.9MMX24.5X84 SH12 4FL TA	11.9	24.5	84	12	4	FBV0503088
1/2"			13	TMRHC-13UN-9.3MMX24.4X73 SH10 3FL TA	9.3	24.4	73	10	3	FBV0503089
9/16"			12	TMRHC-12UN-10.6MMX26.4X84 SH12 4FL TA	10.6	26.4	84	12	4	FBV0503090
	1"		12	TMRHC-12UN-15.9MMX39.1X105 SH16 5FL TA	15.9	39.1	105	16	5	FBV0503091
5/8"			11	TMRHC-11UN-11.5MMX31.1X84 SH12 3FL TA	11.5	31.1	84	12	3	FBV0503092
3/4"			10	TMRHC-10UN-14.3MMX36.8X105 SH16 4FL TA	14.3	36.8	105	16	4	FBV0503093
7/8"			9	TMRHC-9UN-15.9MMX40.9X105 SH16 4FL TA	15.9	40.9	105	16	4	FBV0503094
1"			8	TMRHC-8UN-19.7MMX42.8X105 SH20 4FL TA	19.7	42.8	105	20	4	FBV0503095

Multi Flute

NPT Internal/external threading


TM
RHTS

NPT
ET
IT
NPT
TiAIN


Detail view A

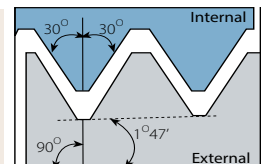
THREAD MILL

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	27	TMRHTS-27NPT-5.9MMX9.8X57 SH6 3FL TA	5.9	9.8	57	6	3	FBV0503096
1/8"	27	TMRHTS-27NPT-7.7MMX10.9X63 SH8 3FL TA	7.7	10.9	63	8	3	FBV0503097
1/4"-3/8"	18	TMRHTS-18NPT-9.9MMX16.4X73 SH10 4FL TA	9.9	16.4	73	10	4	FBV0503098
1/2"	14	TMRHTS-14NPT-11.9MMX20.8X84 SH12 4FL TA	11.9	20.8	84	12	4	FBV0503099
1/2"	14	TMRHTS-14NPT-15.9MMX20.8X93 SH16 4FL TA	15.9	20.8	93	16	4	FBV0503100
1"-2"	11.5	TMRHTS-11.5NPT-19.9X29.7X105 SH20 4F TA	19.9	29.7	105	20	4	FBV0503101
2 1/2"-6"	8	TMRHTS-8NPT-19.9MMX38.1X105 SH20 4FL TA	19.9	38.1	105	20	4	FBV0503102

Defined by: USAS B2.1:1968 | Tolerance class: Standard NPT

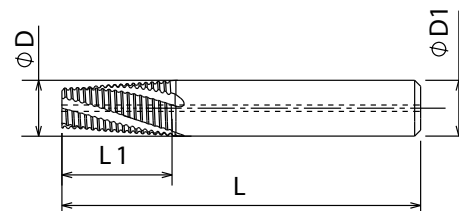
Multi Flute

NPT Internal/external threading


TM
RHTC

NPT
ET
IT
NPT
TiAIN

with coolant hole

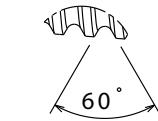
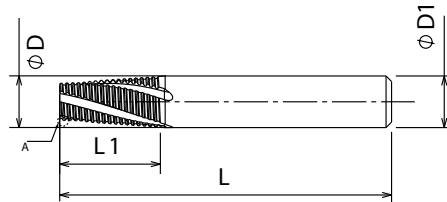
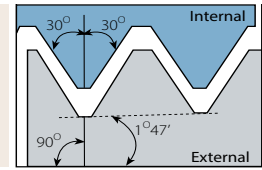


Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	27	TMRHTC-27NPT-5.9MMX9.8X57 SH6 3FL TA	5.9	9.8	57	6	3	FBV0503103
1/8"	27	TMRHTC-27NPT-7.7MMX10.9X63 SH8 3FL TA	7.7	10.9	63	8	3	FBV0503104
1/4"-3/8"	18	TMRHTC-18NPT-9.9MMX16.4X73 SH10 4FL TA	9.9	16.4	73	10	4	FBV0503105
1/2"	14	TMRHTC-14NPT-11.9MMX20.8X84 SH12 4FL TA	11.9	20.8	84	12	4	FBV0503106
1/2"	14	TMRHTC-14NPT-15.9MMX20.8X93 SH16 4FL TA	15.9	20.8	93	16	4	FBV0503107
1"-2"	11.5	TMRHTC-11.5NPT-19.9X29.7X105 SH20 4F TA	19.9	29.7	105	20	4	FBV0503108
2 1/2"-6"	8	TMRHTC-8NPT-19.9MMX38.1X105 SH20 4FL TA	19.9	38.1	105	20	4	FBV0503109

Multi Flute

NPTF Internal/external threading



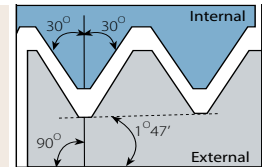
Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	27	TMRHTS-27NPTF-5.9MMX9.9X57 SH6 3FL TA	5.9	9.9	57	6	3	FBV0503110
1/8"	27	TMRHTS-27NPTF-7.7MMX10.8X63 SH8 3FL TA	7.7	10.8	63	8	3	FBV0503111
1/4"-3/8"	18	TMRHTS-18NPTF-9.9MMX16.2X73 SH10 4FL TA	9.9	16.2	73	10	4	FBV0503112
1/2"	14	TMRHTS-14NPTF-11.9MMX20.8X84 SH12 4F TA	11.9	20.8	84	12	4	FBV0503113
1"-2"	11.5	TMRHTS-11.5NPTF-19.9MMX29.7X105SH204FTA	19.9	29.7	105	20	4	FBV0503114
2 1/2"-6"	8	TMRHTS-8NPTF-19.9MMX38.1X105 SH20 4F TA	19.9	38.1	105	20	4	FBV0503115

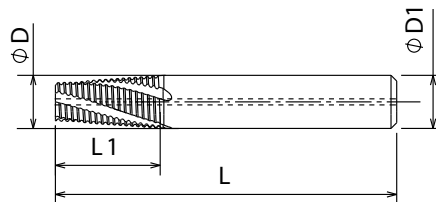
Defined by: ANSI 1.20.3-1976 | Tolerance class: Standard NPTF

Multi Flute

NPTF Internal/External Threading



with coolant hole

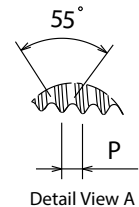
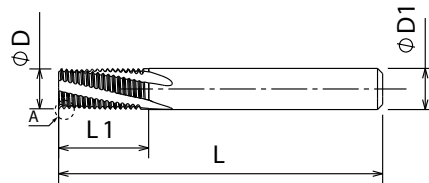
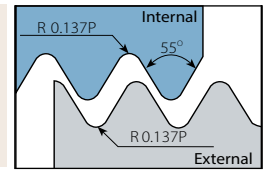


Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	27	TMRHTC-27NPTF-5.9MMX9.9X57 SH6 3FL TA	5.9	9.9	57	6	3	FBV0503116
1/8"	27	TMRHTC-27NPTF-7.7MMX10.8X63 SH8 3FL TA	7.7	10.8	63	8	3	FBV0503117
1/4"-3/8"	18	TMRHTC-18NPTF-9.9MMX16.2X73 SH10 4FL TA	9.9	16.2	73	10	4	FBV0503118
1/2"	14	TMRHTC-14NPTF-11.9MMX20.8X84 SH12 4F TA	11.9	20.8	84	12	4	FBV0503119
1"-2"	11.5	TMRHTC-11.5NPTF-19.9MMX29.7X105SH204FTA	19.9	29.7	105	20	4	FBV0503120
2 1/2"-6"	8	TMRHTC-8NPTF-19.9MMX38.1X105 SH20 4F TA	19.9	38.1	105	20	4	FBV0503121

Multi Flute

BSP (G) Internal/external threading



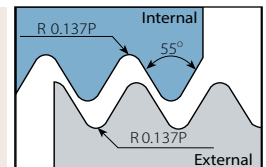
Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	28	TMRHS-28BSP-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503122
1/8"	28	TMRHS-28BSP-7.9MMX14X63 SH8 3FL TA	7.9	14.0	63	8	3	FBV0503123
1/4"-3/8"	19	TMRHS-19BSP-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503124
1/2"-7/8"	14	TMRHS-14BSP-11.9MMX22.7X84 SH12 4FL TA	11.9	22.7	84	12	4	FBV0503125
1"-2"	11	TMRHS-11BSP-15.9MMX32.1X105 SH16 4F TA	15.9	32.1	105	16	4	FBV0503126
1"-6"	11	TMRHS-11BSP-19.9MMX40.4X105 SH20 5F TA	19.9	40.4	105	20	5	FBV0503127

THREAD MILL

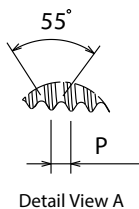
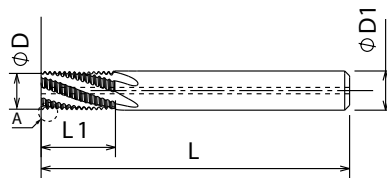
Defined by: B.S.2779:1956 | Tolerance class: Medium class

Multi Flute

BSP (G) Internal/external threading



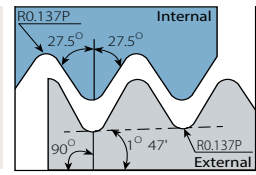
with coolant hole

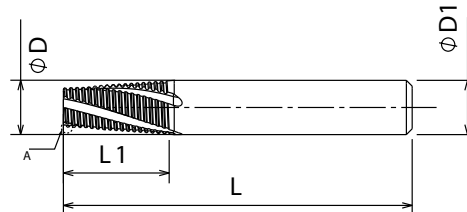


Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	28	TMRHC-28BSP-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503128
1/8"	28	TMRHC-28BSP-7.9MMX14X63 SH8 3FL TA	7.9	14.0	63	8	3	FBV0503129
1/4"-3/8"	19	TMRHC-19BSP-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503130
1/2"-7/8"	14	TMRHC-14BSP-11.9MMX22.7X84 SH12 4FL TA	11.9	22.7	84	12	4	FBV0503131
1"-2"	11	TMRHC-11BSP-15.9MMX32.1X105 SH16 4F TA	15.9	32.1	105	16	4	FBV0503132
1"-6"	11	TMRHC-11BSP-19.9MMX40.4X105 SH20 5F TA	19.9	40.4	105	20	5	FBV0503133

Multi Flute

BSPT (Rc) Internal/external threading


TM
RHTS

BSPT
IT
ET
BS
TiAIN


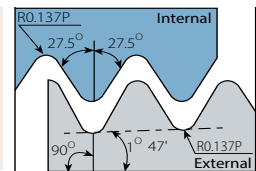
Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	28	TMRHTS-28BSPT-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503134
1/8"	28	TMRHTS-28BSPT-7.9MMX14X63 SH8 3FL TA	7.9	14.0	63	8	3	FBV0503135
1/4"-3/8"	19	TMRHTS-19BSPT-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503136
1/2"-7/8"	14	TMRHTS-14BSPT-11.9MMX22.7X84SH12 4FL TA	11.9	22.7	84	12	4	FBV0503137
1"-2"	11	TMRHTS-11BSPT-15.9MMX32.1X105SH16 4F TA	15.9	32.1	105	16	4	FBV0503138
1"-6"	11	TMRHTS-11BSPT-19.9MMX40.4X105SH20 5F TA	19.9	40.4	105	20	5	FBV0503139

Defined by: B.S.21:1985 | Tolerance class: Tolerance class: Standard BSPT

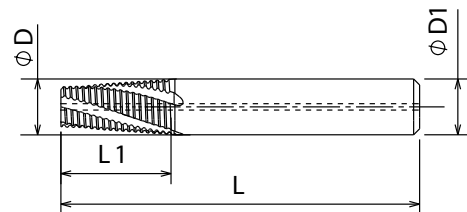
Multi Flute

BSPT (Rc) Internal/external threading


TM
RHTC

BSPT
IT
ET
BS
TiAIN

with coolant hole

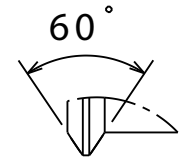
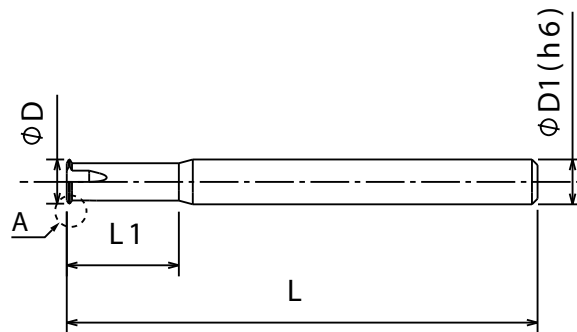
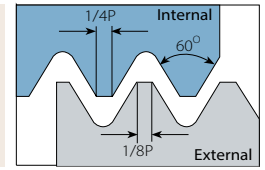


Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"	28	TMRHTC-28BSPT-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503140
1/8"	28	TMRHTC-28BSPT-7.9MMX14X63 SH8 3FL TA	7.9	14.0	63	8	3	FBV0503141
1/4"-3/8"	19	TMRHTC-19BSPT-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503142
1/2"-7/8"	14	TMRHTC-14BSPT-11.9MMX22.7X84SH12 4FL TA	11.9	22.7	84	12	4	FBV0503143
1"-2"	11	TMRHTC-11BSPT-15.9MMX32.1X105SH16 4F TA	15.9	32.1	105	16	4	FBV0503144
1"-6"	11	TMRHTC-11BSPT-19.9MMX40.4X105SH20 5F TA	19.9	40.4	105	20	5	FBV0503145

Multi Flute

Partial profile 60° Internal/external threading

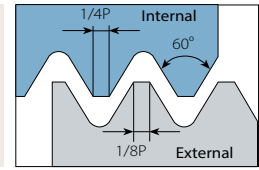


Detail View A

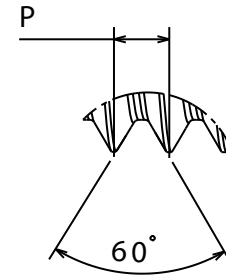
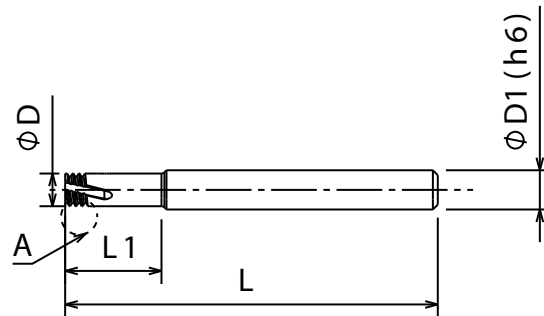
Pitch Range		Description	D	L1	L	D1	No. of Flutes	Minimum Hole Dia	EDP No
mm	TPI		mm	mm	mm	mm			
0.35-0.6	72-40	TMST-P60 1.95MMX6X39 SH3 3FL TA	1.95	6	39	3	3	2.0	FBV0503146
0.5-0.8	48-32	TMST-P60 2.45MMX7.7X39 SH3 3FL TA	2.45	7.7	39	3	3	2.6	FBV0503147
0.5-0.8	48-32	TMST-P60 3.15MMX10X51 SH4 3FL TA	3.15	10	51	4	3	3.3	FBV0503148
0.5-1.0	48-24	TMST-P60 4.00MMX12X51 SH4 3FL TA	4.0	12	51	4	3	4.2	FBV0503149
0.5-1.25	48-20	TMST-P60 4.70MMX15X57 SH6 3FL TA	4.7	15	57	6	3	4.9	FBV0503150
0.5-1.25	48-20	TMST-P60 6.00MMX18X57 SH6 3FL TA	6.0	18	57	6	3	6.3	FBV0503151
0.75-1.5	32-16	TMST-P60 8.00MMX24X63 SH8 3FL TA	8.0	24	63	8	3	8.3	FBV0503152
1.0-2.5	24-10	TMST-P60 10.00MMX30X73 SH10 4FL TA	10.0	30	73	10	4	10.4	FBV0503153
1.0-2.5	24-10	TMST-P60 12.00MMX36X84 SH12 4FL TA	12.0	36	84	12	4	12.5	FBV0503154

Multi Flute

ISO metric thread Internal threading upto 2D



THREAD MILL



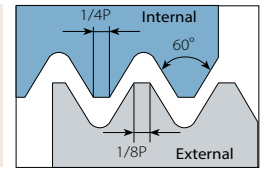
Detail view A

Thread Size	Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
M1.6	0.35	TMMT2D-0.35-ISO-1.2MMX3.3X39 SH3 3FL TA	1.2	3.3	39	3	3	FBV0503155
M1.6	0.35	TMMT2D-0.35-ISO-1.2MMX3.3X57 SH6 3FL TA	1.2	3.3	57	6	3	FBV0503156
M2	0.4	TMMT2D-0.4-ISO-1.54MMX4.4X39 SH3 3FL TA	1.54	4.4	39	3	3	FBV0503157
M2	0.4	TMMT2D-0.4-ISO-1.54MMX4.4X57 SH6 3FL TA	1.54	4.4	57	6	3	FBV0503158
M2.2	0.45	TMMT2D-0.45-ISO-1.63MMX4.8X39 SH3 3FL TA	1.63	4.8	39	3	3	FBV0503159
M2.5	0.45	TMMT2D-0.45-ISO-1.96MMX5.3X57 SH6 3FL TA	1.96	5.3	57	6	3	FBV0503160
M3	0.5	TMMT2D-0.5-ISO-2.4MMX6.4X57 SH6 3FL TA	2.4	6.4	57	6	3	FBV0503161
M3.5	0.6	TMMT2D-0.6-ISO-2.75MMX7.4X57 SH6 3FL TA	2.75	7.4	57	6	3	FBV0503162
M4	0.7	TMMT2D-0.7-ISO-3.15MMX8.6X57 SH6 3FL TA	3.15	8.6	57	6	3	FBV0503163
M5	0.8	TMMT2D-0.8-ISO-4MMX12D57 SH6 3FL TA	4	12	57	6	3	FBV0503164
M6	1	TMMT2D-1.0-ISO-4.75MMX13X57 SH6 3FL TA	4.75	13	57	6	3	FBV0503165
M8	1.25	TMMT2D-1.25-ISO-5.95MMX17.3X57 SH6 3FL TA	5.95	17.3	57	6	3	FBV0503166
M10	1.5	TMMT2D-1.5-ISO-7.90MMX22D63 SH8 3FL TA	7.9	22	63	8	3	FBV0503167
M12	1.75	TMMT2D-1.75-ISO-9.40MMX25.5X73 SH10 3FL TA	9.4	25.5	73	10	3	FBV0503168
M14	2	TMMT2D-2.0-ISO-9.95MMX29X73 SH10 3FL TA	9.95	29	73	10	3	FBV0503169
M16	2	TMMT2D-2.0-ISO-11.95MMX33X84 SH12 4FL TA	11.95	33	84	12	4	FBV0503170
M20	2.5	TMMT2D-2.5-ISO-15.90MMX42D105 SH16 5FL TA	15.9	42	105	16	5	FBV0503171

Multi Flute

ISO metric thread

Internal threading upto 3D/4D



TM

MT
3D

MT
4D

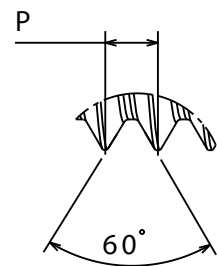
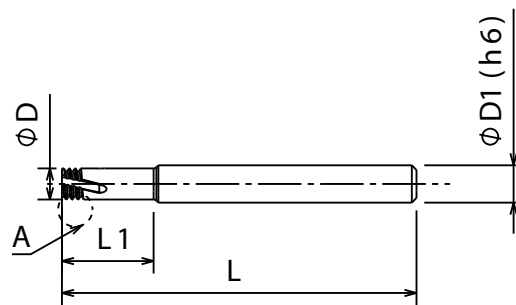


M

IT

ISO

TiAIN

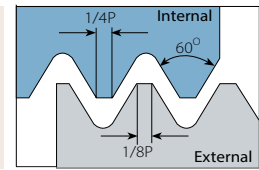


Detail view A

Thread Size	Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
M0.8	0.20	TMMT3D-0.2-ISO-0.6MMX1.8X39 SH3 3FL TA	0.6	1.8	39	3	3	FBV0503172
M1	0.25	TMMT3D-0.25-ISO-0.72MMX2.9X39 SH3 3FL TA	0.72	2.9	39	3	3	FBV0503173
M1.2	0.25	TMMT3D-0.25-ISO-0.9MMX3X39 SH3 3FL TA	0.9	3	39	3	3	FBV0503174
M1.4	0.30	TMMT3D-0.3-ISO-1.06MMX3.9X39 SH3 3FL TA	1.06	3.9	39	3	3	FBV0503175
M1.6	0.35	TMMT3D-0.35-ISO-1.2MMX5.1X39 SH3 3FL TA	1.2	5.1	39	3	3	FBV0503176
M1.6	0.35	TMMT3D-0.35-ISO-1.2MMX5.1X57 SH6 3FL TA	1.2	5.1	57	6	3	FBV0503177
M2	0.40	TMMT3D-0.4-ISO-1.54MMX6.1X39 SH3 3FL TA	1.54	6.1	39	3	3	FBV0503178
M2	0.40	TMMT3D-0.4-ISO-1.54MMX10X39 SH3 3FL TA	1.54	10	39	3	3	FBV0503179
M2	0.40	TMMT3D-0.4-ISO-1.54MMX6.1X57 SH6 3FL TA	1.54	6.1	57	6	3	FBV0503180
M2	0.40	TMMT4D-0.4-ISO-1.54MMX6.1X100 SH6 3FL TA	1.54	6.1	100	6	3	FBV0503181
M2.5	0.45	TMMT3D-0.45-ISO-1.96MMX7.6X39 SH6 3FL TA	1.96	7.6	39	6	3	FBV0503182
M2.5	0.45	TMMT3D-0.45-ISO-1.96MMX7.6X100 SH6 3F TA	1.96	7.6	100	6	3	FBV0503183
M3	0.50	TMMT3D-0.5-ISO-2.4MMX9.3X57 SH6 3FL TA	2.4	9.3	57	6	3	FBV0503184
M3	0.50	TMMT4D-0.5-ISO-2.4MMX9.3X100 SH6 3FL TA	2.4	9.3	100	6	3	FBV0503185
M3.5	0.60	TMMT3D-0.6-ISO-2.75MMX10.6X57 SH6 3FL TA	2.75	10.6	57	6	3	FBV0503186
M4	0.70	TMMT3D-0.7-ISO-3.15MMX12.4X57 SH6 3FL TA	3.15	12.4	57	6	3	FBV0503187
M4	0.70	TMMT3D-0.7-ISO-3.15MMX16X57 SH6 3FL TA	3.15	16	57	6	3	FBV0503188
M4	0.70	TMMT4D-0.7-ISO-3.15MMX12.4X100 SH6 3F TA	3.15	12.4	100	6	3	FBV0503189
M5	0.80	TMMT3D-0.8-ISO-4MMX15.6X57 SH6 3FL TA	4	15.6	57	6	3	FBV0503190
M5	0.80	TMMT3D-0.8-ISO-4MMX21X57 SH6 3FL TA	4	21	57	6	3	FBV0503191
M5	0.80	TMMT4D-0.8-ISO-4MMX15.6X100 SH6 3FL TA	4	15.6	100	6	3	FBV0503192
M6	1.00	TMMT3D-1.0-ISO-4.75MMX19X57 SH6 3FL TA	4.75	19	57	6	3	FBV0503193
M6	1.00	TMMT4D-1.0-ISO-4.75MMX19X100 SH6 3FL TA	4.75	19	100	6	3	FBV0503194
M6	1.00	TMMT3D-1.0-ISO-4.75MMX24D57 SH6 3FL TA	4.75	24	57	6	3	FBV0503195
M8	1.25	TMMT3D-1.25-ISO-5.95MMX24.3X57 SH6 3F TA	5.95	24.3	57	6	3	FBV0503196
M8	1.25	TMMT4D-1.25-ISO-5.95MMX24.3X100 SH6 3FTA	5.95	24.3	100	6	3	FBV0503197
M10	1.50	TMMT3D-1.5-ISO-7.9MMX31X63 SH8 3FL TA	7.9	31	63	8	3	FBV0503198
M10	1.50	TMMT4D-1.5-ISO-7.9MMX31X100 SH8 3FL TA	7.9	31	100	8	3	FBV0503199
M12	1.75	TMMT3D-1.75-ISO-9.4MMX36X73 SH10 3FL TA	9.4	36	73	10	3	FBV0503200
M16	2.00	TMMT4D-2.0-ISO-11.95MMX48X100 SH12 4F TA	11.95	48	100	12	4	FBV0503201

Multi Flute

(UNC, UNF) unified thread
Internal threading upto 2D



TM

MT
2D



UNC

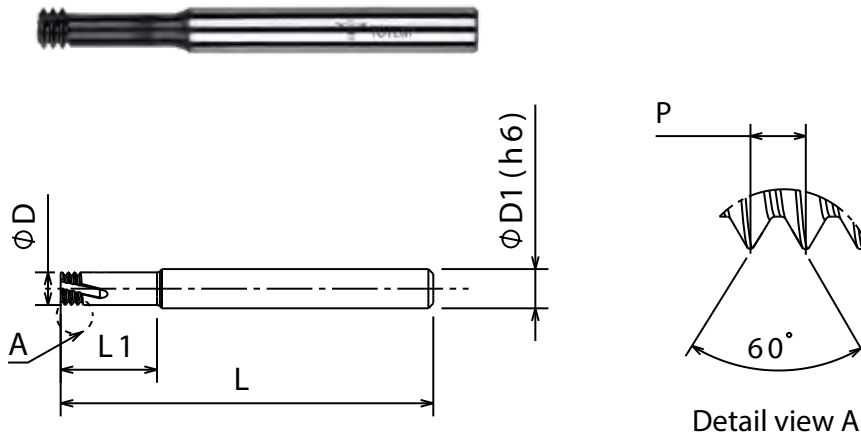
UNF

IT

UNIFIED

TiAIN

THREAD MILL



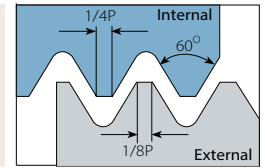
Detail view A

Thread Size		Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse	Fine			mm	mm	mm	mm		
	1	72	TMMT2D-72-UN-1.44MMX3.8X39 SH3 3FL TA	1.44	3.8	39	3	3	FBV0503202
1	2	64	TMMT2D-64-UN-1.4MMX3.9X39 SH3 3FL TA	1.40	3.9	39	3	3	FBV0503203
2	3	56	TMMT2D-56-UN-1.66MMX4.6X39 SH3 3FL TA	1.66	4.6	39	3	3	FBV0503204
2	3	56	TMMT2D-56-UN-1.66MMX4.6X57 SH6 3FL TA	1.66	4.6	57	6	3	FBV0503205
3	4	48	TMMT2D-48-UN-1.88MMX5.4X57 SH6 3FL TA	1.88	5.4	57	6	3	FBV0503206
4		40	TMMT2D-40-UN-2.12MMX6.2X57 SH6 3FL TA	2.12	6.2	57	6	3	FBV0503207
5	6	40	TMMT2D-40-UN-2.46MMX7.1X57 SH6 3FL TA	2.46	7.1	57	6	3	FBV0503208
	8	36	TMMT2D-36-UN-3.31MMX8.8X57 SH6 3FL TA	3.31	8.8	57	6	3	FBV0503209
6		32	TMMT2D-32-UN-2.57MMX7.3X57 SH6 3FL TA	2.57	7.3	57	6	3	FBV0503210
8		32	TMMT2D-32-UN-3.22MMX10.1X57 SH6 3FL TA	3.22	10.1	57	6	3	FBV0503211
	10	32	TMMT2D-32-UN-3.7MMX10.5X57 SH6 3FL TA	3.70	10.5	57	6	3	FBV0503212
	12	28	TMMT2D-28-UN-4.2MMX10.9X57 SH6 3FL TA	4.20	10.9	57	6	3	FBV0503213
	1/4"	28	TMMT2D-28-UN-5.2MMX14X57 SH6 3FL TA	5.20	14.0	57	6	3	FBV0503214
10		24	TMMT2D-24-UN-3.55MMX10.4X57 SH6 3FL TA	3.55	10.4	57	6	3	FBV0503215
	5/16"	24	TMMT2D-24-UN-6.65MMX16.7X63 SH8 3FL TA	6.65	16.7	63	8	3	FBV0503216
1/4"	7/16"	20	TMMT2D-20-UN-4.85MMX13.7X57 SH6 3FL TA	4.85	13.7	57	6	3	FBV0503217
	7/16"	20	TMMT2D-20-UN-7.95MMX24X63 SH8 3FL TA	7.95	24.0	63	8	3	FBV0503218
5/16"		18	TMMT2D-18-UN-5.95MMX16.5X57 SH6 3FL TA	5.95	16.5	57	6	3	FBV0503219
	5/8"	18	TMMT2D-18-UN-11.9MMX34X84 SH12 4FL TA	11.90	34.0	84	12	4	FBV0503220
3/8"		16	TMMT2D-16-UN-6.9MMX21X63 SH8 3FL TA	6.90	21.0	63	8	3	FBV0503221
7/16"		14	TMMT2D-14-UN-7.95MMX23.5X63 SH8 3FL TA	7.95	23.5	63	8	3	FBV0503222
1/2"		13	TMMT2D-13-UN-9.3MMX27X73 SH10 3FL TA	9.30	27.0	73	10	3	FBV0503223
9/16"		12	TMMT2D-12-UN-9.95MMX29X63 SH10 3FL TA	9.95	29.0	63	10	3	FBV0503224
5/8"		11	TMMT2D-11-UN-11.5MMX33X84 SH12 3FL TA	11.50	33.0	84	12	3	FBV0503225

3 Flute

(UNC, UNF) unified thread

Internal threading upto 3D/4D



TM

MT
3D

MT
4D



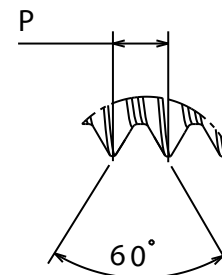
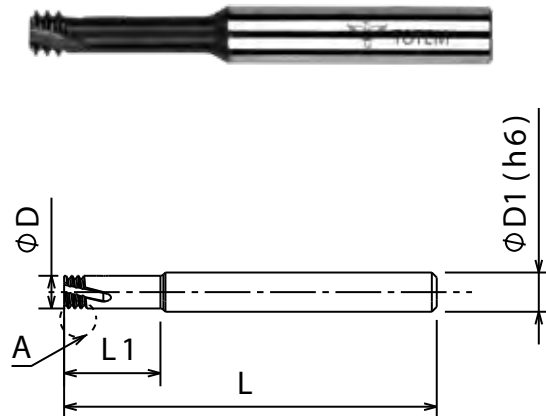
UNC

UNF

IT

UNIFIED

TiAIN



Detail view A

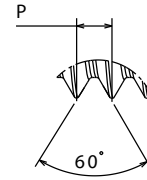
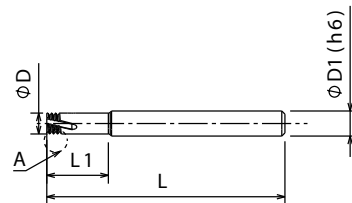
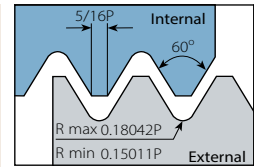
THREAD MILL

Thread Size		Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse	Fine			mm	mm	mm	mm		
	0	80	TMMT3D-80-UN-1.18MMX3.9X39 SH3 3FL TA	1.18	3.9	39	3	3	FBV0503226
	1	72	TMMT3D-72-UN-1.44MMX5.8X39 SH3 3FL TA	1.44	5.8	39	3	3	FBV0503227
	1	72	TMMT3D-72-UN-1.44MMX5.8X57 SH6 3FL TA	1.44	5.8	57	6	3	FBV0503228
2	3	56	TMMT3D-56-UN-1.66MMX6.8X39 SH3 3FL TA	1.66	6.8	39	3	3	FBV0503229
2	3	56	TMMT4D-56-UN-1.66MMX6.8X57 SH6 3FL TA	1.66	6.8	57	6	3	FBV0503230
2	3	56	TMMT3D-56-UN-1.66MMX6.8X100 SH6 3FL TA	1.66	6.8	100	6	3	FBV0503231
4		40	TMMT4D-40-UN-2.12MMX8.1X57 SH6 3FL TA	2.12	8.1	57	6	3	FBV0503232
4		40	TMMT3D-40-UN-2.12MMX8.1X100 SH6 3FL TA	2.12	8.1	100	6	3	FBV0503233
5		40	TMMT3D-40-UN-2.46MMX9.8X57 SH6 3FL TA	2.46	9.8	57	6	3	FBV0503234
6	6	32	TMMT3D-32-UN-2.57MMX10.7X57 SH6 3FL TA	2.57	10.7	57	6	3	FBV0503235
6		32	TMMT4D-32-UN-2.57MMX10.7X100 SH6 3FL TA	2.57	10.7	100	6	3	FBV0503236
8		32	TMMT3D-32-UN-3.22MMX12.7X57 SH6 3FL TA	3.22	12.7	57	6	3	FBV0503237
	10	32	TMMT3D-32-UN-3.7MMX15.5X57 SH6 3FL TA	3.70	15.5	57	6	3	FBV0503238
	10	32	TMMT4D-32-UN-3.7MMX15.5X100 SH6 3FL TA	3.70	15.5	100	6	3	FBV0503239
	12	28	TMMT3D-28-UN-4.2MMX16X57 SH6 3FL TA	4.20	16.0	57	6	3	FBV0503240
	1/4"	28	TMMT3D-28-UN-5.2MMX19.3X57 SH6 3FL TA	5.20	19.3	57	6	3	FBV0503241
	1/4"	28	TMMT4D-28-UN-5.2MMX19.3X100 SH6 3FL TA	5.20	19.3	100	6	3	FBV0503242
	5/16"	24	TMMT3D-24-UN-6.65MMX24.2X63 SH8 3FL TA	6.65	24.2	63	8	3	FBV0503243
1/4"	7/16"	20	TMMT3D-20-UN-4.85MMX19.4X57 SH6 3FL TA	4.85	19.4	57	6	3	FBV0503244
1/4"	7/16"	20	TMMT4D-20-UN-4.85MMX19.4X100 SH6 3FL TA	4.85	19.4	100	6	3	FBV0503245
5/16"		18	TMMT3D-18-UN-5.9MMX23X57 SH6 3FL TA	5.90	23.0	57	6	3	FBV0503246
3/8"		16	TMMT3D-16-UN-6.9MMX28.5X63 SH8 3FL TA	6.90	28.5	63	8	3	FBV0503247

3 Flute

(UNJ) unified thread

Internal threading upto 3D



Detail view A

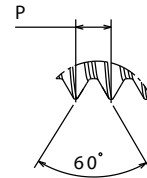
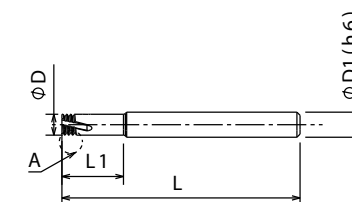
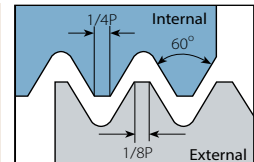
Thread Size		Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
Coarse	Fine								
4	6	40	TMMT3D-40-UNJ-2.1MMX8X57 SH6 3FL TA	2.1	8	57	6	3	FBV0503248
8	10	32	TMMT3D-32-UNJ-3.3MMX13X57 SH6 3FL TA	3.3	12	57	6	3	FBV0503249
	1/4"	28	TMMT3D-28-UNJ-5.4MMX19X57 SH6 3FL TA	5.4	19	57	6	3	FBV0503250
	5/16", 3/8"	24	TMMT3D-24-UNJ-6.7MMX24X63 SH8 3FL TA	6.7	24	63	8	3	FBV0503251
1/4"		20	TMMT3D-20-UNJ-5MMX19X63 SH6 3FL TA	5	19	63	6	3	FBV0503252
	7/16"	20	TMMT3D-20-UNJ-7.9MMX28X63 SH8 3FL TA	7.9	28	63	8	3	FBV0503253
5/16"		18	TMMT3D-18-UNJ-6.4MMX24X63 SH8 3FL TA	6.4	24	63	8	3	FBV0503254
3/8"		16	TMMT3D-16-UNJ-6.9MMX24X63 SH8 3FL TA	6.9	24	63	8	3	FBV0503255
7/16"		14	TMMT3D-14-UNJ-7.9MMX26X63 SH8 3FL TA	7.9	26	63	8	3	FBV0503256
1/2"		13	TMMT3D-13-UNJ-9.9MMX28X73 SH10 3FL TA	9.9	28	73	10	3	FBV0503257

Defined by: ISO 5855 | Tolerance class: 4h/6h-4H/5H

Multi Flute

(MJ) ISO Thread

Internal Threading upto 3D



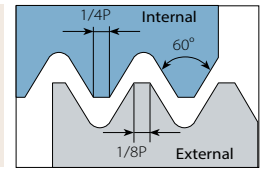
Detail view A

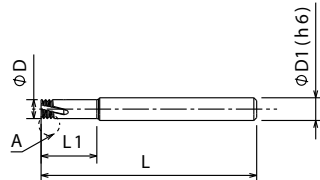
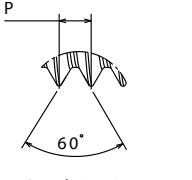
Thread Size	Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
MJ4.0	0.70	TMMT3D-0.7-MJ-3.2MMX13X57 SH6 3FL TA	3.2	12	57	6	3	FBV0503258
MJ5.0	0.80	TMMT3D-0.8-MJ-4MMX15X57 SH6 3FL TA	4	15	57	6	3	FBV0503259
MJ6.0	1.00	TMMT3D-1.0-MJ-4.8MMX18X57 SH6 3FL TA	4.8	18	57	6	3	FBV0503260
MJ8.0	1.25	TMMT3D-1.25-MJ-6.5MMX24X63 SH8 3FL TA	6.5	24	63	8	3	FBV0503261
MJ10.0	1.50	TMMT3D-1.5-MJ-7.9MMX31X63 SH8 3FL TA	7.9	31	63	8	3	FBV0503262
MJ12.0	1.75	TMMT3D-1.75-MJ-9.4MMX31X73 SH10 3FL TA	9.4	31	73	10	3	FBV0503263
MJ14.0 , MJ16.0	2.00	TMMT3D-2.0-MJ-9.9MMX36X73 SH10 3FL TA	9.9	36	73	10	3	FBV0503264

3 Flute

ISO metric thread

Internal threading for hard materials upto 2D



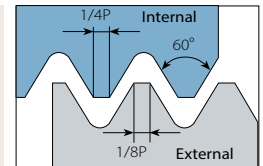
  								
Thread Size	Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
M1.6	0.35	TMMTH2D-0.35-ISO-1.2MMX3.3X57 SH6 3FL TA	1.2	3.3	57	6	3	FBV0503265
M2	0.40	TMMTH2D-0.4-ISO-1.54MMX4.4X57 SH6 3FL TA	1.54	4.4	57	6	3	FBV0503266
M2.2	0.45	TMMTH2D-0.45-ISO-1.63MMX4.8X57 SH6 3FL TA	1.63	4.8	57	6	3	FBV0503267
M2.5	0.45	TMMTH2D-0.45-ISO-1.96MMX5.3X57 SH6 3FL TA	1.96	5.3	57	6	3	FBV0503268
M3	0.50	TMMTH2D-0.5-ISO-2.4MMX6.4X57 SH6 3FL TA	2.4	6.4	57	6	3	FBV0503269
M3.5	0.60	TMMTH2D-0.6-ISO-2.75MMX7.4X57 SH6 3FL TA	2.75	7.4	57	6	3	FBV0503270
M4	0.70	TMMTH2D-0.7-ISO-3.15MMX8.6X57 SH6 3FL TA	3.15	8.6	57	6	3	FBV0503271
M5	0.80	TMMTH2D-0.8-ISO-4MMX12X57 SH6 3FL TA	4	12	57	6	3	FBV0503272
M6	1.00	TMMTH2D-1-ISO-4.75MMX13X57 SH6 3FL TA	4.75	13	57	6	3	FBV0503273
M8	1.25	TMMTH2D-1.25-ISO-5.95MMX17.3X57 SH6 3FL TA	5.95	17.3	57	6	3	FBV0503274
M10	1.50	TMMTH2D-1.5-ISO-7.9MMX22X63 SH8 3FL TA	7.9	22	63	8	3	FBV0503275

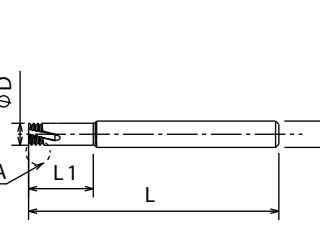
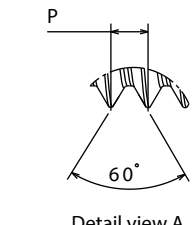
Defined by: R262 (DIN 13) | Tolerance class: 6H

Multi Flute

ISO metric thread

Internal threading for hard materials upto 3D

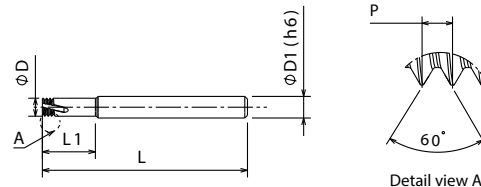
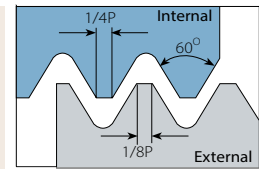


  								
Thread Size	Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
M1.6	0.35	TMMTH3D-0.35-ISO-1.2MMX5.1X57 SH6 3FL TA	1.2	5.1	57	6	3	FBV0503276
M2	0.4	TMMTH3D-0.4-ISO-1.54MMX6.1X57 SH6 3FL TA	1.54	6.1	57	6	3	FBV0503277
M2.2	0.45	TMMTH3D-0.45-ISO-1.96MMX7.6X57 SH6 3FL TA	1.96	7.6	57	6	3	FBV0503278
M3	0.5	TMMTH3D-0.5-ISO-2.4MMX9.3X57 SH6 3FL TA	2.4	9.3	57	6	3	FBV0503279
M4	0.7	TMMTH3D-0.7-ISO-3.15MMX12.4X57 SH6 3FL TA	3.15	12.4	57	6	3	FBV0503280
M5	0.8	TMMTH3D-0.8-ISO-4MMX15.6X57 SH6 3FL TA	4	15.6	57	6	3	FBV0503281
M6	1	TMMTH3D-1-ISO-4.75MMX19X57 SH6 3FL TA	4.75	19	57	6	3	FBV0503282
M8	1.25	TMMTH3D-1.25-ISO-5.95MMX24.3X57 SH6 3FL TA	5.95	24.3	57	6	3	FBV0503283

3 Flute

(UN, UNF) unified thread

Internal threading for hard materials upto 2D



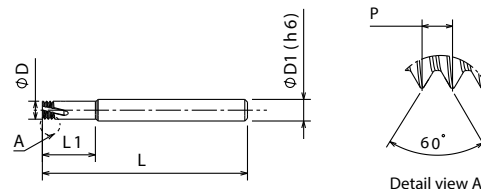
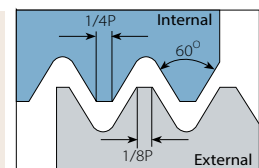
Thread Size		Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
Coarse	Fine								
	1	72	TMMTH2D-72-UN-1.44MMX3.8X57 SH6 3FL TA	1.44	3.8	57	6	3	FBV0503284
1	2	64	TMMTH2D-64-UN-1.4MMX3.9X57 SH6 3FL TA	1.4	3.9	57	6	3	FBV0503285
2	3	56	TMMTH2D-56-UN-1.66MMX4.6X57 SH6 3FL TA	1.66	4.6	57	6	3	FBV0503286
3	4	48	TMMTH2D-48-UN-1.88MMX5.4X57 SH6 3FL TA	1.88	5.4	57	6	3	FBV0503287
4		40	TMMTH2D-40-UN-2.12MMX6.2X57 SH6 3FL TA	2.12	6.2	57	6	3	FBV0503288
5	6	40	TMMTH2D-40-UN-2.46MMX7.1X57 SH6 3FL TA	2.46	7.1	57	6	3	FBV0503289
	8	36	TMMTH2D-36-UN-3.31MMX8.8X57 SH6 3FL TA	3.31	8.8	57	6	3	FBV0503290
6		32	TMMTH2D-32-UN-2.57MMX7.8X57 SH6 3FL TA	2.57	7.8	57	6	3	FBV0503291
8	10	32	TMMTH2D-32-UN-3.22MMX10.3X57 SH6 3FL TA	3.22	10.3	57	6	3	FBV0503292
	1/4"	28	TMMTH2D-28-UN-5.2MMX14X57 SH6 3FL TA	5.2	14	57	6	3	FBV0503293
10		24	TMMTH2D-24-UN-3.55MMX10.4X57 SH6 3FL TA	3.55	10.4	57	6	3	FBV0503294
	5/16"	24	TMMTH2D-24-UN-6.65MMX16.7X64 SH8 3FL TA	6.65	16.7	64	8	3	FBV0503295
1/4"	7/16"	20	TMMTH2D-20-UN-4.85MMX13.7X57 SH6 3FL TA	4.85	13.7	57	6	3	FBV0503296
	7/16"	20	TMMTH2D-20-UN-7.95MMX24X64 SH8 3FL TA	7.95	24	64	8	3	FBV0503297
5/16"		18	TMMTH2D-18-UN-5.95MMX16.5X57 SH6 3FL TA	5.95	16.5	57	6	3	FBV0503298
3/8"		16	TMMTH2D-16-UN-6.9MMX20X63 SH8 3FL TA	6.9	20	63	8	3	FBV0503299
7/16"		14	TMMTH2D-14-UN-7.95MMX23.5X63 SH8 3FL TA	7.95	23.5	63	8	3	FBV0503300

Defined by: ANSI B1.1:74 | Tolerance class: 2B

3 Flute

(UN, UNF) Unified Thread

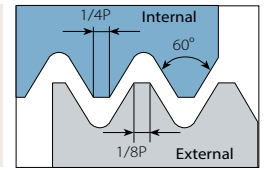
Internal Threading For Hard Materials upto 3D



Thread Size		Pitch mm	Description	D mm	L1 mm	L mm	D1 mm	No. of Flutes	EDP No
Coarse	Fine								
	1	72	TMMTH3D-72-UN-1.44MMX5.8X57 SH6 3FL TA	1.44	5.8	57	6	3	FBV0503301
5	6	40	TMMTH3D-40-UN-2.46MMX9.8X57 SH6 3FL TA	2.46	9.8	57	6	3	FBV0503302
8	10	32	TMMTH3D-32-UN-3.22MMX12.7X57 SH6 3FL TA	3.22	12.7	57	6	3	FBV0503303
	1/4"	28	TMMTH3D-28-UN-5.2MMX19.3X57 SH6 3FL TA	5.2	19.3	57	6	3	FBV0503304
	5/16"	24	TMMTH3D-24-UN-6.65MMX24.2X63 SH8 3FL TA	6.65	24.2	63	8	3	FBV0503305
1/4"	7/16"	20	TMMTH3D-20-UN-4.85MMX19.4X57 SH6 3FL TA	4.85	19.4	57	6	3	FBV0503306

Multi Flute

ISO metric thread Internal threading



TM

RSS



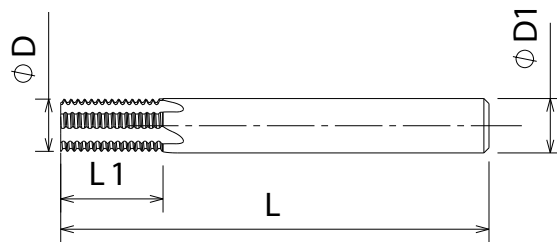
M

MF

IT

ISO

TiAIN

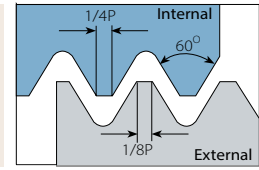


THREAD MILL

Thread Size		Pitch mm	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse	Fine			mm	mm	mm	mm		
	M8	0.75	TMRSS-0.75-ISO-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503307
M5		0.80	TMRSS-0.8-ISO-3.9MMX10X57 SH6 3FL TA	3.9	10	57	6	3	FBV0503308
M6	M7	1.00	TMRSS-1-ISO-4.8MMX11.5X57 SH6 3FL TA	4.8	11.5	57	6	3	FBV0503309
	M10	1.00	TMRSS-1-ISO-7.9MMX17.5X63 SH8 4FL TA	7.9	17.5	63	8	4	FBV0503310
	M12	1.00	TMRSS-1-ISO-9.9MMX20.5X73 SH10 4FL TA	9.9	20.5	73	10	4	FBV0503311
M8	M9	1.25	TMRSS-1.25-ISO-5.9MMX14.4X57 SH6 3FL TA	5.9	14.4	57	6	3	FBV0503312
M10	M11	1.50	TMRSS-1.5-ISO-7.9MMX18.5X63 SH8 3FL TA	7.9	18.5	63	8	3	FBV0503313
	M13	1.50	TMRSS-1.5-ISO-9.9MMX21.8X73 SH10 4FL TA	9.9	21.8	73	10	4	FBV0503314
	M15	1.50	TMRSS-1.5-ISO-11.9MMX26.3X84 SH12 4FL TA	11.9	26.3	84	12	4	FBV0503315
M12		1.75	TMRSS-1.75-ISO-7.9MMX18X64 SH8 3FL TA	7.9	18	64	8	3	FBV0503316
M14		2.00	TMRSS-2-ISO-9.9MMX25X73 SH10 3FL TA	9.9	25	73	10	3	FBV0503317
M16		2.00	TMRSS-2-ISO-11.9MMX27X84 SH12 4FL TA	11.9	27	84	12	4	FBV0503318
M20		2.50	TMRSS-2.5-ISO-11.9MMX30X84 SH12 4FL TA	11.9	30	84	12	4	FBV0503319
M24	M27	3.00	TMRSS-3-ISO-11.5MMX40.5X105 SH16 4FL TA	11.5	40.5	105	16	4	FBV0503320

Multi Flute

(UNC, UNF, UNEF) unified thread Internal threading



TM

RSS

○

UNC

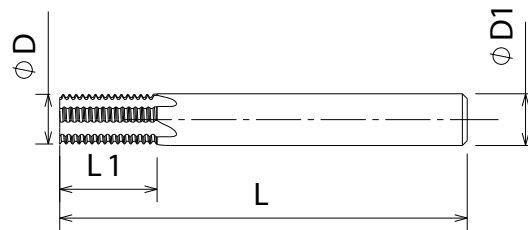
UNF

UNEF

IT

UNIFIED

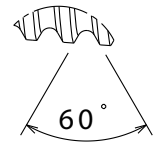
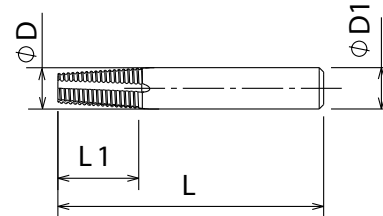
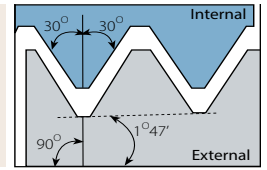
TiAIN



Thread Size			Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
Coarse UNC	Fine UNF	Extra Fine UNEF			mm	mm	mm	mm		
		5/16"	32	TMRSS-32-UN-5.9MMX14X57 SH6 3FL TA	5.9	14	57	6	3	FBV0503321
	1/4"		28	TMRSS-28-UN-5.1MMX12.2X57 SH6 3FL TA	5.1	12.2	57	6	3	FBV0503322
		7/16"-1/2"	28	TMRSS-28-UN-7.9MMX15.8X63 SH8 4FL TA	7.9	15.8	63	8	4	FBV0503323
	5/16"		24	TMRSS-24-UN-5.9MMX10.8X57 SH6 3FL TA	5.9	10.8	57	6	3	FBV0503324
1/4"			20	TMRSS-20-UN-4.8MMX12X57 SH6 3FL TA	4.8	12	57	6	3	FBV0503325
	7/16"		20	TMRSS-20-UN-7.9MMX19.7X63 SH8 3FL TA	7.9	19.7	63	8	3	FBV0503326
	1/2"		20	TMRSS-20-UN-9.9MMX17.5X73 SH10 4FL TA	9.9	17.5	73	10	4	FBV0503327
5/16"			18	TMRSS-18-UN-5.7MMX16X57 SH6 3FL TA	5.7	16	57	6	3	FBV0503328
	9/16"-5/8"		18	TMRSS-18-UN-7.9MMX18.5X63 SH8 3FL TA	7.9	18.5	63	8	3	FBV0503329
3/8"			16	TMRSS-16-UN-6.8MMX18.2X63 SH8 3FL TA	6.8	18.2	63	8	3	FBV0503330
	3/4"		16	TMRSS-16-UN-11.9MMX26.2X84 SH12 4FL TA	11.9	26.2	84	12	4	FBV0503331
7/16"			14	TMRSS-14-UN-7.8MMX20.8X63 SH8 3FL TA	7.8	20.8	63	8	3	FBV0503332
	7/8"		14	TMRSS-14-UN-11.9MMX24.5X84 SH12 4FL TA	11.9	24.5	84	12	4	FBV0503333
1/2"			13	TMRSS-13-UN-9.3MMX24.4X73 SH10 3FL TA	9.3	24.4	73	10	3	FBV0503334
9/16"			12	TMRSS-12-UN-10.6MMX26.4X84 SH12 4FL TA	10.6	26.4	84	12	4	FBV0503335
	1"		12	TMRSS-12-UN-15.9MMX39.1X105 SH16 5FL TA	15.9	39.1	105	16	5	FBV0503336
5/8"			11	TMRSS-11-UN-11.5MMX31.1X84 SH12 4FL TA	11.5	31.1	84	12	4	FBV0503337
3/4"			10	TMRSS-10-UN-14.3MMX36.8X105 SH16 4FL TA	14.3	36.8	105	16	4	FBV0503338
7/8"			9	TMRSS-9-UN-15.9MMX40.9X105 SH16 4FL TA	15.9	40.9	105	16	4	FBV0503339
1"			8	TMRSS-8-UN-19.7MMX39.7X105 SH20 4FL TA	19.7	39.7	105	20	4	FBV0503340

Multi Flute

NPT Internal/external threading



Detail view A

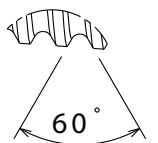
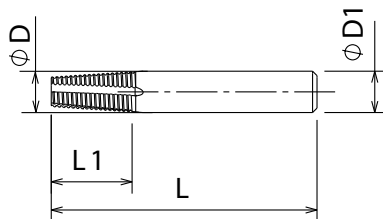
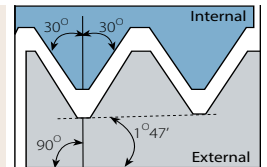
Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"-1/8"	27	TMRSTS-27-NPT-5.9MMX9.8X57 SH6 3FL TA	5.9	9.8	57	6	3	FBV0503341
1/4"-3/8"	18	TMRSTS-18-NPT-9.9MMX16.2X73 SH10 4FL TA	9.9	16.2	73	10	4	FBV0503342
1/2"	14	TMRSTS-14-NPT-11.9MMX20.8X83 SH12 4FL TA	11.9	20.8	83	12	4	FBV0503343
1"-2"	11.5	TMRSTS-11.5-NPT-19.9MMX29.7X105 SH20 4FL TA	19.9	29.7	105	20	4	FBV0503344
2 1/2"-6"	8	TMRSTS-8-NPT-19.9MMX38.1X105 SH20 4FL TA	19.9	38.1	105	20	4	FBV0503345

THREAD MILL

Defined by: USAS B2.1:1968 | Tolerance class: Standard NPT

Multi Flute

NPTF Internal/external threading



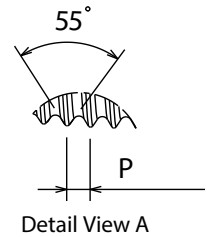
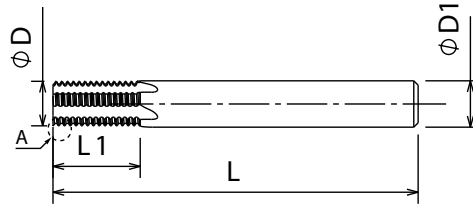
Detail view A

Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"-1/8"	27	TMRSTS-27-NPTF-5.9MMX9.9X57 SH6 3FL TA	5.9	9.9	57	6	3	FBV0503346
1/4"-3/8"	18	TMRSTS-18-NPTF-9.9MMX16.2X73 SH10 4FL TA	9.9	16.2	73	10	4	FBV0503347
1/2"	14	TMRSTS-14-NPTF-11.9MMX20.8X83 SH12 4FL TA	11.9	20.8	83	12	4	FBV0503348
1"-2"	11.5	TMRSTS-11.5-NPTF-19.9MMX29.7X105SH20 4FTA	19.9	29.7	105	20	4	FBV0503349
2 1/2"-6"	8	TMRSTS-8-NPTF-19.9MMX38.1X105 SH20 4FL TA	19.9	38.1	105	20	4	FBV0503350

Multi Flute

BSP (G) Internal/external threading

TM RSS  BSP ET IT BS TiAlN

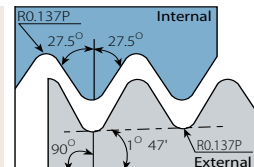


Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"-1/8"	28	TMRSS-28-BSP-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503351
1/4"-3/8"	19	TMRSS-19-BSP-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503352
1/2"-7/8"	14	TMRSS-14-BSP-11.9MMX22.7X83 SH12 4FL TA	11.9	22.7	83	12	4	FBV0503353
1"-2"	11	TMRSS-11-BSP-15.9MMX32.1X105 SH16 4FL TA	15.9	32.1	105	16	4	FBV0503354

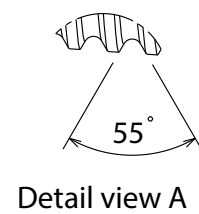
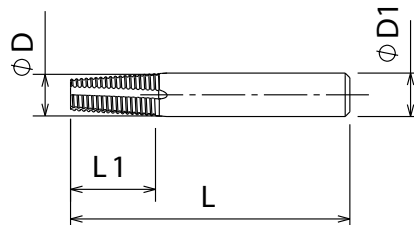
Defined by: B.S.21:1985 | Tolerance class: Tolerance class: Standard BSPT

Multi Flute

BSPT (Rc) Internal/external threading



TM RSTS  BSP ET IT BS TiAlN

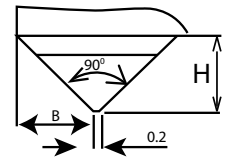


Thread Size	Pitch TPI	Description	D	L1	L	D1	No. of Flutes	EDP No
			mm	mm	mm	mm		
1/16"-1/8"	28	TMRSTS-28-BSPT-5.9MMX11.3X57 SH6 3FL TA	5.9	11.3	57	6	3	FBV0503355
1/4"-3/8"	19	TMRSTS-19-BSPT-9.9MMX16.6X73 SH10 4FL TA	9.9	16.6	73	10	4	FBV0503356
1/2"-7/8"	14	TMRSTS-14-BSPT-11.9MMX22.7X83 SH12 4FL TA	11.9	22.7	83	12	4	FBV0503357
1"-2"	11	TMRSTS-11-BSPT-15.9MMX32.1X105 SH16 4FL TA	15.9	32.1	105	16	4	FBV0503358

3 Flute

Chamfer tools

Internal chamfering- short



CT

A90S

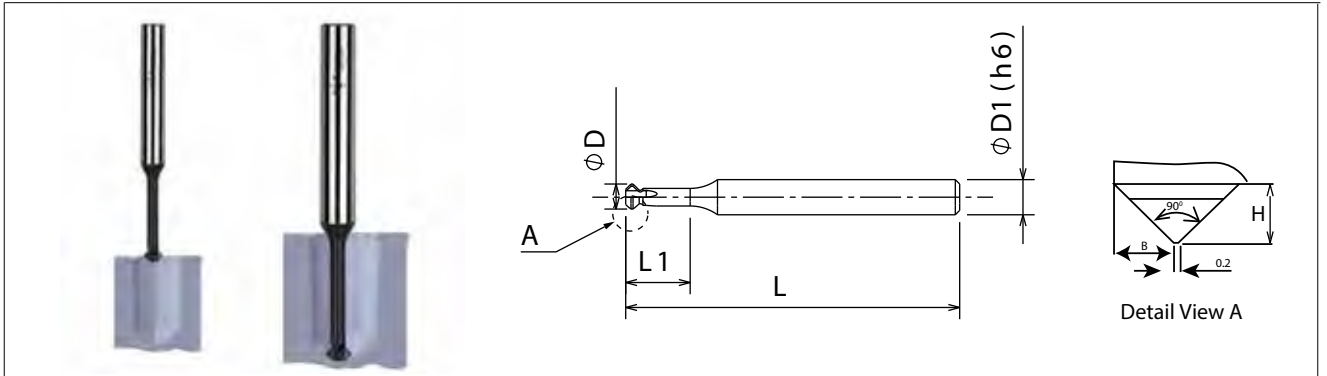


SHORT

IC

IT

TiAIN

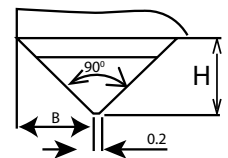


Description	D	L1	L	D1	H	B	Angle	No. Of Flutes	EDP No
	mm	mm	mm	mm	mm	mm	a		
CT-A90S-1.5MMX4X39 SH3 3FL TA	1.50	4	39	3	0.3	0.4	90	3	FBV0503359
CT-A90S-2MMX5X39 SH3 3FL TA	2.00	5	39	3	0.4	0.5	90	3	FBV0503360
CT-A90S-2.5MMX6X39 SH3 3FL TA	2.50	6	39	3	0.5	0.6	90	3	FBV0503361
CT-A90S-3.1MMX8X51 SH4 3FL TA	3.10	8	51	4	0.6	0.6	90	3	FBV0503362
CT-A90S-3.9MMX10X51 SH4 3FL TA	3.90	10	51	4	0.8	0.9	90	3	FBV0503363
CT-A90S-4.5MMX11X58 SH6 3FL TA	4.50	11	58	6	1.1	1.2	90	3	FBV0503364
CT-A90S-4.9MMX12X58 SH6 3FL TA	4.90	12	58	6	1.1	1.2	90	3	FBV0503365
CT-A90S-5.9MMX14X58 SH6 3FL TA	5.90	14	58	6	1.5	1.6	90	3	FBV0503366
CT-A90S-7.9MMX20X64 SH6 3FL TA	7.90	20	64	8	1.6	1.7	90	3	FBV0503367

3 Flute

Chamfer tools

Internal chamfering- long



CT

A90L

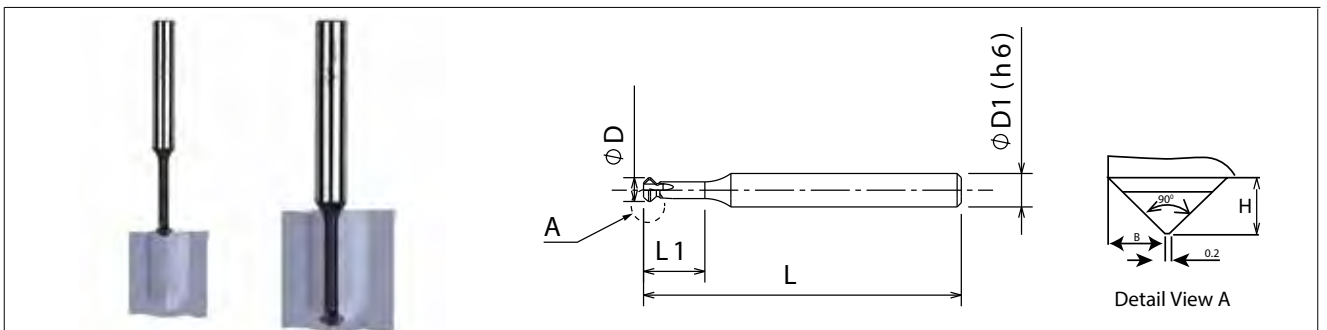


LONG

IC

IT

TiAIN



Description	D	L1	L	D1	H	B	Angle	No. Of Flutes	EDP No
	mm	mm	mm	mm	mm	mm	a		
CT-A90L-3.1MMX12X51 SH4 3FL TA	3.1	12	51	4	0.6	0.6	90	3	FBV0503368
CT-A90L-3.9MMX16X51 SH4 3FL TA	3.9	16	51	4	0.8	0.9	90	3	FBV0503369
CT-A90L-4.9MMX20X58 SH6 3FL TA	4.9	20	58	6	1.1	1.2	90	3	FBV0503370
CT-A90L-5.9MMX24X58 SH4 3FL TA	5.9	24	58	6	1.5	1.6	90	3	FBV0503371
CT-A90L-7.9MMX30X64 SH8 3FL TA	7.9	30	64	8	1.6	1.7	90	3	FBV0503372

4 Flute

**Taper end mills for conic preperation for taper threads
(NPT, NPTF, BSPT) 45 degree chamfer preperation tool**
Internal chamfering- short

TP

IC

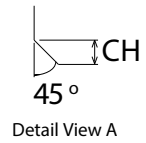
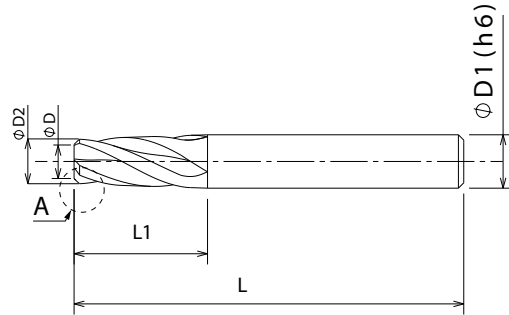
EC

ICP

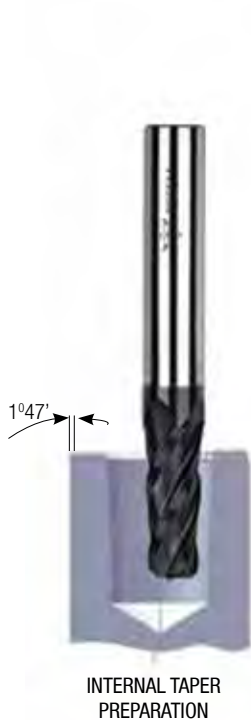
ECP

TiAlN

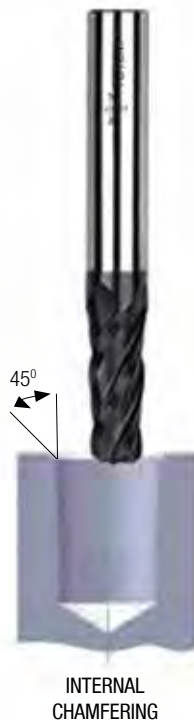
THREAD MILL



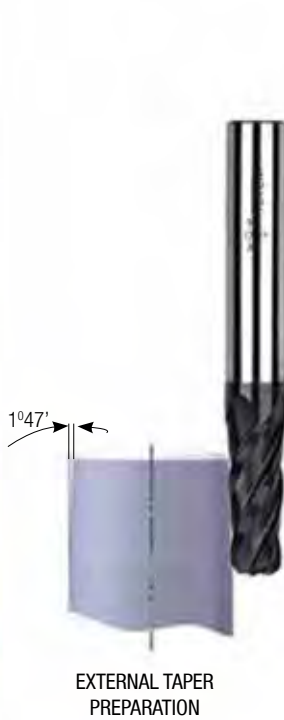
Description	D	L1	L	D1	D2	TPR Angle	CH	No. of Flutes	EDP No
	mm	mm	mm	mm	mm	a	mm		
EM 3.00MMX15X58 SH6 CH1 TPR1.47 4FL TA	3	15	58	6	5	1.47	1	4	FBV0503373
EM 5.60MMX25X73 SH10 CH1.4 TPR1.47 4F TA	5.6	25	73	10	8.4	1.47	1.4	4	FBV0503374
EM 6.30MMX33X84 SH12 CH1.8 TPR1.47 4FTA	6.3	33	84	12	9.9	1.47	1.8	4	FBV0503375



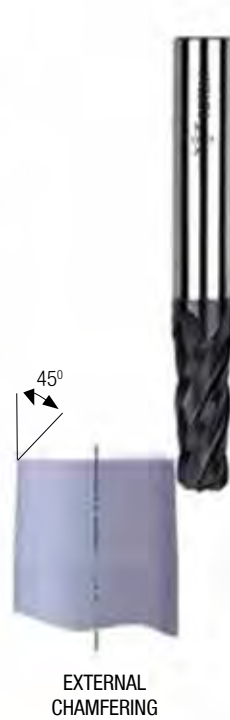
INTERNAL TAPER PREPARATION



INTERNAL CHAMFERING



EXTERNAL TAPER PREPARATION



EXTERNAL CHAMFERING

CARBIDE GRADE : K40UF

AN ADVANCED PVD TiAlN COATED GRADE OVER A TOUGH WEAR-RESISTANT SUBMICRON

SUBSTRATE FOR GENERAL PURPOSE MACHINING OF STEEL, STAINLESS STEEL, SUPERALLOYS.

Workpiece Material Group			Hardness HB	Cutting Speed m/min (Vc)	Feed (fz) mm/tooth Cutting Diameters						
					1.5-3	3-5	5-7	7-9	9-11	11-14	14-20
Steel	P	1	130	70-130	0.03	0.04	0.06	0.07	0.09	0.09	0.12
		2	200	60-120	0.02	0.04	0.05	0.06	0.08	0.08	0.1
		3	240	60-110	0.02	0.03	0.04	0.05	0.05	0.05	0.08
		4	270	60-100	0.02	0.03	0.04	0.05	0.05	0.05	0.06
		5	400	50-80	0.01	0.02	0.03	0.03	0.04	0.04	0.05
Stainless Steel	M	1	200	70-100	0.02	0.02	0.03	0.04	0.05	0.05	0.07
		2	240	70-90	0.02	0.02	0.03	0.04	0.04	0.04	0.06
		3	400	60-80	0.015	0.02	0.02	0.03	0.03	0.03	0.04
Cast Iron K	K	1	190	60-110	0.02	0.03	0.06	0.07	0.08	0.09	0.11
		2	180	60-90	0.02	0.03	0.05	0.06	0.08	0.09	0.12
		3	240	60-90	0.02	0.02	0.03	0.05	0.07	0.08	0.11
Non Ferrous	N	1	80	80-300	0.03	0.04	0.06	0.07	0.10	0.13	0.15
		2	90	100-300	0.03	0.04	0.06	0.07	0.11	0.13	0.16
		3	100	60-250	0.03	0.04	0.06	0.07	0.11	0.13	0.16
		4		100-400	0.05	0.06	0.08	0.09	0.13	0.15	0.18
Super Alloys	N	1	270	25-50	0.01	0.01	0.01	0.02	0.02	0.03	0.03
		2	350	20-40	0.01	0.01	0.01	0.02	0.02	0.03	0.03
		3	300	20-40	0.01	0.01	0.01	0.02	0.02	0.03	0.03
		4		40-80	0.02	0.02	0.02	0.03	0.04	0.04	0.05
				30-60	0.02	0.02	0.02	0.03	0.03	0.04	0.05
Hardened Steel	H		20-50	0.02	0.02	0.02	0.03	0.03	0.03	0.04	
		20-50	0.02	0.02	0.02	0.02	0.03	0.03	0.04		
		2	50 HRc	25-40	0.01	0.01	0.02	0.02	0.02	0.03	0.03
		3	56 HRc	25-50	0.01	0.01	0.02	0.02	0.02	0.03	0.03

Troubleshooting

PROBLEM	CAUSE	SOLUTION
Chipping in cutting edges	Unstable conditions	Check tool and workpiece clamping and stability
	Feed rate too high	Decrease feed per tooth
	Depth of cut large	Increase the number of thread milling passes
Excessive wear	Incorrect cutting speed	Decrease cutting speed
	Incorrect feed per tooth	Increase feed per tooth
	Insufficient coolant	Check stability increase the coolant flow change to climb milling
Vibrations	Cutting speed too high	Change cutting speed
Vibrations	Incorrect tool and workpiece installation	Check stability of workpiece
Vibrations	Large depth of cut stability: tool/machine, workpiece/workpiece clamping	Change to number of passes
Vibrations	Concentricity	Make sure tool overhang in the holding device as short as possible
Bad surface finish on workpiece		Increase cutting speed decrease feed per tooth check stability and overhang of tools
Small difference between gauges (go/no go)	Ratio too close (tool cutting diameter / thread diameter)	Choose tool with smaller cutting diameter

Tips:



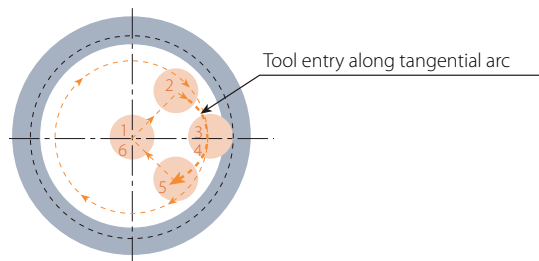
* Recommendation:

At tool entry, set the Feed f [mm/tooth] to 70% lower than the threading Feed.

Example:

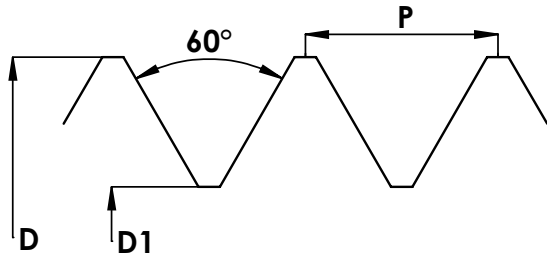
Threading Feed: 0.3[mm/tooth]

Tool entry Feed: 0.09[mm/tooth]

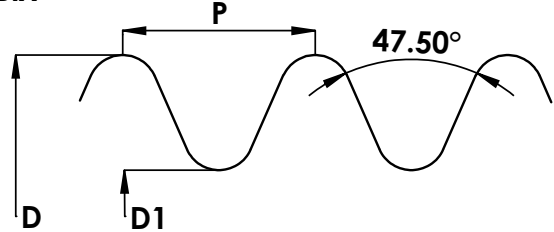


Thread forms

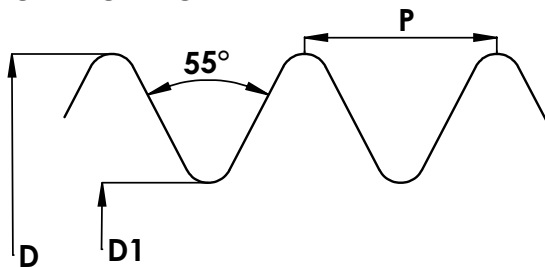
Metric ISO - UNC - UNF



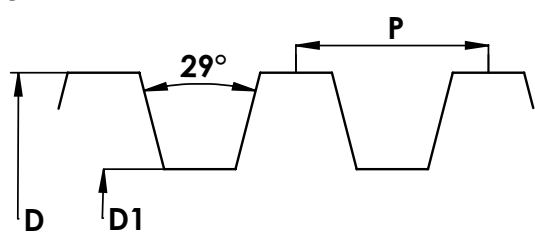
B.A



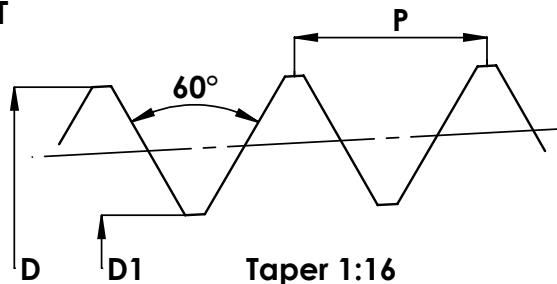
BSW - BSF - BSP



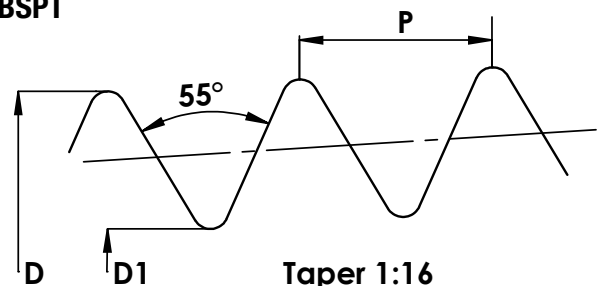
ACME



NPT



BSPT



ACME : Acme Thread
 BA : British Association Standard Thread
 BSF : British Standard Fine Thread Series
 BSP : British Standard Pipe
 BSPT : British Standard Taper Pipe Thread
 BSW : British Standard Whitworth Coarse Thread Series
 M : Metric Screw Thread Series
 NGT : National Gas Taper Thread (See "SGT")
 NPS : for Tap marking only (See NPSC, NPSM)
 NPSC : Dryseal American National Standard Fuel Internal Straight Pipe Thread
 NPSI : Dryseal American National Standard Intermediate Internal Straight Pipe Thread

NPT : American National Standard Taper Pipe Thread
 NPTF : Dryseal American National Standard Taper Pipe Thread
 PG : Panzer Gewinder
 STI : Special Thread for Helical Coil Wire Screw Thread Inserts
 UN : Unified Constant Pitch Thread Series
 UNC : Unified Coarse Thread Series
 UNEF : Unified Extra Fine Thread Series
 UNF : Unified Fine Thread Series
 UNS : Unified Thread-Special
 WW : British Standard Whitworth Special Thread

Advantages of thread milling

« Thread milling is a secure machining operation with less chances of part damage and breakage of the tool

« Threading in difficult to machine materials and hard materials is easy

« Higher thread quality
The cutting conditions are extremely good when you are thread milling. The result of the thread is a higher quality of surface finish, tolerance, angle, etc. Compared with other threading methods.

« Flexible tool
Same cutter can be used for right hand and left hand thread. Threads with different diameters can be made with the same tool as long as the pitch is the same. The same thread mill can be used for blind holes and through holes.

« Threading in blind holes

When thread milling you will get a complete thread profile to the bottom of the hole. When tapping it's necessary to drill much deeper as it's not until the third thread the tap will make a complete thread profile.

« Less wear on the machine spindle

Thread milling will give you longer life to the machine spindle compared with tapping as the rotation on the spindle doesn't need to be stopped and reversed for every thread.

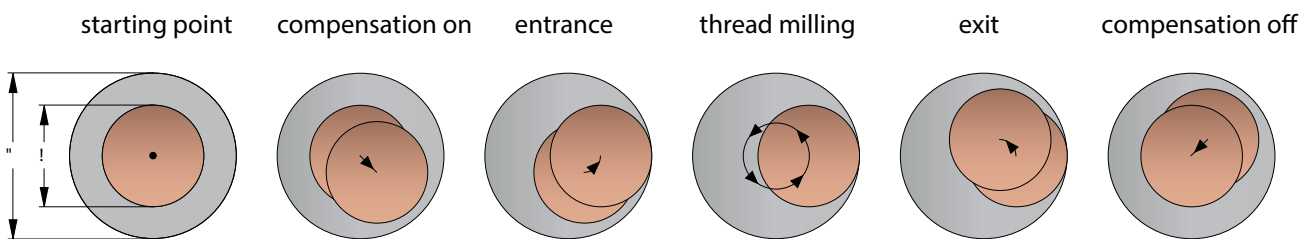
« Energy-saving production

Low energy consumption as the machine spindle doesn't need to be stopped and started after each thread.

« Thread Milling in a lathe with live tools

Reduced machining time compared with thread turning. Excellent chip control.

Threadmill movement during the interpolation cycle



Infeed method

TANGENTIAL APPROACH

Thread milling cutter strategy of Machining and how to enter and exit the work piece. The Tangential arc approach is considered as the best method.

With this method, the tool enters and exits the work piece smoothly. No marks are left on the work piece and there is no vibration, even with harder materials.

Although it requires slightly more complex programming than the radial approach (see below), this is the method recommended for machining the highest quality threads.

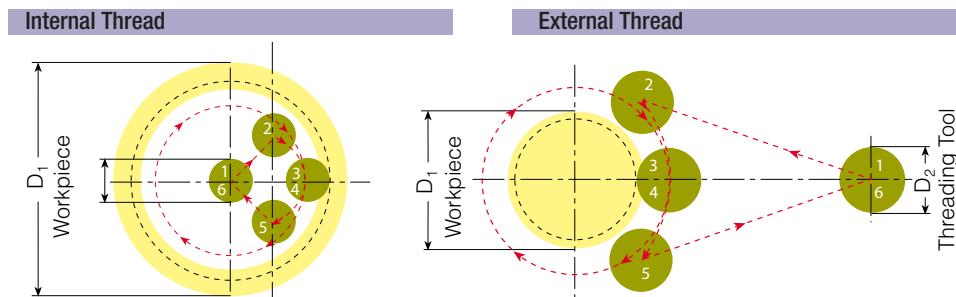
1-2: Rapid approach

2-3: Tool entry along tangential arc, with simultaneous feed along z-axis (@ 30% of the programming Feed)

3-4: Helical movement during one full orbit (360 degrees in cut at full programmed Feed)

4-5: Tool exit along tangential arc, with continuing feed along z-axis

5-6: Rapid return



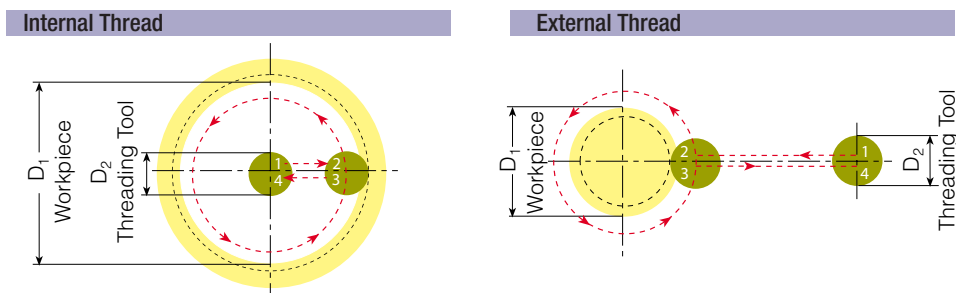
RADIAL APPROACH

This is the simplest method.

There are two characteristics worth noting about the radial approach:

- a small vertical mark may be left at the entry (and exit) point. This is of no significance to the thread itself.
- when using this method with very hard materials, the tool may have a tendency to vibrate as it approaches the full cutting depth.

Note: Radial feed during entry to the full profile depth should only be 1/3 of the subsequent circular feed.



1-2: Radial entry

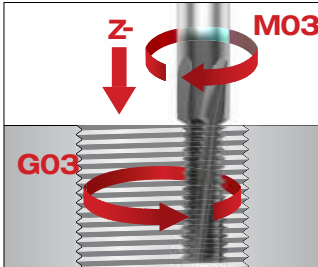
2-3: Helical movement during one full orbit (360 degrees in cut at full programmed Feed)

3-4: Radial exit

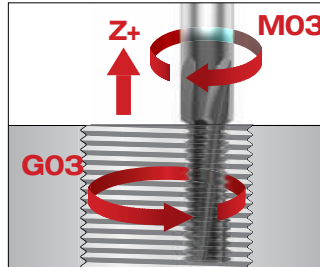
Thread milling methods

INTERNAL THREADING

Climb Milling

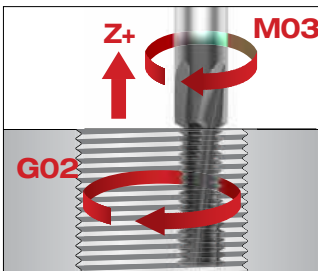


Internal left hand thread

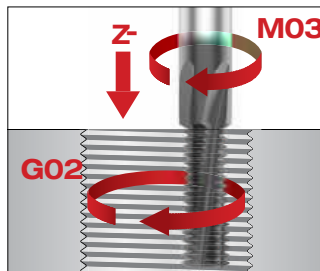


Internal right hand thread

Conventional Milling



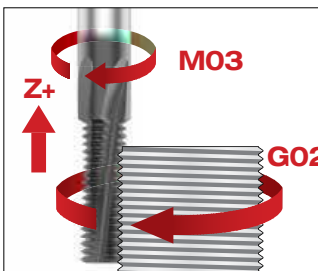
Internal left hand thread



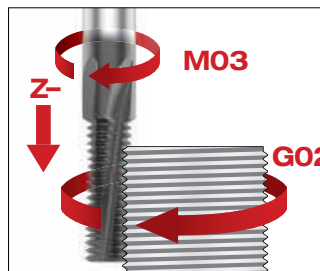
Internal right hand thread

EXTERNAL THREADING

Climb Milling

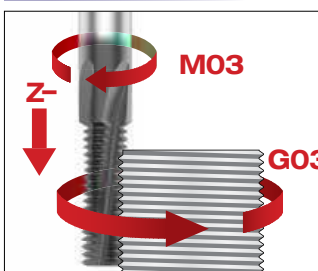


External left hand thread

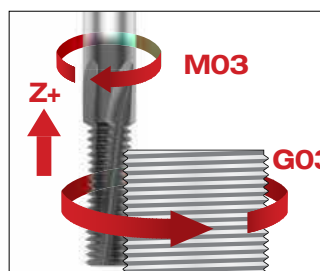


External right hand thread

Conventional Milling



External left hand thread



External right hand thread

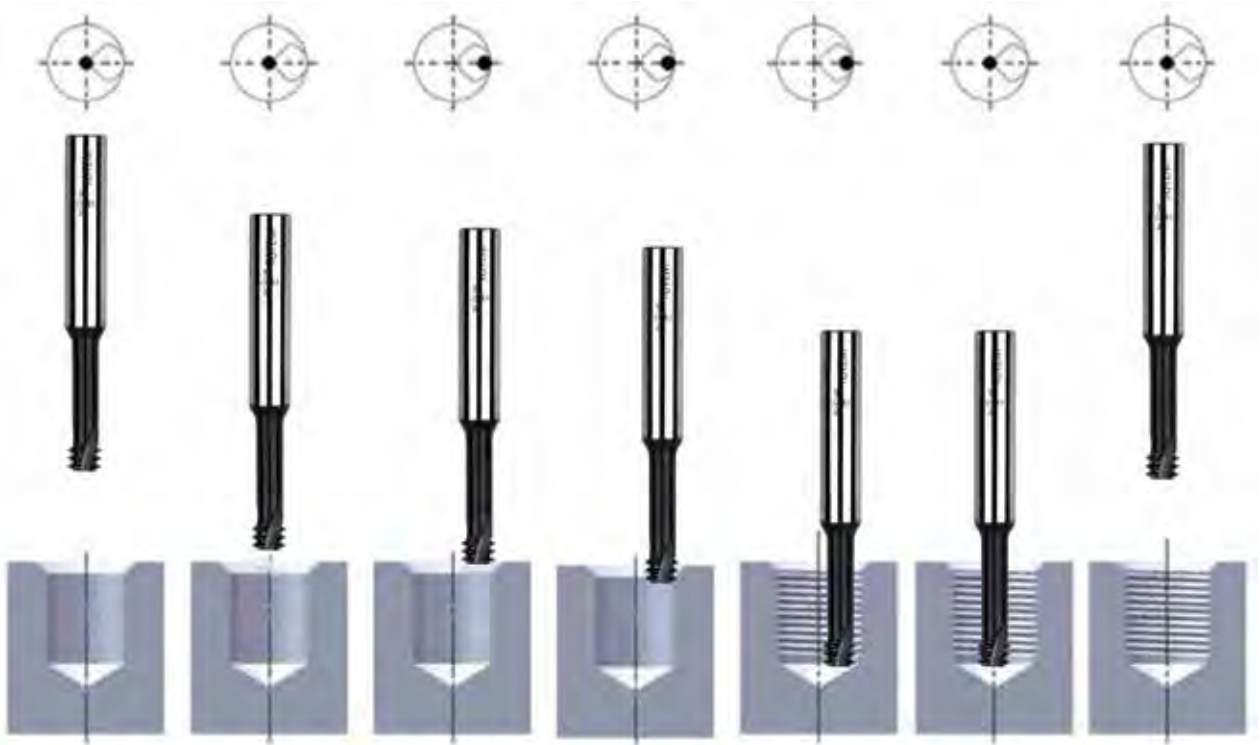
G CODES

G00	Send to position with rapid feed
G01	Send to position with linear movement and control by feed
G02	Clockwise circular interpolation
G03	Counter-clockwise circular interpolation
G40	Cutter compensation cancel
G41	Turn on left hand cutter compensation
G42	Turn on right hand cutter compensation
G54-59	Available workpiece coordinate settings
G90	Absolute positioning
G91	Incremental positioning

M CODES

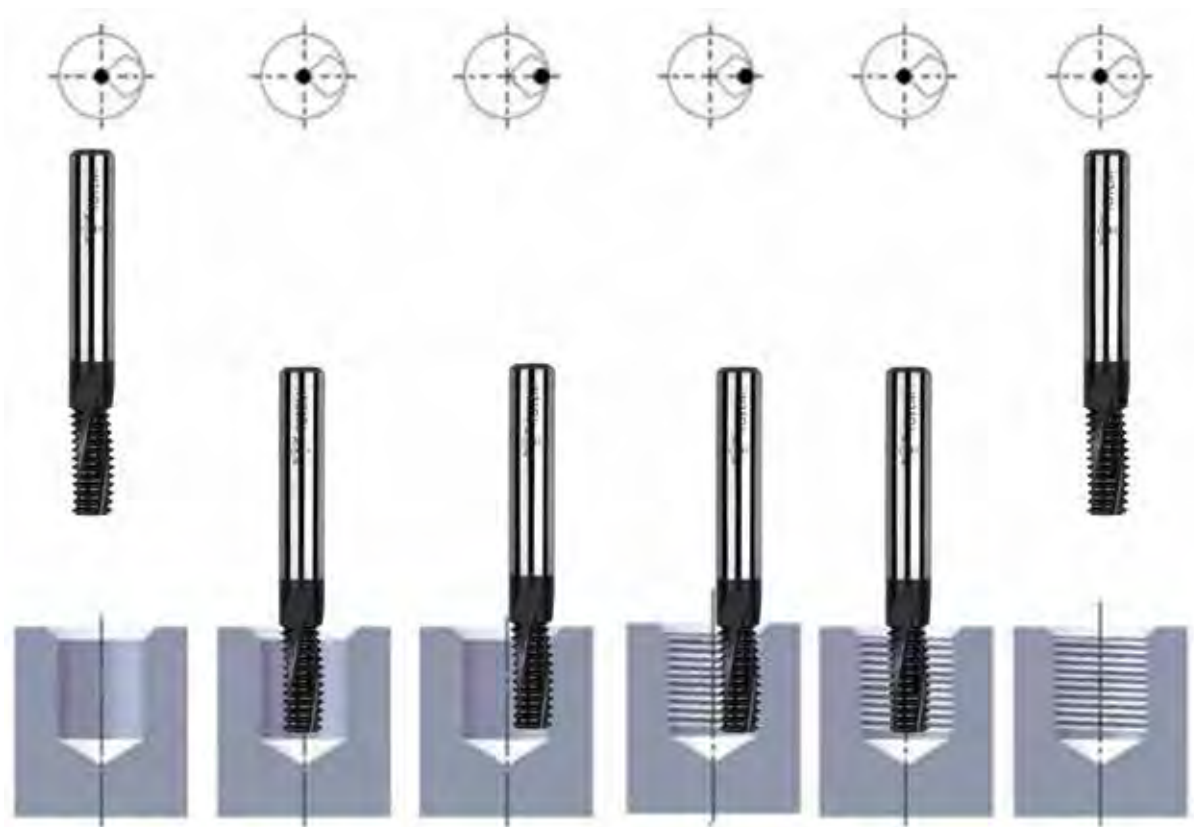
M00	Program stop
M01	Program optional stop
M03	Turn on spindle clockwise direction
M04	Turn on spindle counter-clockwise direction
M05	Turn off spindle rotation
M06	Tool change
M08	Coolant on
M09	Coolant off
M30	Program end and reset to start of program

Threadmill cycle for MT2D/MT3D/MT4D



THREAD MILL

THREADMILL CYCLE FOR RHTS/RHTC/RHS/RHC/RSS/RSTS



Thread mill technical questionnaire

CUSTOMER INFORMATION

Company Name: City:

Name: _____ Designation: _____

Mobile no: Email ID:

WORK CONDITIONS

Machine Type: Spindle Taper.....

Orientation: Horizontal ☐ Vertical ☐

Rotation: Clockwise ☐ Anti-clockwise ☐

Product Code: Project:

Part Name: Part Volume:

Holder Type: Holder Name:.....

CUTTING CONDITIONS

Thread Size: _____ Pitch: _____ Thread Style: _____

Tolerance: _____ RPM _____

Feed: fz (mm/tooth): _____ F (mm/min) _____

Hole Depth:

Coolant Pressure (Bar)..... Tool Life (No of Threads):

Coolant: Internal ☐ External ☐ Y Type ☐

Tool Design: Helical ☐ Straight ☐

WORKPEICE INFORMATION

Workpiece Material: Grade:

Hardness: _____ UTS (N/mm²): _____

Sketch

[illegible]



High Performance Cutting Tools



SOLID CARBIDE DRILLS

TD DRILLS SOLID AND THROUGH COOLANT - 3X, 5X, 7X

4.004

WORK PIECE MATERIALS

PRIMARY

Steel, Stainless Steel, Cast Iron, Super Alloys

FEATURES

- Reinforced core geometry for higher feed rates
- Special flute form for effective chip evacuation
- Special nano grain carbide raw material with an optimum balance of hardness and toughness
- High performance coating for superior wear resistance at higher cutting speeds

FUNCTION

- High performance coating for superior wear resistance at higher cutting speeds
- Universal geometry

BENEFITS

- Higher productivity
- High feed rate geometry
- Lower breakages and rejection rates due to stable core



DHD SERIES - DEEP HOLE DRILLING - 12X, 15X, 20X

4.022

WORK PIECE MATERIALS

PRIMARY

Forged Steel, Stainless Steel, Cast Iron, Aluminium

FEATURES

- Reinforced core design
- Superior surface treatment
- 4 Margins to guide
- High performance coating
- Optimized flute design

FUNCTION

- High performance coating for superior wear resistance at higher cutting speeds
- Stable cutting edge

BENEFITS

- Better hole straightness
- High feed rate geometry
- Lower breakages and rejection rates due to stable core



SOLID CARBIDE JOBBER DRILL - F224/F224A AND F226/F226A

4.036

WORK PIECE MATERIALS

PRIMARY

Steel, Stainless Steel, Cast Iron, Aluminium

FEATURES

- Reinforced core design
- Superior surface treatment
- Available in regular and stub
- 30 Degree helix & 118 degree point angle
- Optimized flute design

FUNCTION

- High performance coating for superior wear resistance at higher cutting speeds
- Stable cutting edge

BENEFITS

- Better hole straightness
- High feed rate geometry
- Lower breakages and rejection rates due to stable core



CARBIDE SPOTTING DRILL (60°/90°/120°)

4.043

WORK PIECE MATERIALS

PRIMARY

Steel, Cast Iron, Stainless Steel, Super Alloys, Hard Steel, Aluminium

FEATURES

- Right-hand helix
- h6 tolerance range
- Point angle tolerance +0°/-1°
- Standard length

FUNCTION

- 60°/90°/120° point angle
- Can be used as a chamfering tool if the spot drill diameter is larger than the final hole size.
- Tight tolerance with a very short flute length
- Highly recommend in deep-hole drilling

BENEFITS

- Ensure accurate hole location by avoiding drill deflection of materials.
- Useful in abrasive workpiece materials where the machining conditions are rigid.
- Designed to be extremely rigid to precisely spot a hole for a twist drill



CARBIDE CENTRE DRILLS

4.044

WORK PIECE MATERIALS

PRIMARY

Steel, Stainless Steel, Cast Iron, Super Alloys

PRIMARY

Cast Irons & Non Ferrous

FEATURES

- DIN333 standard
- Available in both LH and RH cut
- Available in form A and form B

FUNCTION

- 118° point angle
- General centering process for wide range of materials
- Coating available on request
- Can operate on higher cutting speeds

BENEFITS

- Double ended drills produce smoother finishes and many more holes than HSS centre drills
- Works equally well on soft and heat treated materials
- Carbide reduces possibility of breakage
- Increase tool life dramatically



CARBIDE CHAMFER TOOLS (60°/90°)

4.047

WORK PIECE MATERIALS

PRIMARY

Steel, Cast Iron, Stainless Steel, Super Alloys, Hard Steel, Aluminium

FEATURES

- 4 flutes
- Available in TiN coating
- Available in 60° and 90° point angle

FUNCTION

- Versatile chamfering tool

BENEFITS

- Superior surface quality



MULTI FLUTE CARBIDE REAMING TOOLS

4.050

WORK PIECE MATERIALS

PRIMARY

Steel, Stainless Steel, Cast Iron and Non ferrous

FEATURES

- ISO H7 tolerance class hole
- Internal coolant supply
- Available in right hand cut
- Intermediate diameters from 1.5mm - 20mm

FUNCTION

- Special coatings and lead chamfer configurations enable high-speed machining
- Highest metal removal rate at higher speeds and feeds

BENEFITS

- Longer tool life with increased hole and surface quality
- Address most common reaming applications.





High Performance Cutting Tools

DRILLS



TD DRILLS

Features Benefits

- Reinforced core geometry for higher feed rates
- Special flute form for effective chip evacuation
- Special nano grain carbide raw material with an optimum balance of hardness and toughness
- High performance coating for superior wear resistance at higher cutting speeds

Functions & Benefits

- Universal geometry which can be used for Cast Iron and Steel
- Higher Productivity
- High Feed Rate Geometry
- Lower breakages and rejection rates due to stable core

3X

Solid carbide 3X high performance drill

Carbide

STUB



IMAGE 1

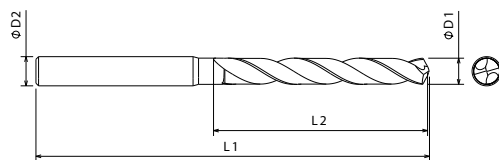
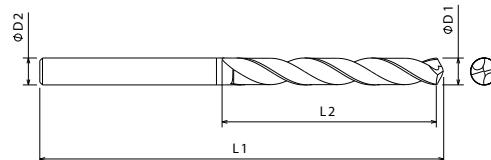


IMAGE 2



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
1.0	7	58	4	1	FBJ0503714
1.2	7	58	4	1	FBJ0503715
1.3	7	58	4	1	FBJ0503716
1.4	7	58	4	1	FBJ0503717
1.5	9	58	4	1	FBJ0503718
1.6	9	58	4	1	FBJ0503719
1.7	9	58	4	1	FBJ0503720
1.8	9	58	4	1	FBJ0503721
1.9	13	58	4	1	FBJ0503722
2.0	13	58	4	1	FBJ0503723
2.1	13	58	4	1	FBJ0503724
2.2	13	58	4	1	FBJ0503725
2.3	13	58	4	1	FBJ0503726
2.4	13	58	4	1	FBJ0503727
2.5	13	58	4	1	FBJ0503728
2.6	13	58	4	1	FBJ0503729
2.7	13	58	4	1	FBJ0503730
2.8	13	58	4	1	FBJ0503731
2.9	13	58	4	1	FBJ0503732
3.0	16	57	3	1	FBJ0501006
3.0	16	57	6	1	FBJ0503835
3.1	22	63	4	1	FBJ0501007
3.1	22	63	6	1	FBJ0503836
3.2	22	63	4	1	FBJ0501008
3.2	22	63	6	1	FBJ0503837
3.3	22	63	4	1	FBJ0501009
3.3	22	63	6	1	FBJ0503838

ØD1	L2	L1	ØD2	Image	EDP No
3.4	22	63	4	1	FBJ0501010
3.4	22	63	6	1	FBJ0503839
3.5	22	63	4	1	FBJ0501011
3.5	22	63	6	1	FBJ0503840
3.6	22	63	4	1	FBJ0501012
3.6	22	63	6	1	FBJ0503841
3.7	22	63	4	1	FBJ0501013
3.7	22	63	6	1	FBJ0503842
3.8	22	63	4	1	FBJ0501014
3.8	22	63	6	1	FBJ0503843
3.9	22	63	4	1	FBJ0501015
3.9	22	63	6	1	FBJ0503844
4.0	22	63	4	2	FBJ0501016
4.0	22	63	6	1	FBJ0503845
4.1	26	63	5	1	FBJ0501017
4.1	26	63	6	1	FBJ0503846
4.2	26	63	5	1	FBJ0501018
4.2	26	63	6	1	FBJ0503847
4.3	26	63	5	1	FBJ0501019
4.3	26	63	6	1	FBJ0503848
4.4	26	63	5	1	FBJ0501020
4.4	26	63	6	1	FBJ0503849
4.5	26	63	5	1	FBJ0501021
4.5	26	63	6	1	FBJ0503850
4.6	26	63	5	1	FBJ0501022
4.6	26	63	6	1	FBJ0503851
4.65	26	63	6	1	FBJ0505029

DRILLS

3X

Solid carbide 3X high performance drill

Carbide

STUB



3X



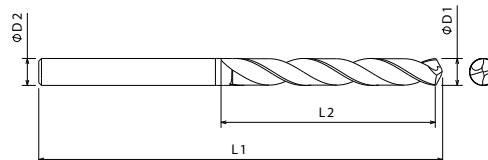
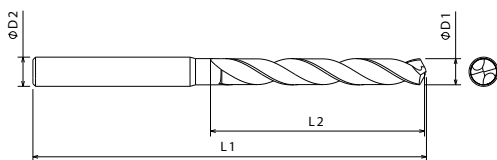
30°

TiAlN



IMAGE 1

IMAGE 2



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
4.65	26	63	5	1	FBJ0505030
4.7	26	63	5	1	FBJ0501023
4.7	26	63	6	1	FBJ0503852
4.8	26	63	5	1	FBJ0501024
4.8	26	63	6	1	FBJ0503853
4.9	26	63	5	1	FBJ0501025
4.9	26	63	6	1	FBJ0503854
5.0	26	63	5	2	FBJ0501026
5.0	26	63	6	1	FBJ0503855
5.1	30	76	6	1	FBJ0501027
5.2	30	76	6	1	FBJ0501028
5.3	30	76	6	1	FBJ0501029
5.4	30	76	6	1	FBJ0501030
5.5	30	76	6	1	FBJ0501031
5.7	30	76	6	1	FBJ0501032
5.8	30	76	6	1	FBJ0501033
5.9	30	76	6	1	FBJ0501034
6.0	30	76	6	2	FBJ0501035
6.1	35	82	8	1	FBJ0501037
6.2	35	82	8	1	FBJ0501038
6.3	35	82	8	1	FBJ0501039
6.4	35	82	8	1	FBJ0501040
6.5	35	82	8	1	FBJ0501041
6.6	35	82	8	1	FBJ0501042
6.7	35	82	8	1	FBJ0501043
6.8	35	82	8	1	FBJ0501044
6.9	35	82	8	1	FBJ0501045

ØD1	L2	L1	ØD2	Image	EDP No
7.0	35	82	8	1	FBJ0501046
7.1	38	82	8	1	FBJ0501047
7.2	38	82	8	1	FBJ0501048
7.3	38	82	8	1	FBJ0501049
7.4	38	82	8	1	FBJ0501050
7.5	38	82	8	1	FBJ0501051
7.6	38	82	8	1	FBJ0501052
7.8	38	82	8	1	FBJ0501053
7.9	38	82	8	1	FBJ0501054
8.0	38	82	8	2	FBJ0501055
8.1	43	89	10	1	FBJ0501056
8.2	43	89	10	1	FBJ0501057
8.3	43	89	10	1	FBJ0501058
8.4	43	89	10	1	FBJ0501059
8.5	43	89	10	1	FBJ0501060
8.6	43	89	10	1	FBJ0501061
8.7	43	89	10	1	FBJ0501062
8.8	43	89	10	1	FBJ0501063
8.9	43	89	10	1	FBJ0501064
9.0	43	89	10	1	FBJ0501065
9.1	43	89	10	1	FBJ0501066
9.2	43	89	10	1	FBJ0501067
9.25	43	89	10	1	FBJ0501068
9.3	43	89	10	1	FBJ0501069
9.4	43	89	10	1	FBJ0501072
9.5	43	89	10	1	FBJ0501070
9.6	43	89	10	1	FBJ0501071

3X

Solid carbide 3X high performance drill

Carbide

STUB

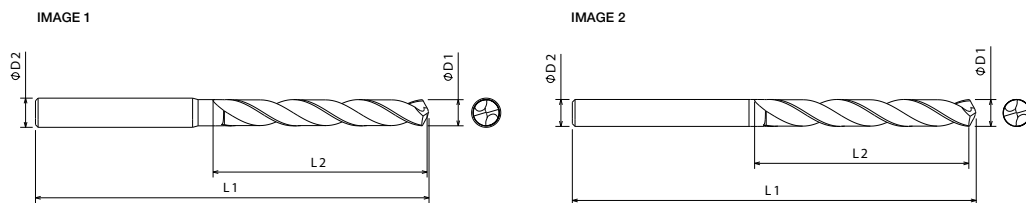


P0-P6

K1-K3

S1-S4

M1-M3



Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
9.7	43	89	10	1	FBJ0501073
9.8	43	89	10	1	FBJ0501074
9.9	43	89	10	1	FBJ0501075
10.0	43	89	10	2	FBJ0501076
10.1	51	101	12	1	FBJ0501077
10.2	51	101	12	1	FBJ0501078
10.3	51	101	12	1	FBJ0501079
10.4	51	101	12	1	FBJ0501080
10.5	51	101	12	1	FBJ0501081
10.6	51	101	12	1	FBJ0501082
10.7	51	101	12	1	FBJ0501083
10.8	51	101	12	1	FBJ0501084
10.9	51	101	12	1	FBJ0501085
11.0	51	101	12	1	FBJ0501086
11.1	51	101	12	1	FBJ0501087
11.2	51	101	12	1	FBJ0501088
11.3	51	101	12	1	FBJ0501089
11.4	51	101	12	1	FBJ0501090
11.5	51	101	12	1	FBJ0501091
11.6	51	101	12	1	FBJ0501092
11.7	51	101	12	1	FBJ0501093
11.8	51	101	12	1	FBJ0501094
11.9	51	101	12	1	FBJ0501095
12.0	51	101	12	2	FBJ0501096
12.1	54	107	14	1	FBJ0501097
12.5	54	107	14	1	FBJ0501098

ØD1	L2	L1	ØD2	Image	EDP No
12.8	54	107	14	1	FBJ0501099
12.83	54	107	14	1	FBJ0501100
12.9	54	107	14	1	FBJ0501101
13.0	54	107	14	1	FBJ0501102
13.5	54	107	14	1	FBJ0501103
13.7	54	107	14	1	FBJ0501104
14.0	54	107	14	2	FBJ0501105
14.5	60	117	16	1	FBJ0501106
14.7	60	117	16	1	FBJ0501107
15.0	60	117	16	1	FBJ0501108
15.3	60	117	16	1	FBJ0501109
15.5	60	117	16	1	FBJ0501110
15.7	60	117	16	1	FBJ0501111
16.0	60	117	16	2	FBJ0501112
16.08	63	122	18	1	FBJ0501113
16.3	63	122	18	1	FBJ0501114
16.5	63	122	18	1	FBJ0501115
17.0	63	122	18	1	FBJ0501116
17.5	63	122	18	1	FBJ0501117
18.0	63	122	18	2	FBJ0501118
18.5	70	133	20	1	FBJ0501119
19.16	70	133	20	1	FBJ0501120
19.25	70	133	20	1	FBJ0501121
19.3	70	133	20	1	FBJ0501122
19.5	70	133	20	1	FBJ0501123
20.0	70	133	20	2	FBJ0501124

5X

Solid carbide 5X high performance drill

Carbide



P0-P6

K1-K3

S1-S4

M1-M3

IMAGE 1

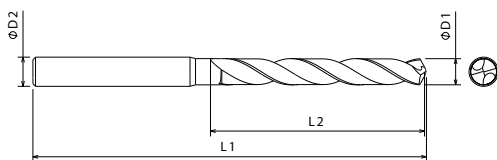
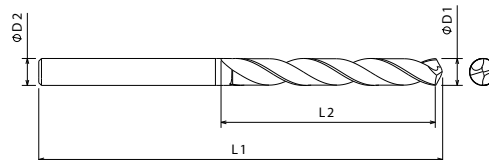


IMAGE 2



Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
1.0	9	58	4	1	FBJ0504389
1.2	9	58	4	1	FBJ0504390
1.3	9	58	4	1	FBJ0504391
1.4	9	58	4	1	FBJ0504392
1.5	12	58	4	1	FBJ0504393
1.6	12	58	4	1	FBJ0504394
1.7	12	58	4	1	FBJ0504395
1.8	12	58	4	1	FBJ0504396
1.9	15	58	4	1	FBJ0504397
2.0	18	58	4	1	FBJ0504398
2.1	18	58	4	1	FBJ0504399
2.2	18	58	4	1	FBJ0504400
2.3	18	58	4	1	FBJ0504401
2.4	22	58	4	1	FBJ0504402
2.5	22	58	4	1	FBJ0504403
2.6	22	58	4	1	FBJ0504404
2.7	22	58	4	1	FBJ0504405
2.8	22	58	4	1	FBJ0504406
2.9	22	58	4	1	FBJ0504407
3.0	28	66	6	1	FBJ0504408
3.0	24	63	3	1	FBJ0501125
3.0	24	63	6	1	FBJ0503886
3.1	32	69	4	1	FBJ0501126
3.1	32	69	6	1	FBJ0503887
3.2	32	69	4	1	FBJ0501127

ØD1	L2	L1	ØD2	Image	EDP No
3.2	32	69	6	1	FBJ0503888
3.3	32	69	4	1	FBJ0501128
3.3	32	69	6	1	FBJ0503889
3.4	32	69	4	1	FBJ0501129
3.4	32	69	6	1	FBJ0503890
3.5	32	69	4	1	FBJ0501130
3.5	32	69	6	1	FBJ0503891
3.6	32	69	4	1	FBJ0501131
3.6	32	69	6	1	FBJ0503892
3.7	32	69	4	1	FBJ0501132
3.7	32	69	6	1	FBJ0503893
3.8	32	69	4	1	FBJ0501133
3.8	32	69	6	1	FBJ0503894
3.9	32	69	4	1	FBJ0501134
3.9	32	69	6	1	FBJ0503895
4.0	32	69	4	2	FBJ0501135
4.0	32	69	6	1	FBJ0503896
4.1	38	80	5	1	FBJ0501136
4.1	38	80	6	1	FBJ0503897
4.2	38	80	5	1	FBJ0501137
4.2	38	80	6	1	FBJ0503898
4.3	38	80	5	1	FBJ0501138
4.3	38	80	6	1	FBJ0503899
4.4	38	80	5	1	FBJ0501139
4.4	38	80	6	1	FBJ0503900

5X

Solid carbide 5X high performance drill



IMAGE 1

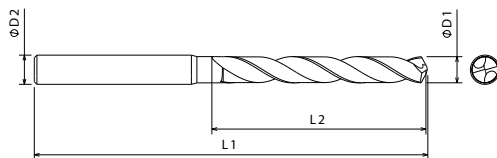
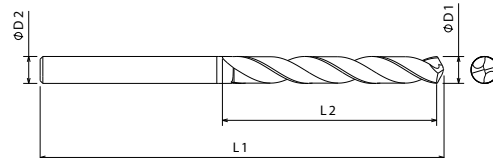


IMAGE 2



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
4.5	38	80	5	1	FBJ0501140
4.5	38	80	6	1	FBJ0503901
4.6	38	80	5	1	FBJ0501141
4.6	38	80	6	1	FBJ0503902
4.65	38	80	6	1	FBJ0505031
4.65	38	80	5	1	FBJ0505032
4.7	38	80	5	1	FBJ0501142
4.7	38	80	6	1	FBJ0503903
4.8	38	80	5	1	FBJ0501143
4.8	38	80	6	1	FBJ0503904
4.9	38	80	5	1	FBJ0501144
4.9	38	80	6	1	FBJ0503905
5.0	38	80	5	2	FBJ0501145
5.0	38	80	6	1	FBJ0503906
5.1	40	82	6	1	FBJ0501146
5.2	40	82	6	1	FBJ0501147
5.3	40	82	6	1	FBJ0501148
5.4	40	82	6	1	FBJ0501149
5.5	40	82	6	1	FBJ0501150
5.7	40	82	6	1	FBJ0501151
5.8	40	82	6	1	FBJ0501152
5.9	40	82	6	1	FBJ0501153
6.0	40	82	6	2	FBJ0501154
6.1	48	91	8	1	FBJ0501155
6.2	48	91	8	1	FBJ0501156

ØD1	L2	L1	ØD2	Image	EDP No
6.3	48	91	8	1	FBJ0501157
6.4	48	91	8	1	FBJ0501158
6.5	48	91	8	1	FBJ0501159
6.6	48	91	8	1	FBJ0501160
6.7	48	91	8	1	FBJ0501161
6.8	48	91	8	1	FBJ0501162
6.9	48	91	8	1	FBJ0501163
7.0	48	91	8	1	FBJ0501164
7.1	48	91	8	1	FBJ0501165
7.2	48	91	8	1	FBJ0501166
7.3	48	91	8	1	FBJ0501167
7.4	48	91	8	1	FBJ0501168
7.5	48	91	8	1	FBJ0501169
7.6	48	91	8	1	FBJ0501170
7.7	48	91	8	1	FBJ0501171
7.8	48	91	8	1	FBJ0501172
7.9	48	91	8	1	FBJ0501173
8.0	48	91	8	2	FBJ0501174
8.1	55	103	10	1	FBJ0501175
8.2	55	103	10	1	FBJ0501176
8.3	55	103	10	1	FBJ0501177
8.4	55	103	10	1	FBJ0501178
8.5	55	103	10	1	FBJ0501179
8.6	55	103	10	1	FBJ0501180
8.7	55	103	10	1	FBJ0501181

DRILLS

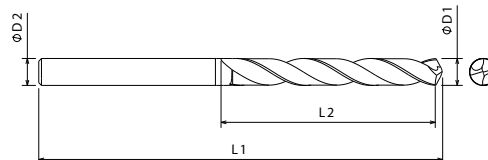
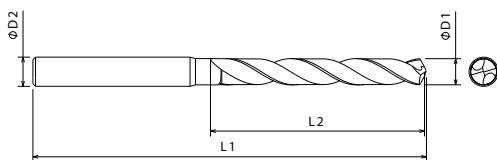
5X

Solid carbide 5X high performance drill



IMAGE 1

IMAGE 2



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
8.8	55	103	10	1	FBJ0501182
8.9	55	103	10	1	FBJ0501183
9.0	55	103	10	1	FBJ0501184
9.1	55	103	10	1	FBJ0501185
9.2	55	103	10	1	FBJ0501186
9.25	55	103	10	1	FBJ0501187
9.3	55	103	10	1	FBJ0501188
9.4	55	103	10	1	FBJ0501189
9.5	55	103	10	1	FBJ0501190
9.6	55	103	10	1	FBJ0501191
9.7	55	103	10	1	FBJ0501192
9.8	55	103	10	1	FBJ0501193
9.9	55	103	10	1	FBJ0501194
10.0	55	103	10	2	FBJ0501195
10.1	60	120	12	1	FBJ0501196
10.2	60	120	12	1	FBJ0501197
10.3	60	120	12	1	FBJ0501198
10.4	60	120	12	1	FBJ0501199
10.5	60	120	12	1	FBJ0501200
10.6	60	120	12	1	FBJ0501201
10.7	60	120	12	1	FBJ0501202
10.8	60	120	12	1	FBJ0501203
10.9	60	120	12	1	FBJ0501204
11.0	60	120	12	1	FBJ0501205
11.1	66	120	12	1	FBJ0501206

ØD1	L2	L1	ØD2	Image	EDP No
11.2	66	120	12	1	FBJ0501207
11.3	66	120	12	1	FBJ0501208
11.4	66	120	12	1	FBJ0501209
11.5	66	120	12	1	FBJ0501210
11.6	66	120	12	1	FBJ0501211
11.7	66	120	12	1	FBJ0501212
11.8	66	120	12	1	FBJ0501213
11.9	66	120	12	1	FBJ0501214
12.0	66	120	12	2	FBJ0501215
12.1	72	126	14	1	FBJ0501216
12.5	72	126	14	1	FBJ0501217
12.8	72	126	14	1	FBJ0501218
12.83	72	126	14	1	FBJ0501219
12.9	72	126	14	1	FBJ0501220
13.0	72	126	14	1	FBJ0501221
13.5	77	134	14	1	FBJ0501222
13.7	77	134	14	1	FBJ0501223
14.0	77	134	14	2	FBJ0501224
14.5	80	140	16	1	FBJ0501225
14.7	80	140	16	1	FBJ0501226
15.0	80	140	16	1	FBJ0501227
15.3	82	146	16	1	FBJ0501228
15.5	82	146	16	1	FBJ0501229
15.7	82	146	16	1	FBJ0501230
16.0	82	146	16	2	FBJ0501231

Cutting parameters

Series 2TDSS/2TDSR METRIC

Workpiece Material Group			Cutting Speed Vc(m/min)			Recommended Feed in mm/rev											
						Tool Diameter (mm)											
					mm	3.00		6.00		10.00		12.00		16.0		20.0	
		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	0	105	125	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		1	105	125	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	105	125	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		3	85	105	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		4	50	65	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		5	85	105	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
Stainless Steels	M	6	50	65	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		1	40	60	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	30	50	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
Cast Iron	K	3	30	50	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		1	125	150	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	95	115	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
Special Alloys	S	3	95	115	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		1	15	25	f rev	0.015	0.026	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		2	10	15	f rev	0.015	0.026	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		3	15	25	f rev	0.015	0.026	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		4	25	45	f rev	0.015	0.026	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191

#RPM(N) = Vc(m/min) X 318.18/Tool Dia.

#Vf(mm/min) = RPM(N) X frev (mm/rev)

Series 2TDSS/2TDSR INCH

Workpiece Material Group			Cutting Speed Vc ft/min			Recommended Feed in inch/rev											
						Tool Diameter (Inch)											
					Inch	1/8		1/4		3/8		1/2		5/8		3/4	
			min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	0	344	410	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	344	410	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	344	410	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		3	279	344.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		4	164	213.2	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		5	279	344.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Stainless Steels	M	6	164	213.2	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	131	196.8	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	98	164	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
Cast Iron	K	3	98	164	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	410	492	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	312	377.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Special Alloys	S	3	312	377.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	49	82	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		2	33	49.2	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		3	49	82	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		4	82	147.6	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075

#RPM (N) = Vc (SFM) X 3.82/Tool Dia.

#Vf (Inch/min) = RPM (N) x frev (inch/rev)

The technical data are based upon theoretical values and are only intended for planning purposes and may vary based on the application. Actual results will vary. No responsibility from Forbes and Company Limited or their distributors is assumed.

Drill tolerance

Details	Cutting Dia. "D1" Range	Cutting Dia. "D1" Tolerance h7 ANSI B4.2	Shank Dia. "D2"	Shank Tolerance h6 ANSI B4.2
2TDSS	1.00-3.00	0.00/-0.010	3.00-6.00	-0.008
	3.00-6.00	0.00/-0.012	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.015	6.00-10.00	-0.009
	10.00-18.00	0.00/-0.018	10.00-18.00	-0.011
	20.00	0.00/-0.021	20.00	-0.013
2TDSR	1.00-3.00	0.00/-0.010	3.00-6.00	-0.008
	3.00-6.00	0.00/-0.012	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.015	6.00-10.00	-0.009
	10.00-16.00	0.00/-0.018	10.00-16.00	-0.011

3X

Solid carbide 3X high performance drill with coolant feed

Carbide

STUB



TiAlN

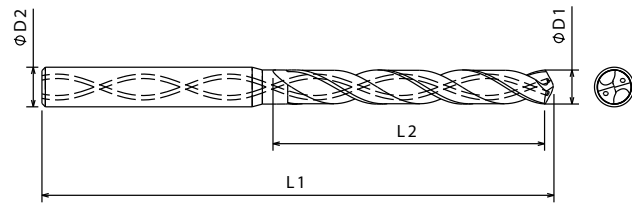


IMAGE 1

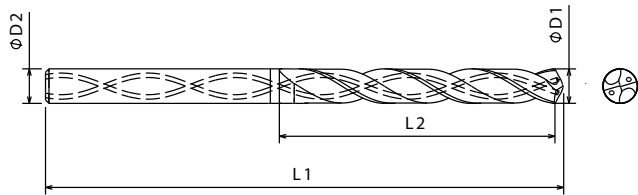


IMAGE 2

P0-P6

K1-K3

M1-M3

S1-S4

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
3.0	16	57	3	2	FBJ0502493
3.1	22	63	4	1	FBJ0502494
3.2	22	63	4	1	FBJ0502495
3.3	22	63	4	1	FBJ0502496
3.4	22	63	4	1	FBJ0502497
3.5	22	63	4	1	FBJ0502498
3.6	22	63	4	1	FBJ0502499
3.7	22	63	4	1	FBJ0502500
3.8	22	63	4	1	FBJ0502501
3.9	22	63	4	1	FBJ0502502
4.0	22	63	4	2	FBJ0502503
4.1	26	65	5	1	FBJ0502504
4.2	26	65	5	1	FBJ0502505
4.3	26	65	5	1	FBJ0502506
4.4	26	65	5	1	FBJ0502507
4.5	26	65	5	1	FBJ0502508
4.6	26	65	5	1	FBJ0502509
4.65	26	65	5	1	FBJ0505033
4.7	26	65	5	1	FBJ0502510
4.8	26	65	5	1	FBJ0502511

ØD1	L2	L1	ØD2	Image	EDP No
4.9	26	65	5	1	FBJ0502512
5.0	26	65	5	2	FBJ0502513
5.1	26	65	6	1	FBJ0502514
5.2	26	65	6	1	FBJ0502515
5.3	26	65	6	1	FBJ0502516
5.4	26	65	6	1	FBJ0502517
5.5	26	65	6	1	FBJ0502518
5.6	26	65	6	1	FBJ0502519
5.7	26	65	6	1	FBJ0502520
5.8	26	65	6	1	FBJ0502521
5.9	26	65	6	1	FBJ0502522
6.0	26	65	6	2	FBJ0502523
6.1	35	80	8	1	FBJ0502524
6.2	35	80	8	1	FBJ0502525
6.3	35	80	8	1	FBJ0502526
6.4	35	80	8	1	FBJ0502527
6.5	35	80	8	1	FBJ0502528
6.6	35	80	8	1	FBJ0502529
6.7	35	80	8	1	FBJ0502530
6.8	35	80	8	1	FBJ0502531

3X

Solid carbide 3X high performance drill with coolant feed

Carbide

STUB

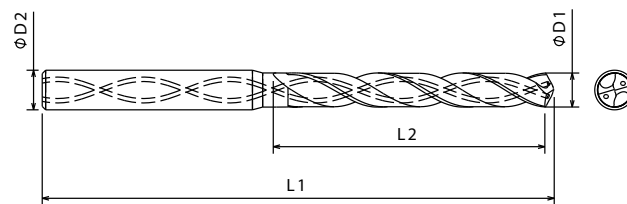


IMAGE 1

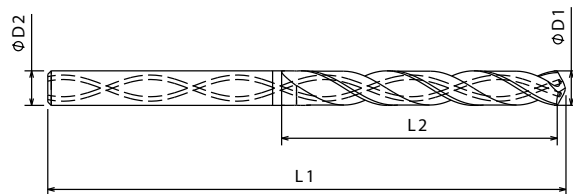


IMAGE 2

P0-P6

K1-K3

M1-M3

S1-S4

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
6.9	35	80	8	1	FBJ0502532
7.0	35	80	8	1	FBJ0502533
7.1	38	80	8	1	FBJ0502534
7.2	38	80	8	1	FBJ0502535
7.3	38	80	8	1	FBJ0502536
7.4	38	80	8	1	FBJ0502537
7.5	38	80	8	1	FBJ0502538
7.6	38	80	8	1	FBJ0502539
7.8	38	80	8	1	FBJ0502540
7.9	38	80	8	1	FBJ0502541
8.0	38	80	8	2	FBJ0502542
8.1	41	82	10	1	FBJ0502543
8.2	41	82	10	1	FBJ0502544
8.3	41	82	10	1	FBJ0502545
8.4	41	82	10	1	FBJ0502546
8.5	41	82	10	1	FBJ0502547
8.6	41	82	10	1	FBJ0502548
8.7	41	82	10	1	FBJ0502549
8.8	41	82	10	1	FBJ0502550
8.9	41	82	10	1	FBJ0502551

ØD1	L2	L1	ØD2	Image	EDP No
9.0	41	82	10	1	FBJ0502552
9.1	41	82	10	1	FBJ0502553
9.2	41	82	10	1	FBJ0502554
9.3	41	82	10	1	FBJ0502555
9.4	41	82	10	1	FBJ0502556
9.5	41	82	10	1	FBJ0502557
9.6	41	82	10	1	FBJ0502558
9.7	41	82	10	1	FBJ0502559
9.8	41	82	10	1	FBJ0502560
9.9	41	82	10	1	FBJ0502561
10.0	41	82	10	2	FBJ0502562
10.1	55	102	12	1	FBJ0502563
10.2	55	102	12	1	FBJ0502564
10.3	55	102	12	1	FBJ0502565
10.4	55	102	12	1	FBJ0502566
10.5	55	102	12	1	FBJ0502567
10.6	55	102	12	1	FBJ0502568
10.7	55	102	12	1	FBJ0502569
10.8	55	102	12	1	FBJ0502570
10.9	55	102	12	1	FBJ0502571

DRILLS

3X

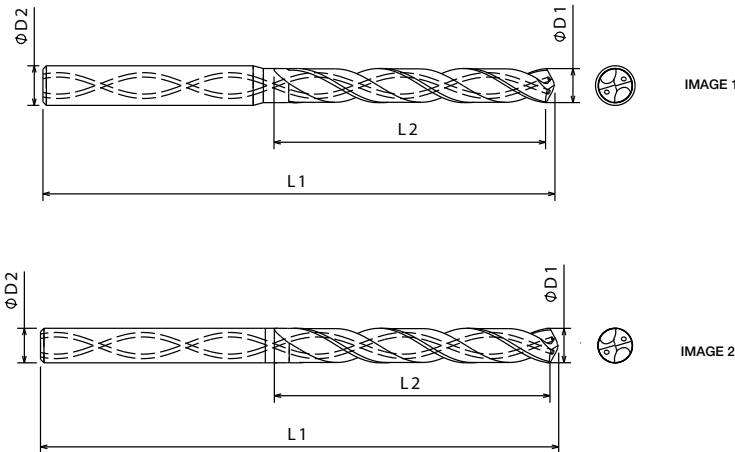
Solid carbide 3X high performance drill with coolant feed

Carbide

STUB



TiAlN



P0-P6

K1-K3

M1-M3

S1-S4

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
11.0	55	102	12	1	FBJ0502572
11.1	55	102	12	1	FBJ0502573
11.2	55	102	12	1	FBJ0502574
11.3	55	102	12	1	FBJ0502575
11.4	55	102	12	1	FBJ0502576
11.5	55	102	12	1	FBJ0502577
11.6	55	102	12	1	FBJ0502578
11.7	55	102	12	1	FBJ0502579
11.8	55	102	12	1	FBJ0502580
11.9	55	102	12	1	FBJ0502581
12.0	55	102	12	2	FBJ0502582
12.1	60	107	14	1	FBJ0502583
12.5	60	107	14	1	FBJ0502584
12.8	60	107	14	1	FBJ0502585
12.9	60	107	14	1	FBJ0502587
13.0	60	107	14	1	FBJ0502588
13.5	60	107	14	1	FBJ0502589
13.7	60	107	14	1	FBJ0502590

ØD1	L2	L1	ØD2	Image	EDP No
14.0	60	107	14	2	FBJ0502591
14.5	60	110	16	1	FBJ0502592
14.7	60	110	16	1	FBJ0502593
15.0	60	110	16	1	FBJ0502594
15.3	60	110	16	1	FBJ0502595
15.5	60	110	16	1	FBJ0502596
15.7	60	110	16	1	FBJ0502597
16.0	60	110	16	2	FBJ0502598
16.3	73	122	18	1	FBJ0502599
16.5	73	122	18	1	FBJ0502600
17.0	73	122	18	1	FBJ0502601
17.5	73	122	18	1	FBJ0502602
18.0	73	122	18	2	FBJ0502603
18.5	80	133	20	1	FBJ0502604
19.1	80	133	20	1	FBJ0502605
19.3	80	133	20	1	FBJ0502607
19.5	80	133	20	1	FBJ0502608
20.0	80	133	20	2	FBJ0502609

5X

Solid carbide 5X high performance drill with coolant feed

Carbide

REG



P0-P6

K1-K3

S1-S4

M1-M3

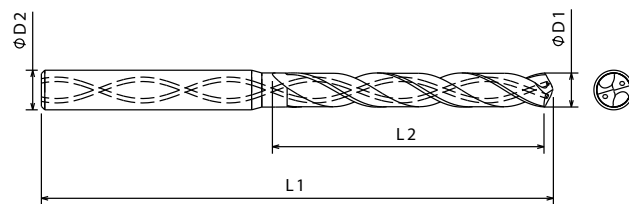


IMAGE 1

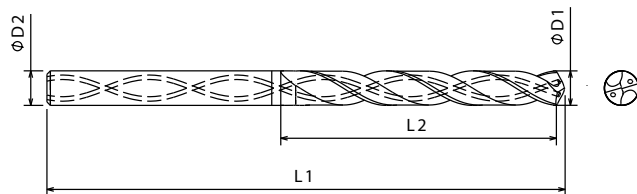


IMAGE 2

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
3.0	24	75	3	2	FBJ0501232
3.1	32	80	4	1	FBJ0501233
3.2	32	80	4	1	FBJ0501234
3.3	32	80	4	1	FBJ0501235
3.4	32	80	4	1	FBJ0501236
3.5	32	80	4	1	FBJ0501237
3.6	32	80	4	1	FBJ0501238
3.7	32	80	4	1	FBJ0501239
3.8	32	80	4	1	FBJ0501240
3.9	32	80	4	1	FBJ0501241
4.0	32	80	4	2	FBJ0501242
4.1	38	82	5	1	FBJ0501243
4.2	38	82	5	1	FBJ0501244
4.3	38	82	5	1	FBJ0501245
4.4	38	82	5	1	FBJ0501246
4.5	38	82	5	1	FBJ0501247
4.6	38	82	5	1	FBJ0501248
4.65	38	82	5	1	FBJ0505034
4.7	38	82	5	1	FBJ0501249
4.8	38	82	5	1	FBJ0501250

ØD1	L2	L1	ØD2	Image	EDP No
4.9	38	82	5	1	FBJ0501251
5.0	38	82	5	2	FBJ0501252
5.1	40	82	6	1	FBJ0501253
5.2	40	82	6	1	FBJ0501254
5.3	40	82	6	1	FBJ0501255
5.4	40	82	6	1	FBJ0501256
5.5	40	82	6	1	FBJ0501257
5.7	40	82	6	1	FBJ0501258
5.8	40	82	6	1	FBJ0501259
5.9	40	82	6	1	FBJ0501260
6.0	40	82	6	2	FBJ0501261
6.1	48	91	8	1	FBJ0501262
6.2	48	91	8	1	FBJ0501263
6.3	48	91	8	1	FBJ0501264
6.4	48	91	8	1	FBJ0501265
6.5	48	91	8	1	FBJ0501266
6.6	48	91	8	1	FBJ0501267
6.7	48	91	8	1	FBJ0501268
6.8	48	91	8	1	FBJ0501269
6.9	48	91	8	1	FBJ0501270

5X

Solid carbide 5X high performance drill with coolant feed

Carbide

REG

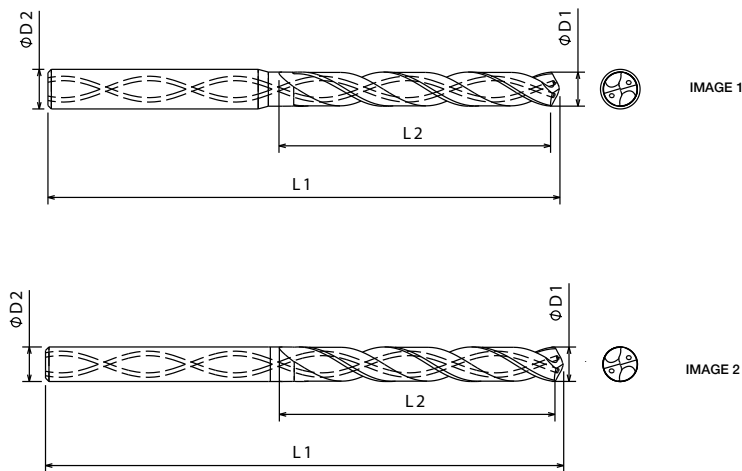


5X



30°

TiAlN



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
7.0	48	91	8	1	FBJ0501271
7.1	48	91	8	1	FBJ0501272
7.14	48	91	8	1	FBJ0501273
7.2	48	91	8	1	FBJ0501274
7.3	48	91	8	1	FBJ0501275
7.4	48	91	8	1	FBJ0501276
7.5	48	91	8	1	FBJ0501277
7.6	48	91	8	1	FBJ0501278
7.7	48	91	8	1	FBJ0501279
7.8	48	91	8	1	FBJ0501280
7.9	48	91	8	1	FBJ0501281
8.0	48	91	8	2	FBJ0501282
8.1	55	103	10	1	FBJ0501283
8.2	55	103	10	1	FBJ0501284
8.3	55	103	10	1	FBJ0501285
8.4	55	103	10	1	FBJ0501286
8.5	55	103	10	1	FBJ0501287
8.6	55	103	10	1	FBJ0501288
8.7	55	103	10	1	FBJ0501289
8.8	55	103	10	1	FBJ0501290

ØD1	L2	L1	ØD2	Image	EDP No
8.9	55	103	10	1	FBJ0501291
9.0	55	103	10	1	FBJ0501292
9.1	55	103	10	1	FBJ0501293
9.2	55	103	10	1	FBJ0501294
9.25	55	103	10	1	FBJ0501295
9.3	55	103	10	1	FBJ0501296
9.4	55	103	10	1	FBJ0501297
9.5	55	103	10	1	FBJ0501298
9.6	55	103	10	1	FBJ0501299
9.7	55	103	10	1	FBJ0501300
9.8	55	103	10	1	FBJ0501301
9.9	55	103	10	1	FBJ0501302
10.0	55	103	10	2	FBJ0501303
10.1	60	120	12	1	FBJ0501304
10.2	60	120	12	1	FBJ0501305
10.3	60	120	12	1	FBJ0501306
10.4	60	120	12	1	FBJ0501307
10.5	60	120	12	1	FBJ0501308
10.6	60	120	12	1	FBJ0501309
10.7	60	120	12	1	FBJ0501310

5X

Solid carbide 5X high performance drill with coolant feed

Carbide

REG



TiAlN

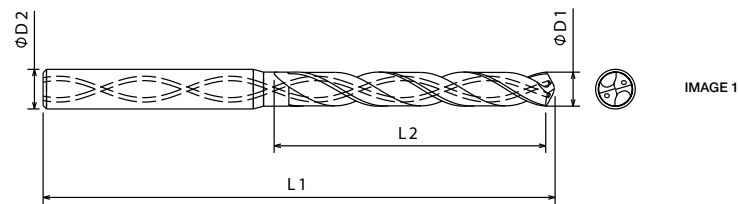


IMAGE 1

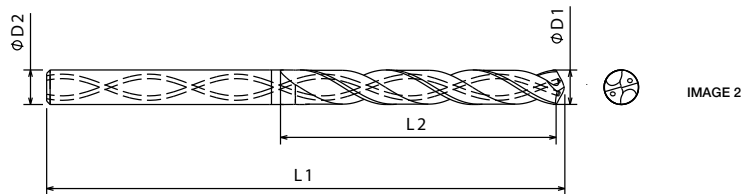


IMAGE 2

P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
10.8	60	120	12	1	FBJ0501311
10.9	60	120	12	1	FBJ0501312
11.0	60	120	12	1	FBJ0501313
11.1	66	120	12	1	FBJ0501314
11.2	66	120	12	1	FBJ0501315
11.3	66	120	12	1	FBJ0501316
11.4	66	120	12	1	FBJ0501317
11.5	66	120	12	1	FBJ0501318
11.6	66	120	12	1	FBJ0501319
11.7	66	120	12	1	FBJ0501320
11.8	66	120	12	1	FBJ0501321
11.9	66	120	12	1	FBJ0501322
12.0	66	120	12	2	FBJ0501323
12.1	72	126	14	1	FBJ0501324
12.5	72	126	14	1	FBJ0501325
12.8	72	126	14	1	FBJ0501326
12.83	72	126	14	1	FBJ0501327
12.9	72	126	14	1	FBJ0501328
13.0	72	126	14	1	FBJ0501329
13.5	77	134	14	1	FBJ0501330
13.7	77	134	14	1	FBJ0501331

ØD1	L2	L1	ØD2	Image	EDP No
14.0	77	134	14	2	FBJ0501332
14.5	80	146	16	1	FBJ0501333
14.7	80	146	16	1	FBJ0501334
15.0	80	146	16	1	FBJ0501335
15.3	82	146	16	1	FBJ0501336
15.5	82	146	16	1	FBJ0501337
15.7	82	146	16	1	FBJ0501338
16.0	82	146	16	2	FBJ0501339
16.08	90	158	18	1	FBJ0501340
16.3	90	158	18	1	FBJ0501341
16.5	90	158	18	1	FBJ0501342
17.0	90	158	18	1	FBJ0501343
17.5	95	158	18	1	FBJ0501344
18.0	95	158	18	2	FBJ0501345
18.5	100	160	20	1	FBJ0501346
19.16	100	160	20	1	FBJ0501347
19.25	100	160	20	1	FBJ0501348
19.3	100	160	20	1	FBJ0501349
19.5	100	160	20	1	FBJ0501350
20.0	100	160	20	2	FBJ0501351

Cutting parameters

Series 2TDCS/2TDCR METRIC

Workpiece Material Group			Cutting Speed Vc (m/min)			Recommended Feed in mm/rev											
						Tool Diameter (mm)											
					mm	3.00		6.00		10.00		12.00		16.0		20.0	
		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	0	150	190	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		1	150	190	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	150	190	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		3	95	130	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		4	60	75	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		5	95	130	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
Stainless Steels	M	6	60	75	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		1	65	95	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	45	65	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
Cast Iron	K	3	45	65	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		1	150	190	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	106	129	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
Special Alloys	S	3	106	129	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		1	20	30	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		2	10	15	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		3	20	30	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		4	35	55	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191

#RPM = Vc x 318.18/Tool Dia.

#mm/min = RPM x mm/rev

Series 2TDCS/2TDCR INCH

Workpiece Material Group			Cutting Speed Vc ft/min		Range	Recommended Feed in inch/rev											
						Tool Diameter (Inch)											
			min	max		Inch	1/8		1/4		3/8		1/2		5/8		3/4
		min	max		min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	0	492	623.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	492	623.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	492	623.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		3	312	426.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		4	197	246	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		5	312	426.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Stainless Steels	M	6	197	246	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	213	311.6	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	148	213.2	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
Cast Iron	K	3	148	213.2	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	492	623.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	348	423.12	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Special Alloys	S	3	348	423.12	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	66	98.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		2	33	49.2	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		3	66	98.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		4	115	180.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075

#RPM (N) = Vc (SFM) X 3.82/Tool Dia.

#Vf (Inch/min) = RPM (N) x frev (inch/rev)

The technical data are based upon theoretical values and are only intended for planning purposes and may vary based on the application. Actual results will vary. No responsibility from Forbes and Company Limited or their distributors is assumed.

Drill tolerance

Details	Cutting Dia. "D1" Range	Cutting Dia. "D1" Tolerance h7 ANSI B4.2	Shank Dia. "D2"	Shank Tolerance h6 ANSI B4.2
2TDCS	3.00-6.00	0.00/-0.012	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.015	6.00-10.00	-0.009
	10.00-18.00	0.00/-0.018	10.00-18.00	-0.011
	20.00	0.00/-0.021	20.00	-0.013
	3.00-6.00	0.00/-0.012	3.00-6.00	-0.008
2TDCR	6.00-10.00	0.00/-0.015	6.00-10.00	-0.009
	10.00-18.00	0.00/-0.018	10.00-18.00	-0.011
	20.00	0.00/-0.021	20.00	-0.013

7X

Solid carbide 7X high performance drill with coolant feed

Carbide

LONG



7X



30°

TiAlN

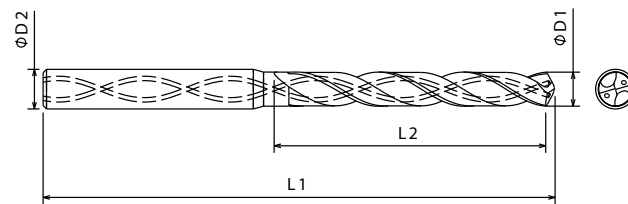


IMAGE 1

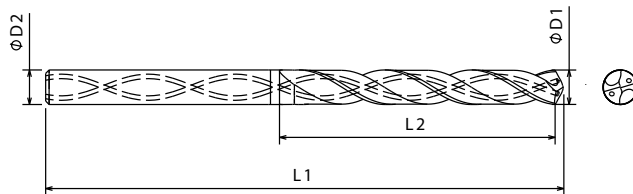


IMAGE 2

P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
3.0	33	81	3	2	FBJ0501352
3.1	40	92	4	1	FBJ0501353
3.2	40	92	4	1	FBJ0501354
3.3	40	92	4	1	FBJ0501355
3.4	40	92	4	1	FBJ0501356
3.5	40	92	4	1	FBJ0501357
3.6	40	92	4	1	FBJ0501358
3.7	40	92	4	1	FBJ0501359
3.8	40	92	4	1	FBJ0501360
3.9	40	92	4	1	FBJ0501361
4.0	40	92	4	2	FBJ0501362
4.1	45	100	5	1	FBJ0501363
4.2	45	100	5	1	FBJ0501364
4.3	45	100	5	1	FBJ0501365
4.4	45	100	5	1	FBJ0501366
4.5	45	100	5	1	FBJ0501367
4.6	45	100	5	1	FBJ0501368
4.65	45	100	5	1	FBJ0505035
4.7	45	100	5	1	FBJ0501369
4.8	45	100	5	1	FBJ0501370
4.9	45	100	5	1	FBJ0501371
5.0	45	100	5	2	FBJ0501372
5.1	51	100	6	1	FBJ0501373
5.2	51	100	6	1	FBJ0501374

ØD1	L2	L1	ØD2	Image	EDP No
5.3	51	100	6	1	FBJ0501375
5.4	51	100	6	1	FBJ0501376
5.5	51	100	6	1	FBJ0501377
5.6	51	100	6	1	FBJ0505036
5.7	51	100	6	1	FBJ0501378
5.8	51	100	6	1	FBJ0501379
5.9	51	100	6	1	FBJ0501380
6.0	51	100	6	2	FBJ0501381
6.1	60	109	8	1	FBJ0501382
6.2	60	109	8	1	FBJ0501383
6.3	60	109	8	1	FBJ0501384
6.4	60	109	8	1	FBJ0501385
6.5	60	109	8	1	FBJ0501386
6.6	60	109	8	1	FBJ0501387
6.7	60	109	8	1	FBJ0501388
6.8	60	109	8	1	FBJ0501389
6.9	60	109	8	1	FBJ0501390
7.0	60	109	8	1	FBJ0501391
7.1	70	118	8	1	FBJ0501392
7.2	70	118	8	1	FBJ0501393
7.3	70	118	8	1	FBJ0501394
7.4	70	118	8	1	FBJ0501395
7.5	70	118	8	1	FBJ0501396
7.6	70	118	8	1	FBJ0501397

7X

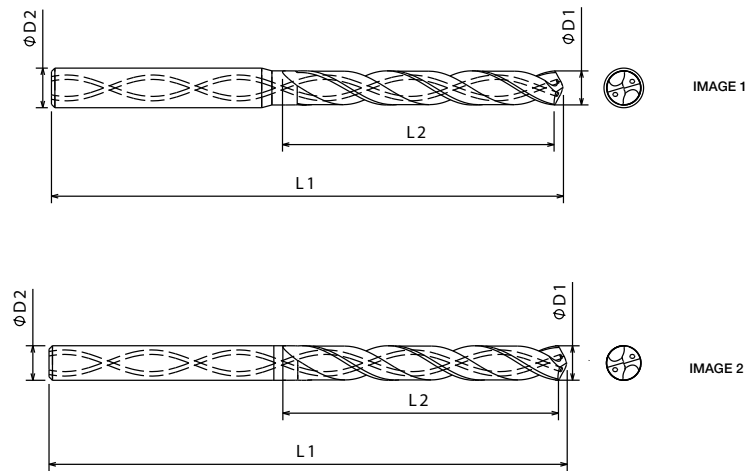
Solid carbide 7X high performance drill with coolant feed

Carbide

LONG



TiAlN



P0-P6

K1-K3

S1-S4

M1-M3

Unit : mm

ØD1	L2	L1	ØD2	Image	EDP No
7.7	70	118	8	1	FBJ0501398
7.8	70	118	8	1	FBJ0501399
7.9	70	118	8	1	FBJ0501400
8.0	70	118	8	2	FBJ0501401
8.1	80	127	10	1	FBJ0501402
8.2	80	127	10	1	FBJ0501403
8.3	80	127	10	1	FBJ0501404
8.4	80	127	10	1	FBJ0501405
8.5	80	127	10	1	FBJ0501406
8.6	80	127	10	1	FBJ0501407
8.7	80	127	10	1	FBJ0501408
8.8	80	127	10	1	FBJ0501409
8.9	80	127	10	1	FBJ0501410
9.0	80	127	10	1	FBJ0501411
9.1	85	136	10	1	FBJ0501412
9.2	85	136	10	1	FBJ0501413
9.25	85	136	10	1	FBJ0501414
9.3	85	136	10	1	FBJ0501415
9.4	85	136	10	1	FBJ0501416
9.5	85	136	10	1	FBJ0501417
9.6	85	136	10	1	FBJ0501418
9.7	85	136	10	1	FBJ0501419
9.8	85	136	10	1	FBJ0501420

ØD1	L2	L1	ØD2	Image	EDP No
9.9	85	136	10	1	FBJ0501421
10.0	85	136	10	2	FBJ0501422
10.1	93	149	12	1	FBJ0501423
10.2	93	149	12	1	FBJ0501424
10.3	93	149	12	1	FBJ0501425
10.4	93	149	12	1	FBJ0501426
10.5	93	149	12	1	FBJ0501427
10.6	93	149	12	1	FBJ0501428
10.7	93	149	12	1	FBJ0501429
10.8	93	149	12	1	FBJ0501430
10.9	93	149	12	1	FBJ0501431
11.0	93	149	12	1	FBJ0501432
11.1	102	155	12	1	FBJ0501433
11.2	102	155	12	1	FBJ0501434
11.3	102	155	12	1	FBJ0501435
11.4	102	155	12	1	FBJ0501436
11.5	102	155	12	1	FBJ0501437
11.6	102	155	12	1	FBJ0501438
11.7	102	155	12	1	FBJ0501439
11.8	102	155	12	1	FBJ0501440
11.9	102	155	12	1	FBJ0501441
12.0	102	155	12	2	FBJ0501442

Cutting parameters

Series 2TDCL METRIC

Workpiece Material Group			Cutting Speed Vc(m/min)			Recommended Feed in mm/rev											
						Tool Diameter (mm)											
					mm	3.00		6.00		10.00		12.00		16.0		20.0	
		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	0	160	180	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		1	160	180	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	160	180	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		3	85	115	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		4	50	70	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		5	85	115	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		6	50	70	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
Stainless Steels	M	1	55	85	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	40	60	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
		3	40	60	f rev	0.051	0.076	0.102	0.152	0.127	0.229	0.152	0.254	0.229	0.305	0.254	0.356
Cast Iron	K	1	160	180	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		2	106	129	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
		3	106	129	f rev	0.102	0.152	0.152	0.229	0.229	0.279	0.254	0.330	0.279	0.381	0.305	0.432
Special Alloys	S	1	20	30	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		2	10	15	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		3	20	30	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191
		4	35	55	f rev	0.015	0.025	0.032	0.064	0.070	0.102	0.090	0.127	0.120	0.152	0.160	0.191

#RPM(N) = Vc(m/min) X 318.18/Tool Dia.

#Vf(mm/min) = RPM(N) X frev (mm/rev)

Series 2TDCL INCH

Workpiece Material Group			Cutting Speed Vc ft/min			Recommended Feed in inch/rev											
						Tool Diameter (Inch)											
			min	max	Inch Range	1/8		1/4		3/8		1/2		5/8		3/4	
			min	max	rev	min	max	min	max	min	max	min	max	min	max	min	max
Steel	P	0	525	590.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	525	590.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	525	590.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		3	279	377.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		4	164	229.6	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		5	279	377.2	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Stainless Steels	M	6	164	229.6	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	180	278.8	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	131	196.8	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
Cast Iron	K	3	131	196.8	f rev	0.0020	0.0030	0.0040	0.0060	0.0050	0.0090	0.0060	0.0100	0.0090	0.0120	0.0100	0.0140
		1	525	590.4	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		2	348	423.12	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
Special Alloys	S	3	348	423.12	f rev	0.0040	0.0060	0.0060	0.0090	0.0090	0.0110	0.0100	0.0130	0.0110	0.0150	0.0120	0.0170
		1	66	98.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		2	33	49.2	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		3	66	98.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075
		4	115	180.4	f rev	0.0006	0.0010	0.0013	0.0025	0.0028	0.0040	0.0035	0.0050	0.0047	0.0060	0.0063	0.0075

#RPM (N) = Vc (SFM) X 3.82/Tool Dia.

#Vf (Inch/min) = RPM (N) x frev (inch/rev)

Drill tolerance

Details	Cutting Dia. "D1" Range	Cutting Dia. "D1" Tolerance h7 ANSI B4.2	Shank Dia. "D2"	Shank Tolerance h6 ANSI B4.2
2TDCL	3.00-6.00	0.00/-0.012	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.015	6.00-10.00	-0.009
	10.00-12.00	0.00/-0.018	10.00-12.00	-0.011

Deep hole drilling

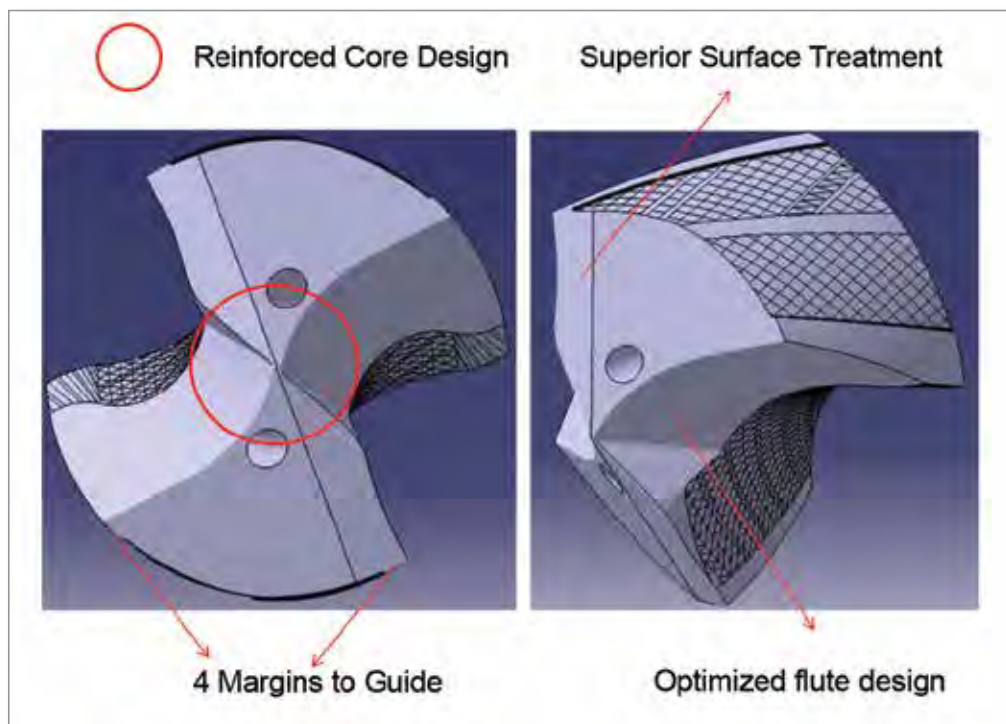


Features

- Reinforced Core Design
- Superior Surface Treatment
- 4 Margins to Guide
- High Performance Coating
- Optimized Flute Design

Benefits

- Stable cutting edge
- Better Chip Evacuation
- Better Hole Straightness
- Superior Tool Life
- Eliminated Breakages



Case studies

Challenge	Reduction in CPC
Component	Crank Shaft
Material	Forged Steel- 30 HRc
Competition	Mitsubishi
Solution	DRILL 8.00MMX240X290 SH8 T/C DHD PT
Machine	HMC
Vc	80m/min
RPM	3200
Feed in mm/min	230 @ entry/ 350 /220 @ exit
Depth	160 X 1 Hole
Existing Tool Life	64 meters
Tool Life Achieved	66 meters
Result	Better tool Life
Benefit	15% reduction in CPC

Challenge	Reduce burr folding at exit
Component	Cylinder Head
Material	Aluminium ADC-7% Si
Competition	OSG Korea
Solution	DRILL 6.00MMX118X175 SH6 T/C DHD
Machine	HMC HSK63A
Vc	188m/min
RPM	10000
Feed in mm/min	500 @ entry/ 1200 /500 @ exit
Depth	80 X 4 Holes
Existing Tool Life	800 meters
Tool Life Achieved	800 meters
Result	Negligible wear and burr folding
Benefit	10% reduction in CPC

Challenge	Reduction in CPC
Component	Crankshaft 4 Cyliner
Material	Forged Steel 38 MnSiV6 30-32 HRc
Competition	OSG
Solution	DRILL 6.00MMX115X 165 SH6 T/C DHD PT
Machine	Angular SPM
Vc	55m/min
RPM	2400
Feed in mm/min	150 @ entry/ 450 /150 @ exit
Depth	85 X 4 Holes
Existing Tool Life	150 meters
Tool Life Achieved	162 meters
Result	No Breakage
Benefit	10% reduction in CPC

Challenge	Reduction in CPC
Component	Crankshaft 4 Cyliner
Material	Forged Steel EN19B 280-320 BHN
Competition	OSG
Solution	DRILL 5.95MMX120X 192 SH6 T/C DHD PT
Machine	HMC
Vc	55m/min
RPM	2934
Feed in mm/min	150 @ entry/ 480 /150 @ exit
Depth	105 X 4 Holes
Existing Tool Life	110 meters
Tool Life Achieved	124 meters
Result	No Breakage
Benefit	10% reduction in CPC

Challenge	Reduction in breakage of oil hole drill
Component	Crankshaft 4 Cyliner
Material	Forged Steel
Competition	Guhring
Solution	DRILL 5.50MMX84X125 SH6 T/C DHD PT
Machine	SPM
Vc	65m/min
RPM	3760
Feed in mm/min	200 @ entry/ 500 /1000 @ exit
Depth	78 X 4 Holes
Existing Tool Life	187 meters
Tool Life Achieved	190 meters
Result	No Breakage
Benefit	10% reduction in CPC

Challenge	Reduction in breakage of oil hole drill
Component	Crankshaft 2 Cyliner
Material	Forged Steel SAE 1541B
Competition	Sumitomo
Solution	DRILL 4.97X115X165MM SH5 T/C DHD PT
Machine	HMC
Vc	73m/min
RPM	4700
Feed in mm/min	200 @ entry/ 700 /500 @ exit
Depth	95 X 2 Holes
Existing Tool Life	34.2 meters
Tool Life Achieved	38 meters
Result	No Breakage
Benefit	10% reduction in CPC

Challenge	Reduction in CPC
Component	Crankshaft 6 Cyliner
Material	Forged Steel 38 MnSiV6 30-32 HRc
Competition	OSG
Solution	DRILL 7.00MMX110X160 SH8 T/C DHD PT
Machine	Angular SPM
Vc	55m/min
RPM	2800
Feed in mm/min	150 @ entry/ 500 /150 @ exit
Depth	80 X 4 Holes
Existing Tool Life	150 meters
Tool Life Achieved	172 meters
Result	No Breakage
Benefit	15% reduction in CPC

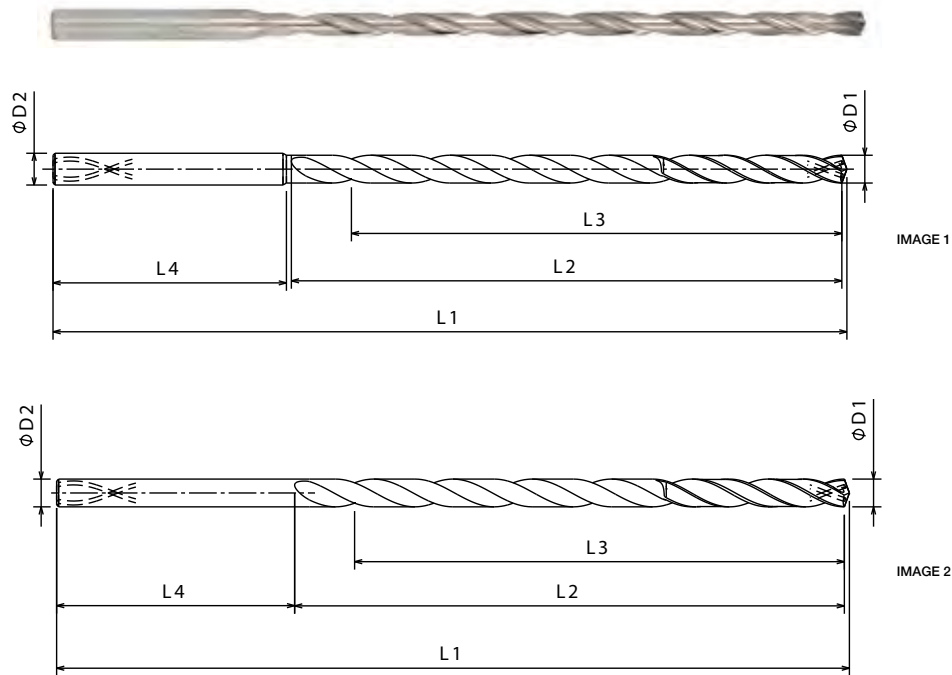
Challenge	Reduction in CPC
Component	Cam Shaft
Material	Forged Steel 16MnCr5 20-25 HRc
Competition	Walter
Solution	DRILL 7.00MMX110X 160 SH8 T/C DHD PT
Machine	SPM
Vc	55m/min
RPM	2500
Feed in mm/min	400 @ entry/ 550 /400 @ exit
Depth	68 X 1 Holes
Existing Tool Life	68 meters
Tool Life Achieved	123 meters
Result	No Breakage
Benefit	50% reduction in CPC

12X

Solid carbide 12X high performance deep hole drill with coolant feed

Carbide

DHD



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
Ø D1	L2	L3	L1	L4	D2		EDP No	EDP No
3.00	52	44	93	36	4	1	FBJ0504114	FBJ0504035
3.175	52	44	93	36	4	1	FBJ0504115	FBJ0504036
3.264	53	44	93	36	4	1	FBJ0504116	FBJ0504037
3.50	53	44	93	36	4	1	FBJ0504117	FBJ0504038
3.970	66	56	107	36	4	1	FBJ0504118	FBJ0504039
4.00	66	56	107	36	6	1	FBJ0504119	FBJ0504040
4.50	67	56	107	36	6	1	FBJ0504120	FBJ0504041
4.60	68	57	107	36	6	1	FBJ0504121	FBJ0504042
4.763	82	69	125	36	6	1	FBJ0504122	FBJ0504043
4.80	82	69	125	36	6	1	FBJ0504123	FBJ0504044
4.90	83	70	125	36	6	1	FBJ0504124	FBJ0504045
5.00	83	70	125	36	6	1	FBJ0504125	FBJ0504046
5.10	83	70	125	36	6	1	FBJ0504126	FBJ0504047
5.20	83	70	125	36	6	1	FBJ0504127	FBJ0504048
5.30	84	71	125	36	6	1	FBJ0504128	FBJ0504049
5.41	84	71	125	36	6	1	FBJ0504129	FBJ0504050
5.50	84	71	125	36	6	1	FBJ0504130	FBJ0504051
5.558	84	71	125	36	6	1	FBJ0504131	FBJ0504052
5.60	85	72	125	36	6	1	FBJ0504132	FBJ0504053
5.70	85	72	125	36	6	1	FBJ0504133	FBJ0504054

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

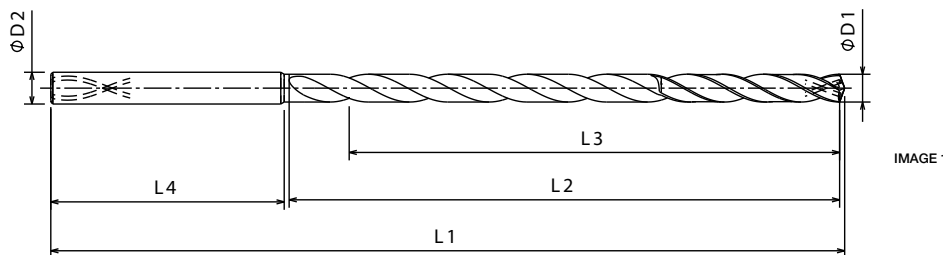
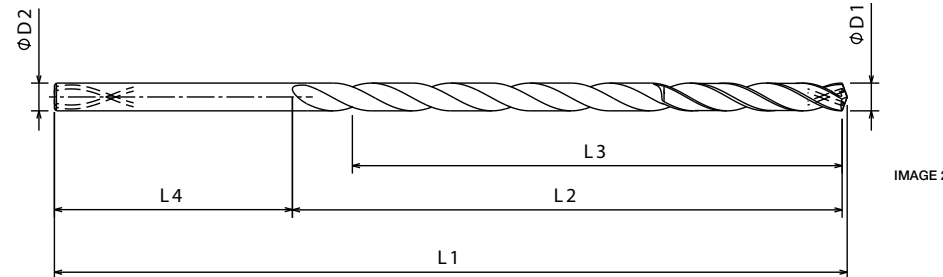
12X

Solid carbide 12X high performance deep hole drill with coolant feed

Carbide

DHD



							P0-P4 M1-M3 K1-K3 N1-N2	
							IMAGE 1	
							IMAGE 2	
							Unit : mm	
Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
Ø D1	L2	L3	L1	L4	D2		EDP No	EDP No
5.80	85	71	125	36	6	1	FBJ0504134	FBJ0504055
5.90	85	71	125	36	6	1	FBJ0504135	FBJ0504056
6.00	86	72	125	36	6	2	FBJ0504136	FBJ0504057
6.20	97	82	139	36	8	1	FBJ0504137	FBJ0504058
6.35	98	83	139	36	8	1	FBJ0504138	FBJ0504059
6.50	98	83	139	36	8	1	FBJ0504139	FBJ0504060
6.528	98	83	139	36	8	1	FBJ0504140	FBJ0504061
6.60	99	84	139	36	8	1	FBJ0504141	FBJ0504062
6.746	99	83	139	36	8	1	FBJ0504142	FBJ0504063
6.80	99	83	139	36	8	1	FBJ0504143	FBJ0504064
6.909	100	84	139	36	8	1	FBJ0504144	FBJ0504065
7.00	100	84	139	36	8	1	FBJ0504145	FBJ0504066
7.145	111	94	153	36	8	1	FBJ0504146	FBJ0504067
7.50	112	95	153	36	8	1	FBJ0504147	FBJ0504068
7.541	112	95	153	36	8	1	FBJ0504148	FBJ0504069
7.70	113	96	153	36	8	1	FBJ0504149	FBJ0504070
7.80	113	95	153	36	8	1	FBJ0504150	FBJ0504071
7.938	114	96	153	36	8	1	FBJ0504151	FBJ0504072
8.00	114	96	153	36	8	2	FBJ0504152	FBJ0504073
8.10	136	116	185	40	10	1	FBJ0504153	FBJ0504074

Application data on page no 4.034

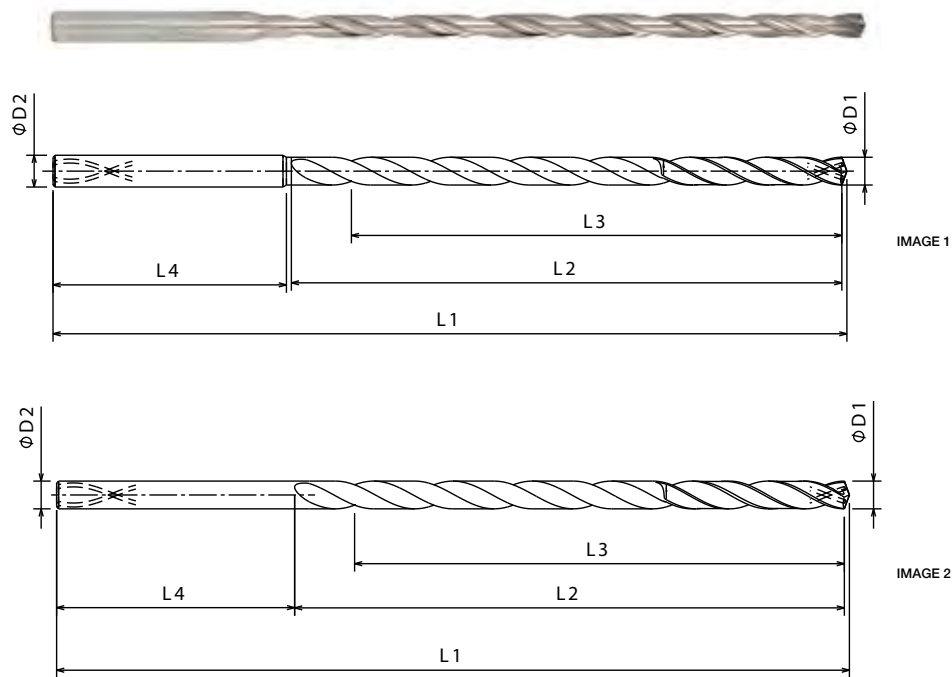
Note: Use DHD drills with Forbes PA150 pilot drills

12X

Solid carbide 12X high performance deep hole drill with coolant feed

Carbide

DHD



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
Ø D1	L2	L3	L1	L4	D2		EDP No	EDP No
8.334	137	117	185	40	10	1	FBJ0504154	FBJ0504075
8.433	137	117	185	40	10	1	FBJ0504155	FBJ0504076
8.50	137	117	185	40	10	1	FBJ0504156	FBJ0504077
8.70	138	118	185	40	10	1	FBJ0504157	FBJ0504078
8.733	138	117	185	40	10	1	FBJ0504158	FBJ0504079
9.00	139	118	185	40	10	1	FBJ0504159	FBJ0504080
9.10	139	118	185	40	10	1	FBJ0504160	FBJ0504081
9.129	139	118	185	40	10	1	FBJ0504161	FBJ0504082
9.50	140	119	185	40	10	1	FBJ0504162	FBJ0504083
9.525	140	119	185	40	10	1	FBJ0504163	FBJ0504084
9.921	142	120	185	40	10	1	FBJ0504164	FBJ0504085
10.00	142	120	185	40	10	2	FBJ0504165	FBJ0504086
10.20	164	140	218	45	12	1	FBJ0504166	FBJ0504087
10.30	165	141	218	45	12	1	FBJ0504167	FBJ0504088
10.32	165	141	218	45	12	1	FBJ0504168	FBJ0504089
10.50	165	141	218	45	12	1	FBJ0504169	FBJ0504090
10.716	166	142	218	45	12	1	FBJ0504170	FBJ0504091
10.80	166	141	218	45	12	1	FBJ0504171	FBJ0504092
11.00	167	142	218	45	12	1	FBJ0504172	FBJ0504093

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

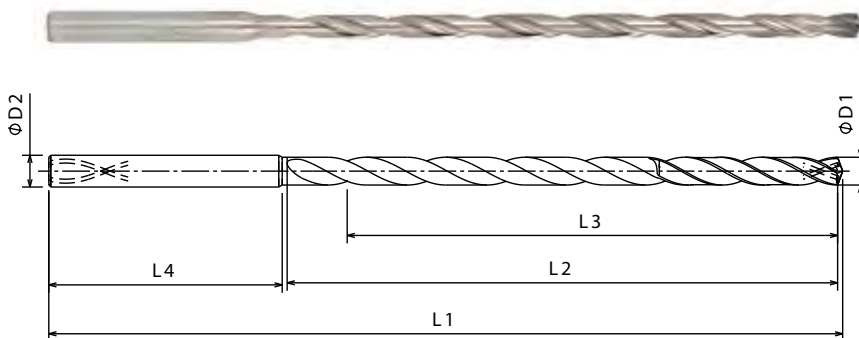
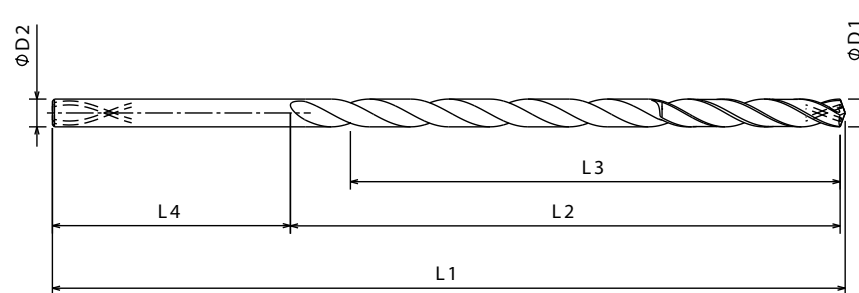
12X

Solid carbide 12X high performance deep hole drill with coolant feed

Carbide

DHD



 							P0-P4 M1-M3 K1-K3 N1-N2	
							Unit : mm	
Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
ØD1	L2	L3	L1	L4	D2		EDP No	EDP No
11.113	167	142	218	45	12	1	FBJ0504173	FBJ0504094
11.50	168	143	218	45	12	1	FBJ0504174	FBJ0504095
11.80	169	143	218	45	12	1	FBJ0504175	FBJ0504096
12.00	170	144	218	45	12	2	FBJ0504176	FBJ0504097
12.10	192	164	246	45	14	1	FBJ0504177	FBJ0504098
12.304	193	165	246	45	14	1	FBJ0504178	FBJ0504099
12.50	193	165	246	45	14	1	FBJ0504179	FBJ0504100
12.70	194	166	246	45	14	1	FBJ0504180	FBJ0504101
13.00	195	166	246	45	14	1	FBJ0504181	FBJ0504102
13.10	195	166	246	45	14	1	FBJ0504182	FBJ0504103
13.50	196	167	246	45	14	1	FBJ0504183	FBJ0504104
14.00	198	168	246	45	14	2	FBJ0504184	FBJ0504105
14.10	220	188	277	48	16	1	FBJ0504185	FBJ0504106
14.288	220	188	277	48	16	1	FBJ0504186	FBJ0504107
14.50	221	189	277	48	16	1	FBJ0504187	FBJ0504108
14.684	222	190	277	48	16	1	FBJ0504188	FBJ0504109
15.00	223	190	277	48	16	1	FBJ0504189	FBJ0504110
15.50	224	191	277	48	16	1	FBJ0504190	FBJ0504111
15.875	225	192	277	48	16	1	FBJ0504191	FBJ0504112
16.00	226	192	277	48	16	2	FBJ0504192	FBJ0504113

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

15X

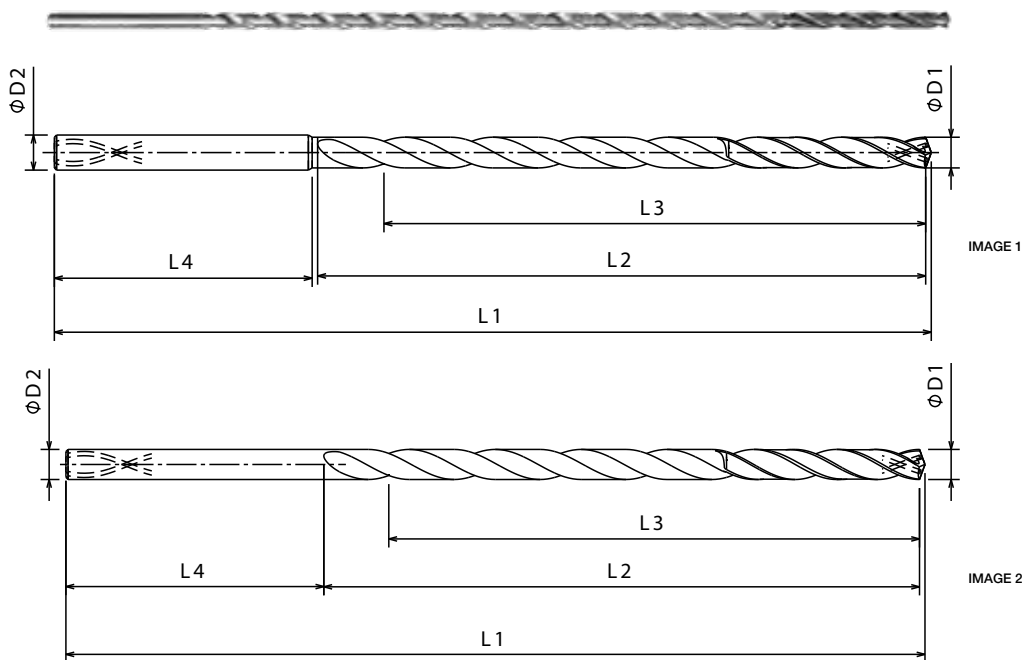
Solid carbide 15X high performance deep hole drill with coolant feed

Carbide

DHD



DRILLS



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAlN
ØD1	L2	L3	L1	L4	D2		EDP No	EDP No
3.00	67	58	105	32	4	1	FBJ0504245	FBJ0504193
3.175	67	58	105	32	4	1	FBJ0504246	FBJ0504194
3.20	67	58	105	32	4	1	FBJ0504247	FBJ0504195
3.50	68	59	105	32	4	1	FBJ0504248	FBJ0504196
3.970	70	60	105	32	4	1	FBJ0504249	FBJ0504197
4.00	70	60	105	32	6	1	FBJ0504250	FBJ0504198
4.50	85	74	124	34	6	1	FBJ0504251	FBJ0504199
4.623	86	75	124	34	6	1	FBJ0504252	FBJ0504200
4.763	86	75	124	34	6	1	FBJ0504253	FBJ0504201
4.90	87	75	124	34	6	1	FBJ0504254	FBJ0504202
5.00	87	75	124	34	6	1	FBJ0504255	FBJ0504203
5.260	102	89	143	36	6	1	FBJ0504256	FBJ0504204
5.41	102	89	143	36	6	1	FBJ0504257	FBJ0504205
5.50	102	89	143	36	6	1	FBJ0504258	FBJ0504206
5.558	102	89	143	36	6	1	FBJ0504259	FBJ0504207
5.80	103	89	143	36	6	1	FBJ0504260	FBJ0504208
5.90	104	90	143	36	6	1	FBJ0504261	FBJ0504209
6.00	104	90	143	36	6	2	FBJ0504262	FBJ0504210

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

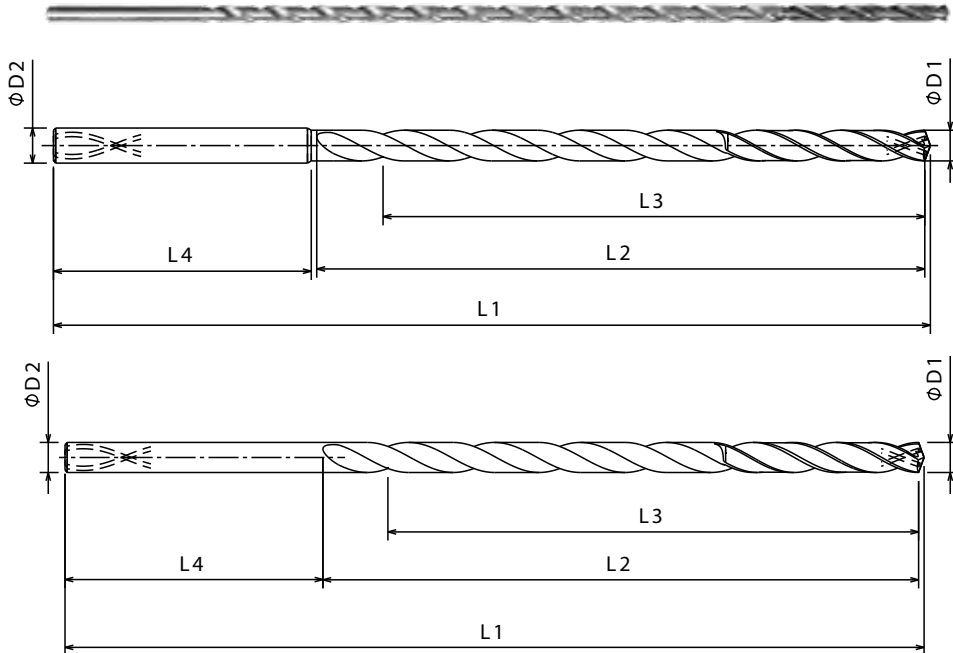
15X

Solid carbide 15X high performance deep hole drill with coolant feed

Carbide

DHD



							P0-P4 M1-M3 K1-K3 N1-N2	
							Unit : mm	
Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
Ø D1	L2	L3	L1	L4	D2		EDP No	EDP No
6.20	118	103	162	38	8	1	FBJ0504263	FBJ0504211
6.35	119	104	162	38	8	1	FBJ0504264	FBJ0504212
6.50	119	104	162	38	8	1	FBJ0504265	FBJ0504213
6.528	119	104	162	38	8	1	FBJ0504266	FBJ0504214
6.746	120	104	162	38	8	1	FBJ0504267	FBJ0504215
6.909	121	105	162	38	8	1	FBJ0504268	FBJ0504216
7.00	121	105	162	38	8	1	FBJ0504269	FBJ0504217
7.145	135	118	181	40	8	1	FBJ0504270	FBJ0504218
7.50	136	119	181	40	8	1	FBJ0504271	FBJ0504219
7.541	136	119	181	40	8	1	FBJ0504272	FBJ0504220
7.938	138	120	181	40	8	1	FBJ0504273	FBJ0504221
8.00	138	120	181	40	8	2	FBJ0504274	FBJ0504222
8.334	153	134	200	42	10	1	FBJ0504275	FBJ0504223
8.433	153	134	200	42	10	1	FBJ0504276	FBJ0504224
8.50	153	134	200	42	10	1	FBJ0504277	FBJ0504225
8.733	154	134	200	42	10	1	FBJ0504278	FBJ0504226
9.00	155	135	200	42	10	1	FBJ0504279	FBJ0504227

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

15X

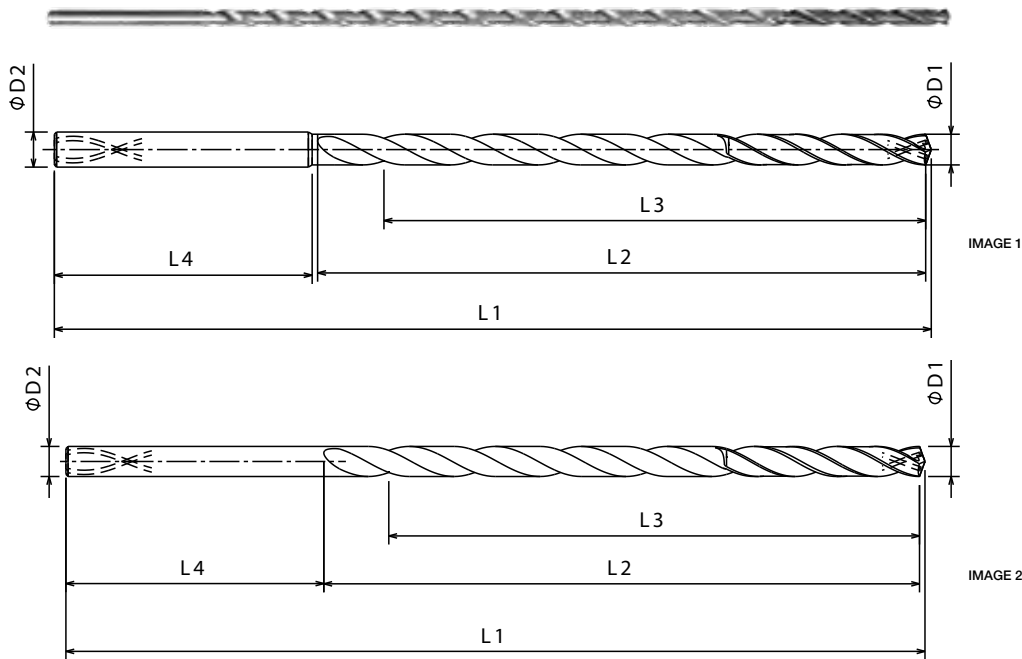
Solid carbide 15X high performance deep hole drill with coolant feed

Carbide

DHD



DRILLS



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAlN
Ø D1	L2	L3	L1	L4	D2		EDP No	EDP No
9.10	169	148	219	44	10	1	FBJ0504280	FBJ0504228
9.50	170	149	219	44	10	1	FBJ0504281	FBJ0504229
9.525	170	149	219	44	10	1	FBJ0504282	FBJ0504230
9.75	171	149	219	44	10	1	FBJ0504283	FBJ0504231
10.00	172	150	219	44	10	2	FBJ0504284	FBJ0504232
10.20	186	163	238	46	12	1	FBJ0504285	FBJ0504233
10.50	187	164	238	46	12	1	FBJ0504286	FBJ0504234
10.72	188	165	238	46	12	1	FBJ0504287	FBJ0504235
11.00	189	165	238	46	12	1	FBJ0504288	FBJ0504236
11.50	204	179	257	48	12	1	FBJ0504289	FBJ0504237
12.00	206	180	257	48	12	2	FBJ0504290	FBJ0504238
12.50	221	194	276	50	14	1	FBJ0504291	FBJ0504239
12.70	222	195	276	50	14	1	FBJ0504292	FBJ0504240
13.00	223	195	276	50	14	1	FBJ0504293	FBJ0504241
13.10	237	208	295	52	14	1	FBJ0504294	FBJ0504242
13.50	238	209	295	52	14	1	FBJ0504295	FBJ0504243
14.00	240	210	295	52	14	2	FBJ0504296	FBJ0504244

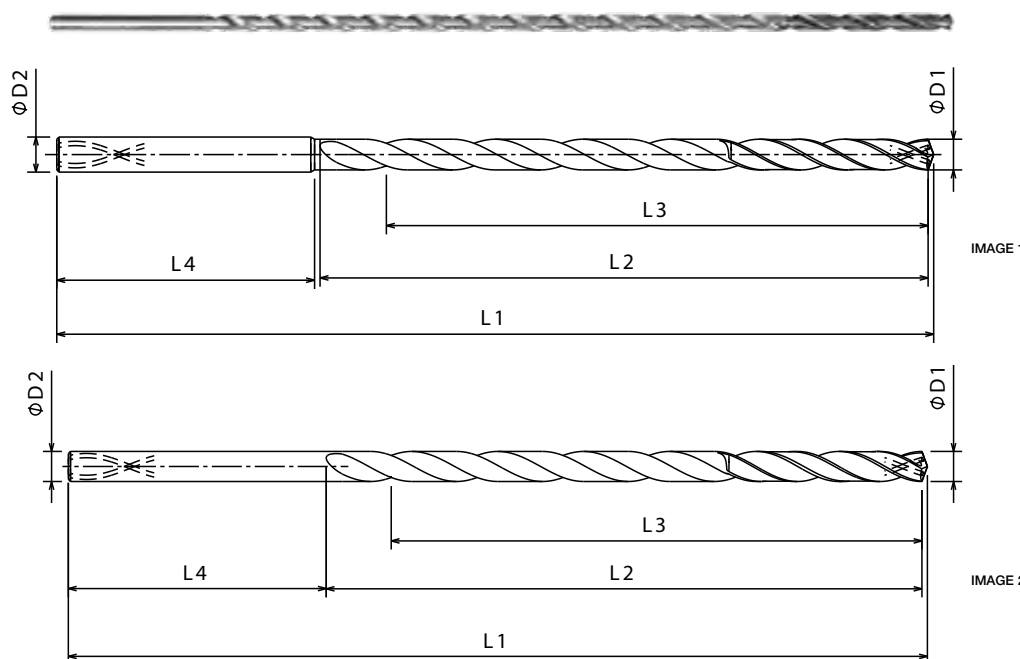
Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

20X

Solid carbide 20X high performance deep hole drill with coolant feed



							P0-P4 M1-M3 K1-K3 N1-N2	
							Unit : mm	
Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAlN
ØD1	L2	L3	L1	L4	D2		EDP No	EDP No
3.00	83	74	125	32	4	1	FBJ0504341	FBJ0504297
3.175	83	74	125	32	4	1	FBJ0504342	FBJ0504298
3.30	84	75	125	32	4	1	FBJ0504343	FBJ0504299
3.50	86	77	125	32	4	1	FBJ0504344	FBJ0504300
3.97	89	79	125	32	4	1	FBJ0504345	FBJ0504301
4.00	90	80	125	32	6	1	FBJ0504346	FBJ0504302
4.50	108	97	149	34	6	1	FBJ0504347	FBJ0504303
4.623	109	98	149	34	6	1	FBJ0504348	FBJ0504304
4.763	110	99	149	34	6	1	FBJ0504349	FBJ0504305
4.90	112	100	149	34	6	1	FBJ0504350	FBJ0504306
5.00	112	100	149	34	6	1	FBJ0504351	FBJ0504307
5.26	128	115	173	36	6	1	FBJ0504352	FBJ0504308
5.41	129	116	173	36	6	1	FBJ0504353	FBJ0504309
5.50	130	117	173	36	6	1	FBJ0504354	FBJ0504310
5.558	130	117	173	36	6	1	FBJ0504355	FBJ0504311

Application data on page no 4.034

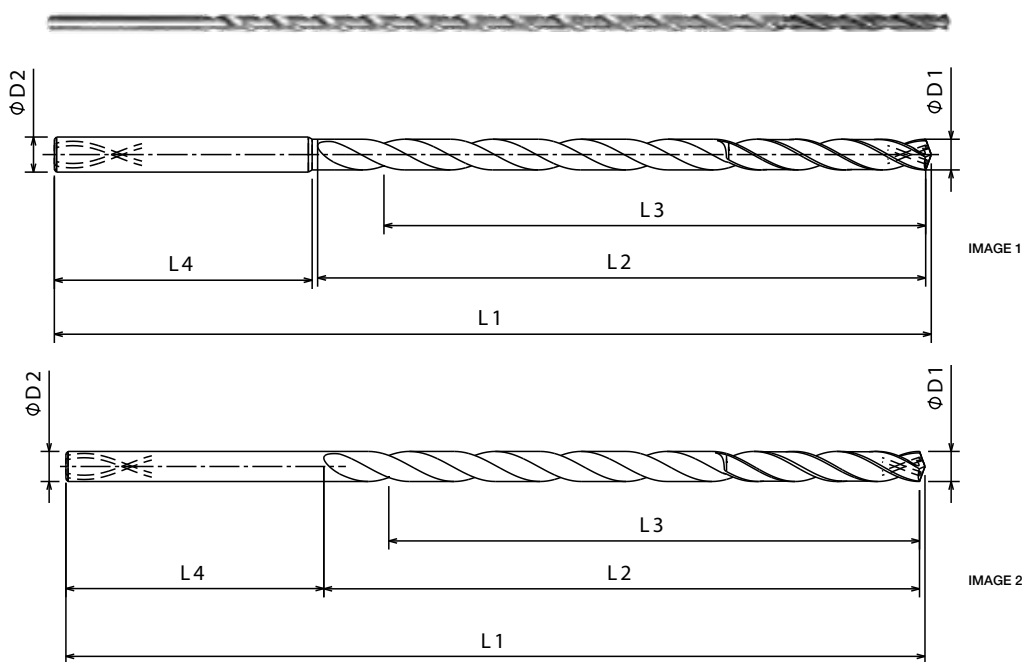
Note: Use DHD drills with Forbes PA150 pilot drills

20X

Solid carbide 20X high performance deep hole drill with coolant feed



DRILLS



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAlN
ØD1	L2	L3	L1	L4	D2		EDP No	EDP No
5.80	132	118	173	36	6	1	FBJ0504356	FBJ0504312
5.90	134	120	173	36	6	1	FBJ0504357	FBJ0504313
6.00	134	120	173	36	6	2	FBJ0504358	FBJ0504314
6.20	149	134	197	38	8	1	FBJ0504359	FBJ0504315
6.35	151	136	197	38	8	1	FBJ0504360	FBJ0504316
6.50	152	137	197	38	8	1	FBJ0504361	FBJ0504317
6.528	152	137	197	38	8	1	FBJ0504362	FBJ0504318
6.746	154	138	197	38	8	1	FBJ0504363	FBJ0504319
6.909	155	139	197	38	8	1	FBJ0504364	FBJ0504320
7.00	156	140	197	38	8	1	FBJ0504365	FBJ0504321
7.145	171	154	221	40	8	1	FBJ0504366	FBJ0504322
7.50	174	157	221	40	8	1	FBJ0504367	FBJ0504323
7.541	174	157	221	40	8	1	FBJ0504368	FBJ0504324
7.938	177	159	221	40	8	1	FBJ0504369	FBJ0504325
8.00	178	160	221	40	8	2	FBJ0504370	FBJ0504326

Application data on page no 4.034

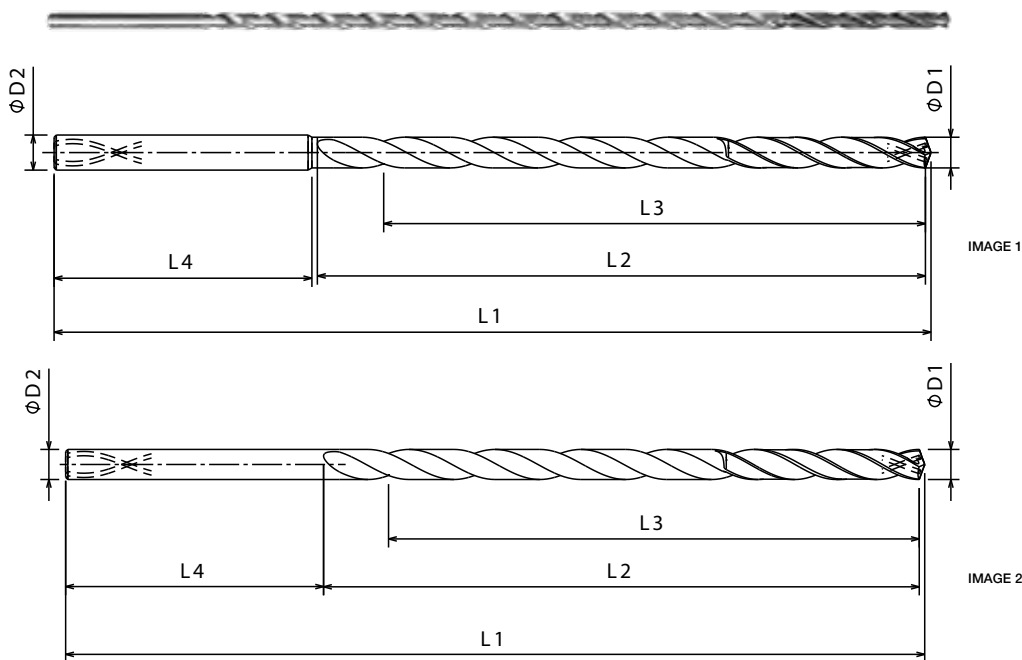
Note: Use DHD drills with Forbes PA150 pilot drills

20X

Solid carbide 20X high performance deep hole drill with coolant feed

Carbide

DHD



P0-P4

M1-M3

K1-K3

N1-N2

Unit : mm

Diameter	Flute Length	Cutting Length	Overall Length	Shank Length	Shank Diameter	Image	Bright - Polished	TiAIN
ØD1	L2	L3	L1	L4	D2		EDP No	EDP No
8.334	194	175	245	42	10	1	FBJ0504371	FBJ0504327
8.433	195	176	245	42	10	1	FBJ0504372	FBJ0504328
8.50	196	177	245	42	10	1	FBJ0504373	FBJ0504329
8.733	198	178	245	42	10	1	FBJ0504374	FBJ0504330
9.00	200	180	245	42	10	1	FBJ0504375	FBJ0504331
9.10	215	194	269	44	10	1	FBJ0504376	FBJ0504332
9.50	218	197	269	44	10	1	FBJ0504377	FBJ0504333
9.525	218	197	269	44	10	1	FBJ0504378	FBJ0504334
9.75	220	198	269	44	10	1	FBJ0504379	FBJ0504335
10.00	222	200	269	44	10	2	FBJ0504380	FBJ0504336
10.20	237	214	293	46	12	1	FBJ0504381	FBJ0504337
10.50	240	217	293	46	12	1	FBJ0504382	FBJ0504338
10.72	242	219	293	46	12	1	FBJ0504383	FBJ0504339
11.00	244	220	293	46	12	1	FBJ0504384	FBJ0504340

Application data on page no 4.034

Note: Use DHD drills with Forbes PA150 pilot drills

Cutting parameters

Series DHD-12X/DHD-15X/DHD-20X METRIC TiAlN

Workpiece Material Group			Cutting Speed Vc (m/min)			Recommended feed in mm/rev													
						Diameter in mm													
			min	max	mm	3.00		4.00		6.00		8.00		10.0		12.0		16.0	
		min	max	Range	min	max	min	max	min	max	min	max	min	max	min	max	min	max	
Steel	P	0	50	80	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		1	50	80	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		2	50	80	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		3	40	60	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		4	40	60	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
Stainless Steels	M	1	40	60	f rev	0.05	0.09	0.07	0.12	0.09	0.14	0.10	0.15	0.11	0.16	0.12	0.17	0.14	0.19
		2	30	50	f rev	0.04	0.08	0.06	0.11	0.08	0.13	0.09	0.14	0.10	0.15	0.11	0.16	0.13	0.18
		3	30	50	f rev	0.04	0.08	0.06	0.11	0.08	0.13	0.09	0.14	0.10	0.15	0.11	0.16	0.13	0.18
Cast Iron	K	1	60	100	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		2	60	80	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24
		3	60	80	f rev	0.10	0.12	0.12	0.13	0.14	0.16	0.16	0.18	0.18	0.20	0.20	0.22	0.22	0.24

Series DHD-12X/DHD-15X/DHD-20X Bright METRIC

Workpiece Material Group			Cutting Speed Vc(m/min)			Recommended feed in mm/rev													
						Diameter in mm													
			min	max	mm Range	3.00		4.00		6.00		8.00		10.0		12.0		16.0	
					min	max	min	max	min	max	min	max	min	max	min	max	min	max	
Non Ferrous	N	1	120	300	f rev	0.12	0.17	0.13	0.18	0.15	0.24	0.19	0.29	0.26	0.35	0.31	0.4	0.41	0.51
		2	120	300	f rev	0.12	0.17	0.13	0.18	0.15	0.24	0.19	0.29	0.26	0.35	0.31	0.4	0.41	0.51

#RPM(N) = Vc(m/min) X 318.18/Tool Dia.

#Vf(mm/min) = RPM(N) X frev (mm/rev)

The technical data are based upon theoretical values and are only intended for planning purposes and may vary based on the application. Actual results will vary. No responsibility from Forbes and Company Limited or their distributors is assumed.

Case studies

Challenge	Reduction in CPC	Challenge	Reduction in CPC
Component	Crank Shaft	Component	Crank Shaft
Material	Forged Steel SAE1541	Material	Forged Steel 35 HRC
Competition	OSG	Competition	Mitsubishi/Sumitomo/Walter
Solution	DRILL 5.00MMX135X185 SH6 T/C DHD PT	Solution	DRILL 5.97MMX160X210 SH6 T/C DHD PT
Machine	SPM	Machine	HMC
Vc	59m/min	Vc	66m/min
RPM	3800	RPM	3500
Feed in mm/min	150 @ entry/ 480/150 @ exit	Feed in mm/min	420mm/min
Depth	105 X 2 Holes	Depth	138 X 6 Holes
Existing Tool Life	26 meters	Existing Tool Life	33 meters
Tool Life Achieved	32 meters	Tool Life Achieved	33 meters
Result	No Breakage	Result	No Breakage
Benefit	10% reduction in CPC	Benefit	10% reduction in CPC

Drill tolerance

Details	Cutting Dia. "D1" Range	Cutting Dia. "D1" Tolerance h7 ANSI B4.2	Shank Dia. "D2"	Shank Tolerance h6 ANSI B4.2
DHD 12X	3.00-6.00	-0.020/-0.030	4.00-6.00	-0.008
	6.00-10.00	-0.020/-0.030	6.00-10.00	-0.009
	10.00-16.00	-0.020/-0.030	10.00-16.00	-0.011
DHD 15X	3.00-6.00	-0.020/-0.030	4.00-6.00	-0.008
	6.00-10.00	-0.020/-0.030	6.00-10.00	-0.009
	10.00-14.00	-0.020/-0.030	10.00-14.00	-0.011
DHD 20X	3.00-6.00	-0.020/-0.030	4.00-6.00	-0.008
	6.00-10.00	-0.020/-0.030	6.00-10.00	-0.009
	10.00-12.00	-0.020/-0.030	10.00-12.00	-0.011

Technical details

Clamping-Always use a Hydraulic chuck and ensure that the tool is set and the max run out is within 2-3 microns

SPOT FACING/ SURFACE PREPARATION



- Create a small flat which will ensure that the next tool has a flat surface to drill- Machine a flat surface on the surface using a flat end mill or a slot drill capable of Spot facing,
- Ensure the spot face is atleast equal to the diameter of the tool

DRILLING A PILOT HOLE – USE A DRILL WITH A WIDER POINT ANGLE THAN THE DEEP HOLE DRILL



- We always recommend you to ask your supplier to supply the long drill along with the pilot, This would ensure better understanding of the process as a whole by the supplier, For example we recommend that the Pilot should have an angle of 150-155 degrees and the long drill 135-142, this is recommended to ensure no rubbing during entry and the best centring for the long drill
- We always ensure that the pilots we make are of a positive tolerance when compared to the oil hole drill. For Example the pilot we prepare is generally of m7 tolerance and the DHD is of h7 tolerance. This will ensure no interference during machining
- We recommend that you drill a minimum of 1XD for the pilot or can go as high as per the application of the long drill, Note that the higher the pilot drills, the long drill has a lesser contact time which will help improve output on the long run
- We also recommend that you can combine the Spot Face and the Pilot into a single tool and try the Forbes designed flat bottom pilot tool to reduce your cycle time

DRILLING WITH THE LONG DRILL – ENTRY AND INITIAL CUTTING



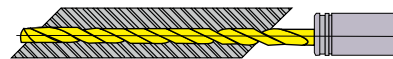
- Enter the drilled pilot hole at a lower cutting speed (lower than 30m/min) and a moderate feed and stop about 1-3mm before the bottom face of the pilot drill

DRILLING WITH THE LONG DRILL – DRILLING THE DEEP HOLE



- Start cutting at the recommended parameters of the supplier without any pecking cycle. Note here first achieve the desired RPM and then start the feed, generally we notice a lot of breakage at this area as the Drill would not have reached its suggested RPM and contact the surface creating high load condition and break.

DRILLING WITH THE LONG DRILL – BREAKING THROUGH

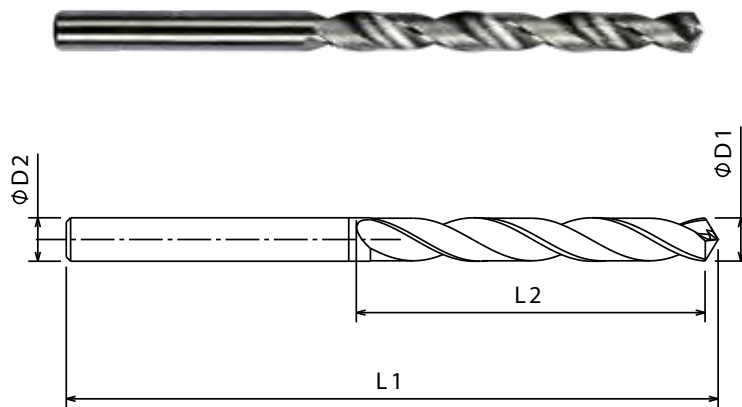


- At the exit we typically will face a challenge where the drill will need to break out into a cross hole or a curved exit. We recommend you drop you feed at the exit to 15%-20% of the recommended cutting parameters. This will ensure lowest probability of an edge breakage due to uneven cutting.

RETRACTION OF THE LONG DRILL



- Retract the drill with anything between 1m to 3mm feed rate upto the last 5mm of the pilot hole and then clear the hole at the same parameters used during entry.

5X
Solid carbide jobber drill
Carbide
REG

P1-P6
M1-M2
K1-K2
N5-N6
Unit : mm

Ø D1	L2	L1	Ø D2	F224 (BRIGHT)	F224A (TiAlN)
				EDP No	EDP No
1.00	12.00	34	1.00	FBJ0501506	FBJ0501507
1.05	12.00	34	1.05	FBJ0501516	FBJ0501517
1.10	14.00	36	1.10	FBJ0501520	FBJ0501521
1.15	14.00	36	1.15	FBJ0501528	FBJ0501529
1.20	16.00	38	1.20	FBJ0501532	FBJ0501533
1.25	16.00	38	1.25	FBJ0501542	FBJ0501543
1.30	16.00	38	1.30	FBJ0501546	FBJ0501547
1.35	18.00	40	1.35	FBJ0501550	FBJ0501551
1.40	18.00	40	1.40	FBJ0501554	FBJ0501555
1.45	18.00	40	1.45	FBJ0501560	FBJ0501561
1.50	18.00	40	1.50	FBJ0501570	FBJ0501571
1.60	20.00	43	1.60	FBJ0501584	FBJ0501585
1.70	20.00	43	1.70	FBJ0501592	FBJ0501593
1.80	22.00	46	1.80	FBJ0501598	FBJ0501599
1.90	22.00	46	1.90	FBJ0501604	FBJ0501605
2.00	24.00	49	2.00	FBJ0501612	FBJ0501613
2.10	24.00	49	2.10	FBJ0501618	FBJ0501619
2.20	27.00	53	2.20	FBJ0501622	FBJ0501623
2.30	27.00	53	2.30	FBJ0501628	FBJ0501629
2.40	30.00	57	2.40	FBJ0501638	FBJ0501639
2.50	30.00	57	2.50	FBJ0501646	FBJ0501647
2.60	30.00	57	2.60	FBJ0501654	FBJ0501655

Ø D1	L2	L1	Ø D2	F224 (BRIGHT)	F224A (TiAlN)
				EDP No	EDP No
2.70	33.00	61	2.70	FBJ0501660	FBJ0501661
2.80	33.00	61	2.80	FBJ0501664	FBJ0501665
3.00	33.00	61	3.00	FBJ0500001	FBJ0500002
3.10	36.00	65	3.10	FBJ0500003	FBJ0500004
3.20	36.00	65	3.20	FBJ0500005	FBJ0500006
3.30	36.00	65	3.30	FBJ0500007	FBJ0500008
3.40	39.00	70	3.40	FBJ0500009	FBJ0500010
3.50	39.00	70	3.50	FBJ0500011	FBJ0500012
3.60	39.00	70	3.60	FBJ0500013	FBJ0500014
3.70	39.00	70	3.70	FBJ0500015	FBJ0500016
3.80	43.00	75	3.80	FBJ0500017	FBJ0500018
3.90	43.00	75	3.90	FBJ0500019	FBJ0500020
4.00	43.00	75	4.00	FBJ0500021	FBJ0500022
4.10	43.00	75	4.10	FBJ0500023	FBJ0500024
4.20	43.00	75	4.20	FBJ0500025	FBJ0500026
4.30	47.00	80	4.30	FBJ0500027	FBJ0500028
4.40	47.00	80	4.40	FBJ0500029	FBJ0500030
4.50	47.00	80	4.50	FBJ0500031	FBJ0500032
4.60	47.00	80	4.60	FBJ0500033	FBJ0500034
4.70	47.00	80	4.70	FBJ0500035	FBJ0500036
4.80	52.00	86	4.80	FBJ0500037	FBJ0500038
4.90	52.00	86	4.90	FBJ0500039	FBJ0500040

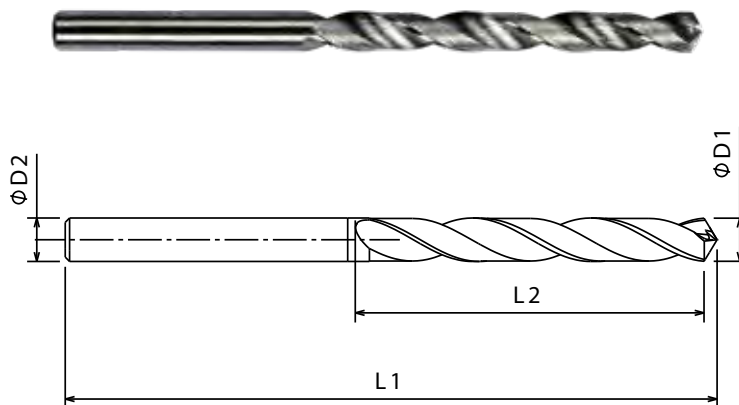
Application data on page no 4.042

5X

Solid carbide jobber drill

Carbide

REG



P1-P6

M1-M2

K1-K2

N5-N6

Unit : mm

Ø D1	L2	L1	Ø D2	F224 (BRIGHT) EDP No	F224A (TiAlN) EDP No
5.00	52.00	86	5.00	FBJ0500041	FBJ0500042
5.10	52.00	86	5.10	FBJ0500043	FBJ0500044
5.20	52.00	86	5.20	FBJ0500045	FBJ0500046
5.30	52.00	86	5.30	FBJ0500047	FBJ0500048
5.40	57.00	93	5.40	FBJ0500049	FBJ0500050
5.50	57.00	93	5.50	FBJ0500051	FBJ0500052
5.60	57.00	93	5.60	FBJ0500053	FBJ0500054
5.70	57.00	93	5.70	FBJ0500055	FBJ0500056
5.80	57.00	93	5.80	FBJ0500057	FBJ0500058
5.90	57.00	93	5.90	FBJ0500059	FBJ0500060
6.00	57.00	93	6.00	FBJ0500061	FBJ0500062
6.10	63.00	101	6.10	FBJ0500063	FBJ0500064
6.20	63.00	101	6.20	FBJ0500065	FBJ0500066
6.30	63.00	101	6.30	FBJ0500067	FBJ0500068
6.40	63.00	101	6.40	FBJ0500069	FBJ0500070
6.50	63.00	101	6.50	FBJ0500071	FBJ0500072
6.60	63.00	101	6.60	FBJ0500073	FBJ0500074
6.70	63.00	101	6.70	FBJ0500075	FBJ0500076
6.80	69.00	109	6.80	FBJ0500077	FBJ0500078
6.90	69.00	109	6.90	FBJ0500079	FBJ0500080
7.00	69.00	109	7.00	FBJ0500081	FBJ0500082
7.10	69.00	109	7.10	FBJ0500083	FBJ0500084

Ø D1	L2	L1	Ø D2	F224 (BRIGHT) EDP No	F224A (TiAlN) EDP No
7.20	69.00	109	7.20	FBJ0500085	FBJ0500086
7.30	69.00	109	7.30	FBJ0500087	FBJ0500088
7.40	69.00	109	7.40	FBJ0500089	FBJ0500090
7.50	69.00	109	7.50	FBJ0500091	FBJ0500092
7.60	75.00	117	7.60	FBJ0500093	FBJ0500094
7.70	75.00	117	7.70	FBJ0500095	FBJ0500096
7.80	75.00	117	7.80	FBJ0500097	FBJ0500098
7.90	75.00	117	7.90	FBJ0500099	FBJ0500100
8.00	75.00	117	8.00	FBJ0500101	FBJ0500102
8.10	75.00	117	8.10	FBJ0500103	FBJ0500104
8.20	75.00	117	8.20	FBJ0500105	FBJ0500106
8.30	75.00	117	8.30	FBJ0500107	FBJ0500108
8.40	75.00	117	8.40	FBJ0500109	FBJ0500110
8.50	75.00	117	8.50	FBJ0500111	FBJ0500112
8.60	81.00	125	8.60	FBJ0500113	FBJ0500114
8.70	81.00	125	8.70	FBJ0500115	FBJ0500116
8.80	81.00	125	8.80	FBJ0500117	FBJ0500118
8.90	81.00	125	8.90	FBJ0500119	FBJ0500120
9.00	81.00	125	9.00	FBJ0500121	FBJ0500122
9.10	81.00	125	9.10	FBJ0500123	FBJ0500124
9.20	81.00	125	9.20	FBJ0500125	FBJ0500126
9.30	81.00	125	9.30	FBJ0500127	FBJ0500128

5X

Solid carbide jobber drill

Carbide

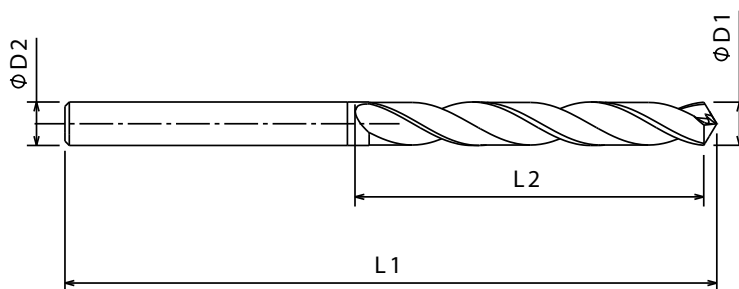
REG



5X



30°



P1-P6

M1-M2

K1-K2

N5-N6

Unit : mm

Ø D1	L2	L1	Ø D2	F224 (BRIGHT)	F224A (TiAIN)
				EDP No	EDP No
9.40	81.00	125	9.40	FBJ0500129	FBJ0500130
9.50	81.00	125	9.50	FBJ0500131	FBJ0500132
9.60	87.00	133	9.60	FBJ0500133	FBJ0500134
9.70	87.00	133	9.70	FBJ0500135	FBJ0500136
9.80	87.00	133	9.80	FBJ0500137	FBJ0500138
9.90	87.00	133	9.90	FBJ0500139	FBJ0500140
10.00	87.00	133	10.00	FBJ0500141	FBJ0500142
10.10	87.00	133	10.10	FBJ0500143	FBJ0500144
10.20	87.00	133	10.20	FBJ0500145	FBJ0500146
10.30	87.00	133	10.30	FBJ0500147	FBJ0500148
10.40	87.00	133	10.40	FBJ0500149	FBJ0500150
10.50	87.00	133	10.50	FBJ0500151	FBJ0500152
10.60	87.00	133	10.60	FBJ0500153	FBJ0500154
10.70	94.00	142	10.70	FBJ0500155	FBJ0500156
10.80	94.00	142	10.80	FBJ0500157	FBJ0500158
10.90	94.00	142	10.90	FBJ0500159	FBJ0500160
11.00	94.00	142	11.00	FBJ0500161	FBJ0500162
11.10	94.00	142	11.10	FBJ0500163	FBJ0500164
11.20	94.00	142	11.20	FBJ0500165	FBJ0500166
11.30	94.00	142	11.30	FBJ0500167	FBJ0500168
11.40	94.00	142	11.40	FBJ0500169	FBJ0500170

Ø D1	L2	L1	Ø D2	F224 (BRIGHT)	F224A (TiAIN)
				EDP No	EDP No
11.50	94.00	142	11.50	FBJ0500171	FBJ0500172
11.60	94.00	142	11.60	FBJ0500173	FBJ0500174
11.70	94.00	142	11.70	FBJ0500175	FBJ0500176
11.80	94.00	142	11.80	FBJ0500177	FBJ0500178
11.90	101.00	151	11.90	FBJ0500179	FBJ0500180
12.00	101.00	151	12.00	FBJ0500181	FBJ0500182
12.50	101.00	151	12.50	FBJ0500183	FBJ0500184
13.00	101.00	151	13.00	FBJ0500185	FBJ0500186
13.50	108.00	160	13.50	FBJ0500187	FBJ0500188
14.00	108.00	160	14.00	FBJ0500189	FBJ0500190
14.50	114.00	169	14.50	FBJ0500191	FBJ0500192
15.00	114.00	169	15.00	FBJ0500193	FBJ0500194
15.50	120.00	178	15.50	FBJ0500195	FBJ0500196
16.00	120.00	178	16.00	FBJ0500197	FBJ0500198
16.50	125.00	184	16.50	FBJ0500199	FBJ0500200
17.00	125.00	184	17.00	FBJ0500201	FBJ0500202
17.50	130.00	191	17.50	FBJ0500203	FBJ0500204
18.00	130.00	191	18.00	FBJ0500205	FBJ0500206
18.50	135.00	198	18.50	FBJ0500207	FBJ0500208
19.00	135.00	198	19.00	FBJ0500209	FBJ0500210
20.00	140.00	205	20.00	FBJ0500211	FBJ0500212

3X

Solid carbide jobber drill

Carbide

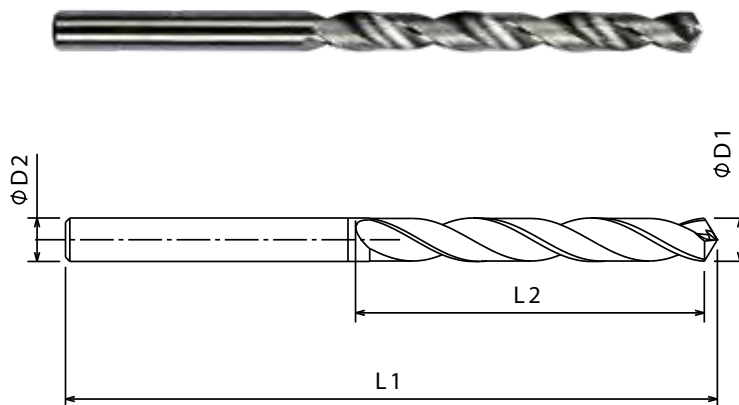
STUB



3X



30°



P1-P6

M1-M2

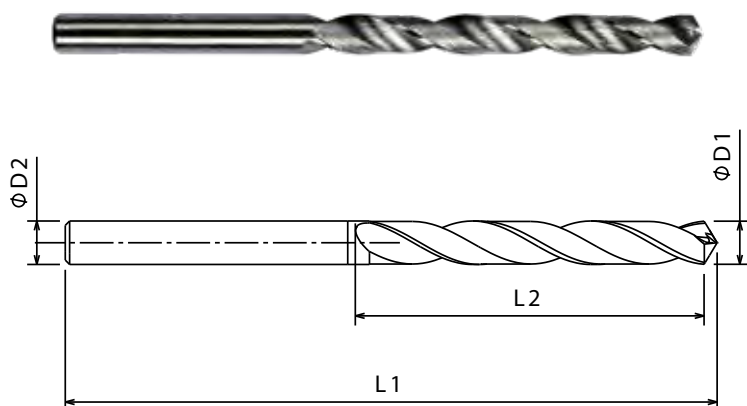
K1-K2

N5-N6

Unit : mm

ØD1	L2	L1	ØD2	F226 (BRIGHT) EDP No	F226A (TiAlN) EDP No
1.00	6	26	1.00	FBJ0501504	FBJ0501505
1.05	7	28	1.05	FBJ0501518	FBJ0501519
1.10	7	28	1.10	FBJ0501522	FBJ0501523
1.15	8	30	1.15	FBJ0501530	FBJ0501531
1.20	8	30	1.20	FBJ0501534	FBJ0501535
1.25	8	30	1.25	FBJ0501544	FBJ0501545
1.30	8	30	1.30	FBJ0501548	FBJ0501549
1.35	9	32	1.35	FBJ0501552	FBJ0501553
1.40	9	32	1.40	FBJ0501556	FBJ0501557
1.45	9	32	1.45	FBJ0501562	FBJ0501563
1.50	9	32	1.50	FBJ0501572	FBJ0501573
1.60	10	34	1.60	FBJ0501580	FBJ0501581
1.70	10	34	1.70	FBJ0501590	FBJ0501591
1.80	11	36	1.80	FBJ0501594	FBJ0501595
1.90	11	36	1.90	FBJ0501600	FBJ0501601
2.00	12	38	2.00	FBJ0501608	FBJ0501609
2.10	12	38	2.10	FBJ0501616	FBJ0501617
2.20	13	40	2.20	FBJ0501620	FBJ0501621
2.30	13	40	2.30	FBJ0501624	FBJ0501625
2.40	14	43	2.40	FBJ0501634	FBJ0501635
2.50	14	43	2.50	FBJ0501642	FBJ0501643
2.60	14	43	2.60	FBJ0501652	FBJ0501653

ØD1	L2	L1	ØD2	F226 (BRIGHT) EDP No	F226A (TiAlN) EDP No
2.70	16	46	2.70	FBJ0501658	FBJ0501659
2.80	16	46	2.80	FBJ0501662	FBJ0501663
3.00	16	46	3.00	FBJ0500213	FBJ0500214
3.10	18	49	3.10	FBJ0500215	FBJ0500216
3.20	18	49	3.20	FBJ0500217	FBJ0500218
3.30	18	49	3.30	FBJ0500219	FBJ0500220
3.40	20	52	3.40	FBJ0500221	FBJ0500222
3.50	20	52	3.50	FBJ0500223	FBJ0500224
3.60	20	52	3.60	FBJ0500225	FBJ0500226
3.70	20	52	3.70	FBJ0500227	FBJ0500228
3.80	22	55	3.80	FBJ0500229	FBJ0500230
3.90	22	55	3.90	FBJ0500231	FBJ0500232
4.00	22	55	4.00	FBJ0500233	FBJ0500234
4.10	22	55	4.10	FBJ0500235	FBJ0500236
4.20	22	55	4.20	FBJ0500237	FBJ0500238
4.30	24	58	4.30	FBJ0500239	FBJ0500240
4.40	24	58	4.40	FBJ0500241	FBJ0500242
4.50	24	58	4.50	FBJ0500243	FBJ0500244
4.60	24	58	4.60	FBJ0500245	FBJ0500246
4.70	24	58	4.70	FBJ0500247	FBJ0500248
4.80	26	62	4.80	FBJ0500249	FBJ0500250
4.90	26	62	4.90	FBJ0500251	FBJ0500252

3X
Solid carbide jobber drill
Carbide
STUB

P1-P6
M1-M2
K1-K2
N5-N6
Unit : mm

ØD1	L2	L1	ØD2	F226 (BRIGHT)	F226A (TiAlN)
				EDP No	EDP No
5.00	26	62	5.00	FBJ0500253	FBJ0500254
5.10	26	62	5.10	FBJ0500255	FBJ0500256
5.20	26	62	5.20	FBJ0500257	FBJ0500258
5.30	26	62	5.30	FBJ0500259	FBJ0500260
5.40	28	66	5.40	FBJ0500261	FBJ0500262
5.50	28	66	5.50	FBJ0500263	FBJ0500264
5.60	28	66	5.60	FBJ0500265	FBJ0500266
5.70	28	66	5.70	FBJ0500267	FBJ0500268
5.80	28	66	5.80	FBJ0500269	FBJ0500270
5.90	28	66	5.90	FBJ0500271	FBJ0500272
6.00	28	66	6.00	FBJ0500273	FBJ0500274
6.10	31	70	6.10	FBJ0500275	FBJ0500276
6.20	31	70	6.20	FBJ0500277	FBJ0500278
6.30	31	70	6.30	FBJ0500279	FBJ0500280
6.40	31	70	6.40	FBJ0500281	FBJ0500282
6.50	31	70	6.50	FBJ0500283	FBJ0500284
6.60	31	70	6.60	FBJ0500285	FBJ0500286
6.70	31	70	6.70	FBJ0500287	FBJ0500288
6.80	34	74	6.80	FBJ0500289	FBJ0500290
6.90	34	74	6.90	FBJ0500291	FBJ0500292
7.00	34	74	7.00	FBJ0500293	FBJ0500294
7.10	34	74	7.10	FBJ0500295	FBJ0500296

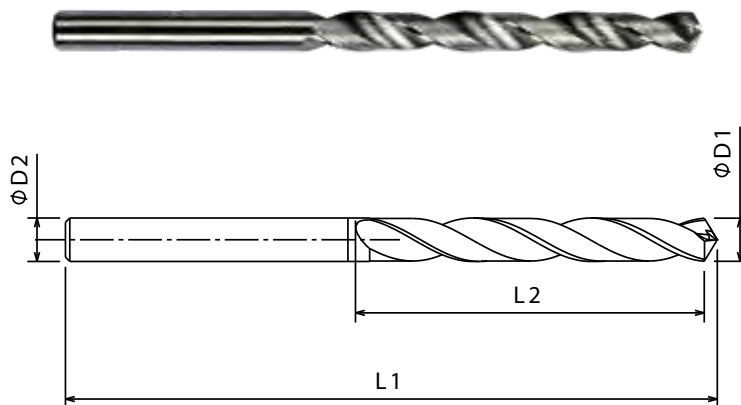
ØD1	L2	L1	ØD2	F226 (BRIGHT)	F226A (TiAlN)
				EDP No	EDP No
7.20	34	74	7.20	FBJ0500297	FBJ0500298
7.30	34	74	7.30	FBJ0500299	FBJ0500300
7.40	34	74	7.40	FBJ0500301	FBJ0500302
7.50	34	74	7.50	FBJ0500303	FBJ0500304
7.60	37	79	7.60	FBJ0500305	FBJ0500306
7.70	37	79	7.70	FBJ0500307	FBJ0500308
7.80	37	79	7.80	FBJ0500309	FBJ0500310
7.90	37	79	7.90	FBJ0500311	FBJ0500312
8.00	37	79	8.00	FBJ0500313	FBJ0500314
8.10	37	79	8.10	FBJ0500315	FBJ0500316
8.20	37	79	8.20	FBJ0500317	FBJ0500318
8.30	37	79	8.30	FBJ0500319	FBJ0500320
8.40	37	79	8.40	FBJ0500321	FBJ0500322
8.50	37	79	8.50	FBJ0500323	FBJ0500324
8.60	40	84	8.60	FBJ0500325	FBJ0500326
8.70	40	84	8.70	FBJ0500327	FBJ0500328
8.80	40	84	8.80	FBJ0500329	FBJ0500330
8.90	40	84	8.90	FBJ0500331	FBJ0500332
9.00	40	84	9.00	FBJ0500333	FBJ0500334
9.10	40	84	9.10	FBJ0500335	FBJ0500336
9.20	40	84	9.20	FBJ0500337	FBJ0500338
9.30	40	84	9.30	FBJ0500339	FBJ0500340

3X

Solid carbide jobber drill

Carbide

STUB



P1-P6

M1-M2

K1-K2

N5-N6

Unit : mm

ØD1	L2	L1	ØD2	F226 (BRIGHT) EDP No	F226A (TiAlN) EDP No
9.40	40	84	9.40	FBJ0500341	FBJ0500342
9.50	40	84	9.50	FBJ0500343	FBJ0500344
9.60	43	89	9.60	FBJ0500345	FBJ0500346
9.70	43	89	9.70	FBJ0500347	FBJ0500348
9.80	43	89	9.80	FBJ0500349	FBJ0500350
9.90	43	89	9.90	FBJ0500351	FBJ0500352
10.00	43	89	10.00	FBJ0500353	FBJ0500354
10.10	43	89	10.10	FBJ0500355	FBJ0500356
10.20	43	89	10.20	FBJ0500357	FBJ0500358
10.30	43	89	10.30	FBJ0500359	FBJ0500360
10.40	43	89	10.40	FBJ0500361	FBJ0500362
10.50	43	89	10.50	FBJ0500363	FBJ0500364
10.60	43	89	10.60	FBJ0500365	FBJ0500366
10.70	47	95	10.70	FBJ0500367	FBJ0500368
10.80	47	95	10.80	FBJ0500369	FBJ0500370
10.90	47	95	10.90	FBJ0500371	FBJ0500372
11.00	47	95	11.00	FBJ0500373	FBJ0500374
11.10	47	95	11.10	FBJ0500375	FBJ0500376
11.20	47	95	11.20	FBJ0500377	FBJ0500378
11.30	47	95	11.30	FBJ0500379	FBJ0500380
11.40	47	95	11.40	FBJ0500381	FBJ0500382

ØD1	L2	L1	ØD2	F226 (BRIGHT) EDP No	F226A (TiAlN) EDP No
11.50	47	95	11.50	FBJ0500383	FBJ0500384
11.60	47	95	11.60	FBJ0500385	FBJ0500386
11.70	47	95	11.70	FBJ0500387	FBJ0500388
11.80	47	95	11.80	FBJ0500389	FBJ0500390
11.90	51	102	11.90	FBJ0500391	FBJ0500392
12.00	51	102	12.00	FBJ0500393	FBJ0500394
12.50	51	102	12.50	FBJ0500395	FBJ0500396
13.00	51	102	13.00	FBJ0500397	FBJ0500398
13.50	54	107	13.50	FBJ0500399	FBJ0500400
14.00	54	107	14.00	FBJ0500401	FBJ0500402
14.50	56	111	14.50	FBJ0500403	FBJ0500404
15.00	56	111	15.00	FBJ0500405	FBJ0500406
15.50	58	115	15.50	FBJ0500407	FBJ0500408
16.00	58	115	16.00	FBJ0500409	FBJ0500410
16.50	60	119	16.50	FBJ0500411	FBJ0500412
17.00	60	119	17.00	FBJ0500413	FBJ0500414
17.50	62	123	17.50	FBJ0500415	FBJ0500416
18.00	62	123	18.00	FBJ0500417	FBJ0500418
18.50	64	127	18.50	FBJ0500419	FBJ0500420
19.00	64	127	19.00	FBJ0500421	FBJ0500422
20.00	66	131	20.00	FBJ0500423	FBJ0500424

Cutting parameters

Series F224/F226 METRIC

Workpiece Material Group		Cutting Speed Vc (m/min)			Recommended feed in mm/rev																				
					Diameter in mm																				
				mm	1.0		1.5		3.0		4.0		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	min	max	
Steel	P	1	50	55	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		2	50	55	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		3	45	50	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		4	45	50	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		5	40	45	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		6	40	45	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
Stainless Steels	M	1	50	55	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		2	40	45	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
Cast Iron	K	1	75	85	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
		2	50	55	f rev	0.020	0.025	0.040	0.050	0.061	0.076	0.081	0.101	0.122	0.152	0.138	0.172	0.162	0.203	0.202	0.253	0.220	0.275	0.244	0.305
Non Ferrous	N	5	105	120	f rev	0.005	0.006	0.010	0.013	0.040	0.050	0.048	0.060	0.061	0.076	0.073	0.091	0.081	0.101	0.122	0.152	0.162	0.203	0.180	0.225
		6	105	120	f rev	0.005	0.006	0.010	0.013	0.040	0.050	0.048	0.060	0.061	0.076	0.073	0.091	0.081	0.101	0.122	0.152	0.162	0.203	0.180	0.225

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

For coated F224/F226 increase cutting speed by 20%

Series F224/F226 Inch

Workpiece Material Group			Cutting Speed Vc ft/min			Recommended feed in mm/rev																			
						Diameter in mm																			
						Inch	1/32		1/16		1/8		1/6		1/4		1/3		3/8		1/2		5/8		3/4
		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	1	164	180	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		2	164	180	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		3	148	164	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		4	148	164	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		5	131	148	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		6	131	148	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
Stainless Steels	M	1	164	180	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		2	131	148	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
Cast Iron	K	1	246	279	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
		2	164	180	f rev	0.0008	0.0010	0.0016	0.0020	0.0024	0.0030	0.0032	0.0040	0.0048	0.0060	0.0054	0.0068	0.0064	0.0080	0.0080	0.0100	0.0087	0.0108	0.0096	0.0120
Non Ferrous	N	5	344	394	f rev	0.0002	0.0002	0.0004	0.0005	0.0016	0.0020	0.0019	0.0024	0.0024	0.0030	0.0029	0.0036	0.0032	0.0040	0.0048	0.0060	0.0064	0.0080	0.0071	0.0089
		6	344	394	f rev	0.0002	0.0002	0.0004	0.0005	0.0016	0.0020	0.0019	0.0024	0.0024	0.0030	0.0029	0.0036	0.0032	0.0040	0.0048	0.0060	0.0064	0.0080	0.0071	0.0089

#RPM (N) = Vc (SFM) X 3.82/Tool Dia. #Vf (Inch/min) = RPM (N) x frev (inch/rev)

The technical data are based upon theoretical values and are only intended for planning purposes and may vary based on the application. Actual results will vary. No responsibility from Forbes and Company Limited or their distributors is assumed.

Drill tolerance

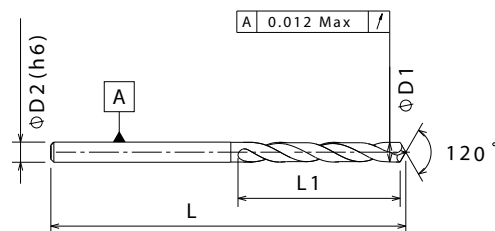
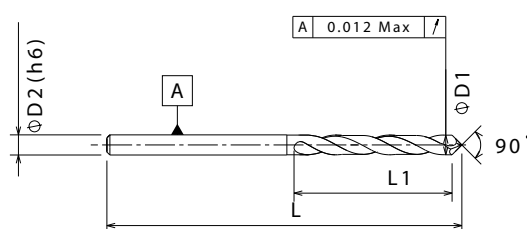
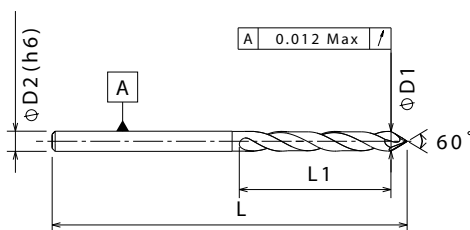
Details	Cutting Dia. "D1" Range	Cutting Dia. "D1" Tolerance h7 ANSI B4.2	Shank Dia. "D2"	Shank Tolerance h6 ANSI B4.2
F224/224A	1.00-3.00	0.00/-0.013	1.00-3.00	-0.006
	3.00-6.00	0.00/-0.013	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.013	6.00-10.00	-0.009
	10.00-18.00	0.00/-0.013	10.00-12.00	-0.011
	20.00	0.00/-0.013	20.00	-0.013
F226/226A	1.00-3.00	0.00/-0.013	1.00-3.00	-0.006
	3.00-6.00	0.00/-0.013	3.00-6.00	-0.008
	6.00-10.00	0.00/-0.013	6.00-10.00	-0.009
	10.00-18.00	0.00/-0.013	10.00-12.00	-0.011
	20.00	0.00/-0.013	20.00	-0.013

Spotting drill (60°/90°/120°)

Carbide



TiN



P1-P5

M1-M3

K1-K3

S1-S4

N1-N5

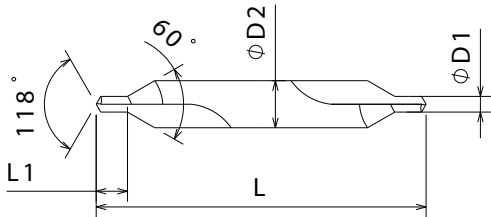
DRILLS

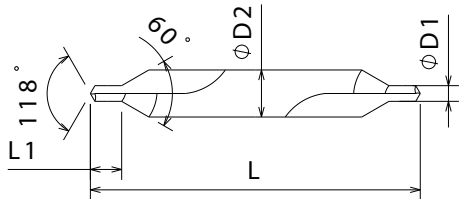
Unit : mm

Cutting Dia	Flute Length	Shank Dia	OAL	Number of teeth	Helix	EDP No	EDP No	EDP No
ØD1	L1	ØD2	L	Z		60°	90°	120°
2.00	6.00	2.00	50.00	2	30	FBJ0505371	FBJ0505380	FBJ0505389
3.00	8.00	3.00	50.00	2	30	FBJ0505372	FBJ0505381	FBJ0505390
4.00	11.00	4.00	50.00	2	30	FBJ0505373	FBJ0505382	FBJ0505391
5.00	13.00	5.00	50.00	2	30	FBJ0505374	FBJ0505383	FBJ0505392
6.00	15.00	6.00	50.00	2	30	FBJ0505375	FBJ0505384	FBJ0505393
8.00	20.00	8.00	60.00	2	30	FBJ0505376	FBJ0505385	FBJ0505394
10.00	25.00	10.00	75.00	2	30	FBJ0505377	FBJ0505386	FBJ0505395
12.00	30.00	12.00	75.00	2	30	FBJ0505378	FBJ0505387	FBJ0505396
16.00	45.00	16.00	100.00	2	30	FBJ0505379	FBJ0505388	FBJ0505397

Carbide center drill

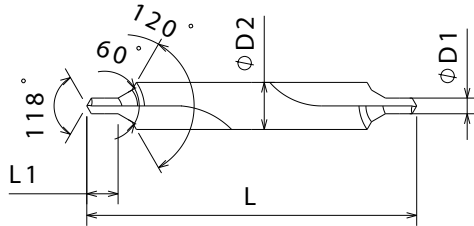


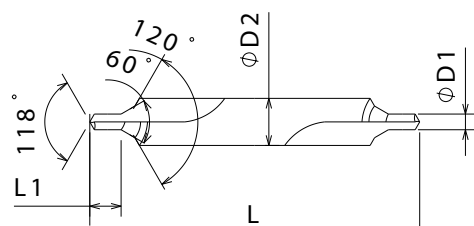
						P1-P5 M1-M3 K1-K3 S1-S4 N1-N5
Cutting Dia	Shank Dia	OAL	Flute Length	Form	Hand	Bright
ØD1	ØD2	L	L1			EDP No
1	3.15	31	1.8	A	RH	FBJ0505428
1.25	3.15	31	2.2	A	RH	FBJ0505429
1	4	35	1.9	A	RH	FBJ0505430
1.6	4	35	2.8	A	RH	FBJ0505431
2	5	40	3.3	A	RH	FBJ0505432
2.5	6.3	45	4.1	A	RH	FBJ0505433
3	8	50	4.9	A	RH	FBJ0505434
3.15	8	50	4.9	A	RH	FBJ0505461

				Form-A LH 		P1-P5 M1-M3 K1-K3 S1-S4 N1-N5
Cutting Dia	Shank Dia	OAL	Flute Length	Form	Hand	Bright
ØD1	ØD2	L	L1			EDP No
1	3.15	31	1.8	A	LH	FBJ0505442
1.25	3.15	31	2.2	A	LH	FBJ0505443
1	4	35	1.9	A	LH	FBJ0505444
1.6	4	35	2.8	A	LH	FBJ0505445
2	5	40	3.3	A	LH	FBJ0505446
2.5	6.3	45	4.1	A	LH	FBJ0505447
3	8	50	4.9	A	LH	FBJ0505448
3.15	8	50	4.9	A	LH	FBJ0505460

Carbide center Drill



 				P1-P5 M1-M3 K1-K3 S1-S4 N1-N5		
Cutting Dia	Shank Dia	OAL	Flute Length	Form	Hand	Bright
ØD1	ØD2	L	L1			EDP No
1	3.15	31	1.8	B	RH	FBJ0505435
1.25	3.15	31	2.2	B	RH	FBJ0505436
1	4	35	1.9	B	RH	FBJ0505437
1.6	4	35	2.8	B	RH	FBJ0505438
2	5	40	3.3	B	RH	FBJ0505439
2.5	6.3	45	4.1	B	RH	FBJ0505440
3	8	50	4.9	B	RH	FBJ0505441
3.15	8	50	4.9	B	RH	FBJ0505459

 				P1-P5 M1-M3 K1-K3 S1-S4 N1-N5		
Cutting Dia	Shank Dia	OAL	Flute Length	Form	Hand	Bright
ØD1	ØD2	L	L1			EDP No
1	3.15	31	1.8	B	LH	FBJ0505449
1.25	3.15	31	2.2	B	LH	FBJ0505450
1	4	35	1.9	B	LH	FBJ0505451
1.6	4	35	2.8	B	LH	FBJ0505452
2	5	40	3.3	B	LH	FBJ0505453
2.5	6.3	45	4.1	B	LH	FBJ0505454
3	8	50	4.9	B	LH	FBJ0505455
3.15	8	50	4.9	B	LH	FBJ0505458

Cutting parameters

Spotting Drills

Workpiece Material Group			Cutting Speed (Vc) m/min	Recommended feed in mm/rev								
				Diameter in mm								
				2	3	4	5	6	8	10	12	16
Steel	P	1	70-80	0.0635	0.0991	0.1245	0.1499	0.1753	0.2007	0.2261	0.2515	0.2769
		2	60-70	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
		3	50-60	0.0508	0.0787	0.0940	0.1143	0.1346	0.1549	0.1753	0.1956	0.2159
		4	40-50	0.0406	0.0635	0.0754	0.0872	0.0991	0.1109	0.1228	0.1347	0.1465
		5	20-25	0.0508	0.0787	0.0940	0.1143	0.1346	0.1549	0.1753	0.1956	0.2159
Stainless Steel	M	1	20-25	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
		2	15-20	0.0508	0.0787	0.0940	0.1143	0.1346	0.1549	0.1753	0.1956	0.2159
		3	12-15	0.0508	0.0787	0.0940	0.1143	0.1346	0.1549	0.1753	0.1956	0.2159
Cast Iron	K	1	80-90	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
		2	70-80	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
		3	60-70	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
Super Alloys	S	1	15-20	0.0406	0.0635	0.0754	0.0872	0.0991	0.1109	0.1228	0.1347	0.1465
		4	10-15	0.0406	0.0635	0.0754	0.0872	0.0991	0.1109	0.1228	0.1347	0.1465
Cast Iron	K	1	150-200	0.1245	0.2007	0.2388	0.2769	0.3150	0.3531	0.3912	0.4293	0.4674
		2	120-150	0.0991	0.1600	0.1897	0.2193	0.2489	0.2786	0.3082	0.3379	0.3675
		3	100-120	0.0991	0.1600	0.1897	0.2193	0.2489	0.2786	0.3082	0.3379	0.3675
Non Ferrous	N	1	160-180	0.0787	0.1245	0.1499	0.1753	0.2007	0.2261	0.2515	0.2769	0.3023
		2	160-180	0.0787	0.1245	0.1499	0.1753	0.2007	0.2261	0.2515	0.2769	0.3023
		3	120-130	0.0787	0.1245	0.1499	0.1753	0.2007	0.2261	0.2515	0.2769	0.3023
		4	20-30	0.0635	0.0991	0.1194	0.1397	0.1600	0.1803	0.2007	0.2210	0.2413
		5	40-50	0.0508	0.0787	0.0940	0.1143	0.1346	0.1549	0.1753	0.1956	0.2159

Center Drills

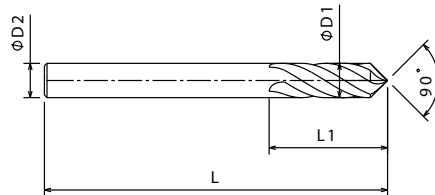
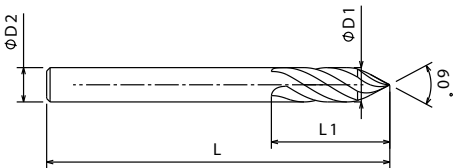
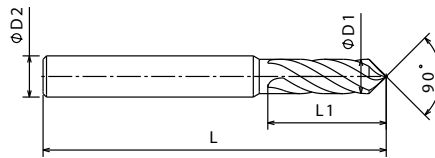
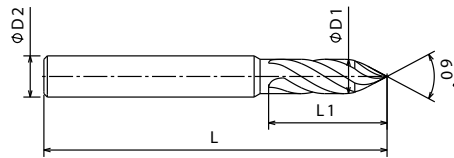
Workpiece Material Group			Cutting Speed (Vc) m/min	Recommended feed in mm/rev											
				Diameter in mm											
				0.5	1	1.25	1.6	2	2.5	3	3.15	4	5	6.3	8
Steel	P	1	60-70	0.008	0.015	0.028	0.028	0.037	0.051	0.059	0.064	0.079	0.079	0.099	0.124
		2	45-50	0.008	0.015	0.028	0.028	0.037	0.051	0.059	0.064	0.079	0.079	0.099	0.124
		3	35-45	0.008	0.013	0.024	0.023	0.031	0.041	0.049	0.051	0.064	0.064	0.079	0.099
		4	20-35	0.008	0.015	0.028	0.028	0.037	0.051	0.059	0.064	0.079	0.079	0.099	0.124
		5	15-20	0.005	0.008	0.015	0.017	0.023	0.033	0.039	0.041	0.051	0.051	0.064	0.079
Stainless Steel	M	1	30-20	0.008	0.013	0.024	0.023	0.031	0.041	0.049	0.051	0.064	0.064	0.079	0.099
		2	20-15	0.008	0.013	0.024	0.023	0.031	0.041	0.049	0.051	0.064	0.064	0.079	0.099
		3	15-Oct	0.008	0.013	0.024	0.023	0.031	0.041	0.049	0.051	0.064	0.064	0.079	0.099
Cast Iron	K	1	50-60	0.013	0.018	0.036	0.041	0.056	0.079	0.094	0.099	0.124	0.124	0.16	0.201
		2	60-70	0.013	0.018	0.036	0.041	0.056	0.079	0.094	0.099	0.124	0.124	0.16	0.201
		3	50-60	0.01	0.015	0.03	0.033	0.045	0.064	0.076	0.079	0.099	0.099	0.124	0.16
Super Alloys	S	1	Oct-15	0.005	0.005	0.011	0.013	0.018	0.025	0.031	0.033	0.041	0.041	0.051	0.064
		4	Oct-15	0.005	0.008	0.015	0.017	0.023	0.033	0.039	0.041	0.051	0.051	0.064	0.079
Non Ferrous	N	1	150-160	0.015	0.02	0.043	0.05	0.07	0.099	0.119	0.124	0.16	0.16	0.201	0.249
		2	100-120	0.013	0.018	0.036	0.041	0.056	0.079	0.094	0.099	0.124	0.124	0.16	0.201
		3	140-150	0.013	0.018	0.036	0.041	0.056	0.079	0.094	0.099	0.124	0.124	0.16	0.201
		4	120-130	0.01	0.015	0.03	0.033	0.045	0.064	0.076	0.079	0.099	0.099	0.124	0.16
		5	90-100	0.01	0.015	0.03	0.033	0.045	0.064	0.076	0.079	0.099	0.099	0.124	0.16

Chamfer tool (60°/90°)

Carbide

30°

TiN



P1-P5

M1-M2

K1-K2

S1-S2

N1

DRILLS

Unit : mm

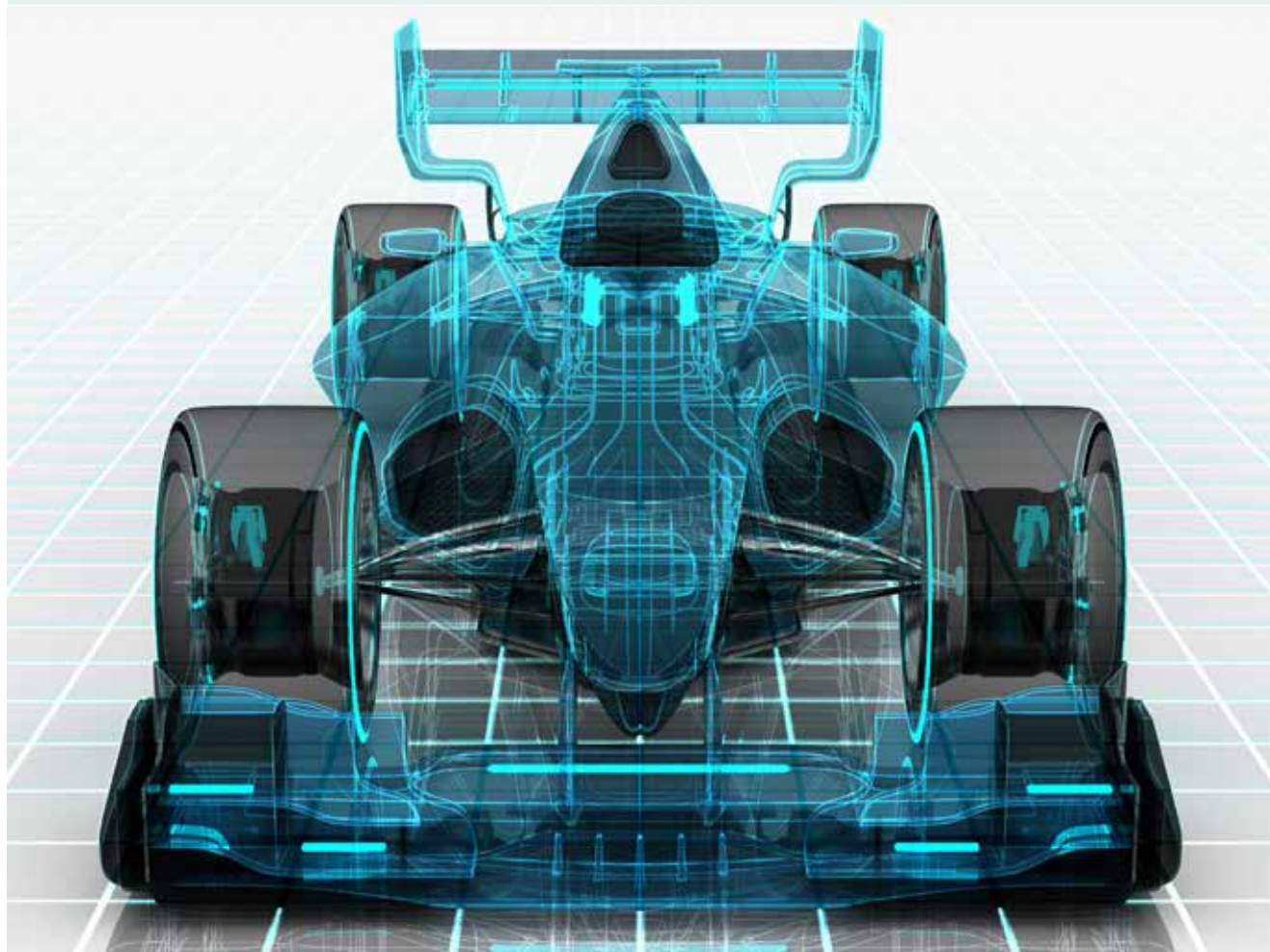
Cutting Dia	Flute Length	Shank Dia	OAL	Number of teeth	Helix	EDP No 60°	EDP No 90°
ØD1	L1	ØD2	L	Z		TiN Coated	TiAlN Coated
3.00	20.00	3.00	50.00	4	30	FBJ0505363	FBJ0505410
4.00	20.00	4.00	50.00	4	30	FBJ0505364	FBJ0505411
5.00	20.00	5.00	50.00	4	30	FBJ0505365	FBJ0505357
6.00	20.00	6.00	50.00	4	30	FBJ0505366	FBJ0505358
8.00	25.00	8.00	60.00	4	30	FBJ0505367	FBJ0505359
10.00	30.00	10.00	75.00	4	30	FBJ0505368	FBJ0505360
12.00	30.00	12.00	75.00	4	30	FBJ0505369	FBJ0505361
16.00	30.00	16.00	100.00	4	30	FBJ0505370	FBJ0505362

Cutting parameters

Chamfer Tool

Workpiece Material Group			Cutting Speed (Vc) m/min	Recommended feed in mm/rev						
				Diameter in mm						
				3	6	8	10	12	16	20
Steel	P	1	150-160	0.010	0.013	0.015	0.025	0.033	0.043	0.048
		2	130-140	0.008	0.010	0.013	0.015	0.025	0.033	0.043
		3	100-110	0.008	0.010	0.013	0.015	0.025	0.033	0.043
		4	80-90	0.008	0.010	0.013	0.015	0.025	0.033	0.043
		5	60-70	0.008	0.010	0.013	0.015	0.025	0.033	0.043
Stainless Steel	M	1	60-70	0.008	0.010	0.013	0.015	0.025	0.033	0.043
		2	40-50	0.008	0.010	0.013	0.015	0.025	0.033	0.043
Super Alloys	S	1	65-70	0.008	0.010	0.013	0.015	0.025	0.033	0.043
		2	40-45	0.008	0.010	0.013	0.015	0.025	0.033	0.043
Cast Iron	K	1	140-150	0.010	0.013	0.015	0.025	0.033	0.043	0.048
		2	120-130	0.008	0.010	0.013	0.015	0.025	0.033	0.043
Non Ferrous	N	1	165-175	0.127	0.018	0.025	0.033	0.043	0.048	0.064

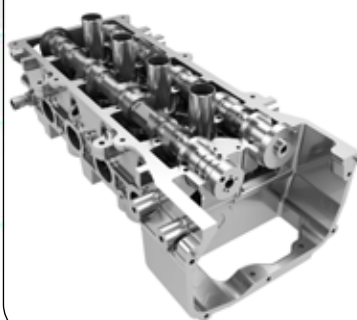
Automotive solutions



CRANKSHAFT



CYLINDER HEAD



CYLINDER BLOCK



CONNECTING ROD



GEAR AND FLANGE MACHINING



INTAKE MANIFOLD





CARBIDE REAMERS

About TMRT - Totem Multiflute Reaming Tools

- These reamers are designed for the highest metal removal rates from diameter 1.5mm–12mm as a standard
- All standard reamers are ground to an ISO H7 tolerance class hole to address most common applications.
- Special coatings and lead chamfer configurations enable high-speed machining of steel, stainless steel, cast iron, and non-ferrous materials at high speeds.

Features & Benefits

- Higher productivity and profitability
- Longer tool life with increased hole and surface quality
- Highest metal removal rate at higher speeds and feeds due to reaming-specific low cobalt grades and substrates.
- Intermediate diameters from 1.5mm - 20mm can be offered as per various lead chamfer configuration as a custom solution.
- All TMRT reamers are also offered with internal coolant supply.

TMRT

Totem multi flute reaming tools

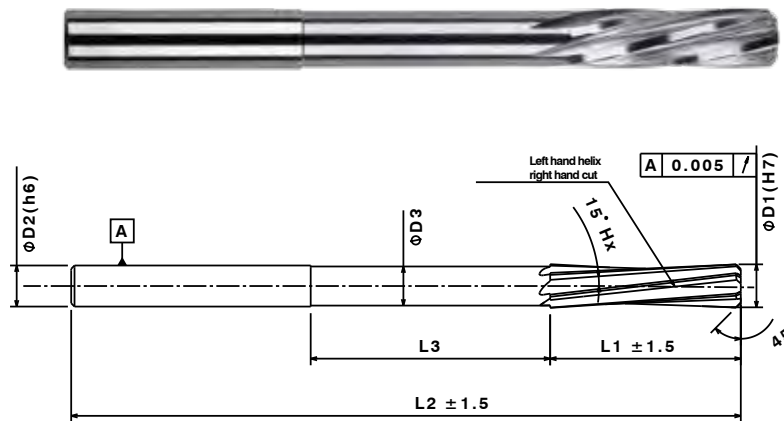
Carbide



BF



RH



P0-P6

K1-K3

M1-M3

N1-N7

REAMERS

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	SPIRAL FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
1.5	16	16	1.4	57	3	4	FBK0508453
1.95	16	16	1.7	57	3	4	FBK0508442
1.96	16	16	1.7	57	3	4	FBK0508443
1.97	16	16	1.7	57	3	4	FBK0508444
1.98	16	16	1.7	57	3	4	FBK0508445
1.99	16	16	1.7	57	3	4	FBK0508446
2.0	16	16	1.8	57	3	4	FBK0508447
2.01	16	16	1.8	57	3	4	FBK0508448
2.02	16	16	1.8	57	3	4	FBK0508449
2.03	16	16	1.8	57	3	4	FBK0508450
2.04	16	16	1.8	57	3	4	FBK0508451
2.05	16	16	1.8	57	3	4	FBK0508452
2.95	16	16	2.7	65	3	4	FBK0508309
2.96	16	16	2.7	65	3	4	FBK0508310
2.97	16	16	2.7	65	3	4	FBK0508311
2.98	16	16	2.7	65	3	4	FBK0508312
2.99	16	16	2.7	65	3	4	FBK0508313
3.0	16	20	2.5	65	3	4	FBK0508314
3.01	16	20	2.51	65	3	4	FBK0508315
3.02	16	20	2.52	65	3	4	FBK0508316
3.03	16	20	2.53	65	3	4	FBK0508317
3.04	16	20	2.54	65	3	4	FBK0508318
3.05	16	20	2.55	65	3	4	FBK0508319
3.1	16	20	2.6	65	3	4	FBK0508320
3.2	16	20	2.7	65	3	4	FBK0508321
3.3	19	20	2.8	65	3	4	FBK0508322
3.35	19	20	2.85	65	3	4	FBK0508323
3.4	19	20	2.9	70	3	4	FBK0508324
3.45	19	20	2.95	70	3	4	FBK0508325
3.55	19	20	3.05	70	3	4	FBK0508326
3.6	19	20	3.1	70	3	4	FBK0508327
3.65	19	20	3.15	70	3	4	FBK0508328

TMRT

Totem multi flute reaming tools

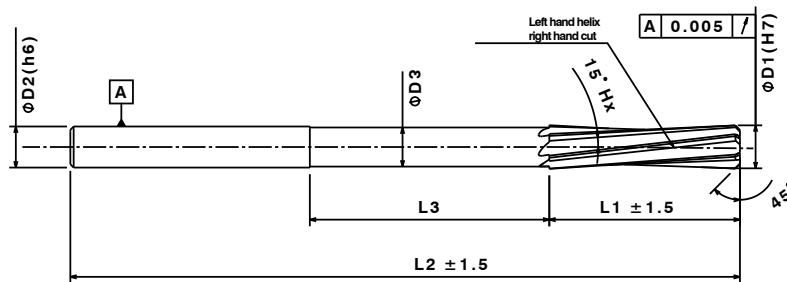
Carbide



BF



RH



P0-P6

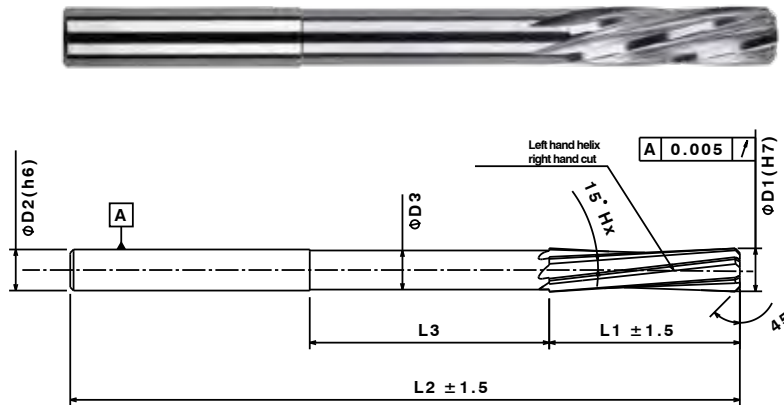
K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	SPIRAL FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
3.7	19	25	3.2	70	4	4	FBK0508329
3.75	19	25	3.25	75	4	4	FBK0508330
3.8	19	25	3.3	75	4	4	FBK0508331
3.9	19	25	3.4	75	4	4	FBK0508332
3.95	19	25	3.45	75	4	4	FBK0508333
3.96	19	25	3.46	70	4	4	FBK0508334
3.97	19	25	3.47	70	4	4	FBK0508335
3.98	19	25	3.48	70	4	4	FBK0508336
3.99	19	25	3.49	70	4	4	FBK0508337
4.0	19	25	3.5	75	4	4	FBK0508338
4.01	19	25	3.51	70	4	4	FBK0508339
4.02	19	25	3.52	70	4	4	FBK0508340
4.03	19	25	3.53	70	4	4	FBK0508341
4.04	19	25	3.54	70	4	4	FBK0508342
4.05	19	25	3.55	75	4	4	FBK0508343
4.1	22	25	3.6	75	4	4	FBK0508344
4.15	22	25	3.65	75	4	4	FBK0508345
4.2	22	25	3.7	75	4	4	FBK0508346
4.25	22	25	3.75	80	4	4	FBK0508347
4.3	22	25	3.8	80	4	4	FBK0508348
4.35	22	25	3.85	80	4	4	FBK0508349
4.4	22	25	3.9	80	4	4	FBK0508350
4.45	22	25	3.95	80	4	4	FBK0508351
4.5	22	25	4	80	4	4	FBK0508352
4.55	22	25	4.05	80	4	4	FBK0508353
4.6	22	25	4.1	80	4	4	FBK0508354
4.65	22	25	4.15	80	5	6	FBK0508355
4.7	22	25	4.2	80	5	6	FBK0508356
4.74	7/8"	25	4.24	2-3/4"	5	6	FBK0508357
4.75	22	25	4.25	80	5	6	FBK0508358
4.8	22	29	4.3	86	5	6	FBK0508359
4.85	22	29	4.35	86	5	6	FBK0508360



P0-P6

K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	SPIRAL FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
4.9	25	29	4.4	85	5	6	FBK0508361
4.95	25	29	4.45	86	5	6	FBK0508362
4.96	25	29	4.46	86	5	6	FBK0508363
4.97	25	29	4.47	86	5	6	FBK0508364
4.99	25	29	4.49	86	5	6	FBK0508365
5.0	25	29	4.5	86	5	6	FBK0508366
5.01	25	29	4.51	86	5	6	FBK0508367
5.02	25	29	4.52	86	5	6	FBK0508368
5.03	25	29	4.53	86	5	6	FBK0508369
5.04	25	29	4.54	86	5	6	FBK0508370
5.05	25	29	4.55	86	5	6	FBK0508371
5.1	25	29	4.6	86	5	6	FBK0508372
5.15	25	29	4.65	86	5	6	FBK0508373
5.2	25	29	4.7	86	5	6	FBK0508374
5.25	25	29	4.75	86	5	6	FBK0508375
5.3	25	29	4.8	86	5	6	FBK0508376
5.35	25	29	4.85	86	5	6	FBK0508377
5.4	25	33	4.9	93	5	6	FBK0508378
5.45	25	33	4.95	93	5	6	FBK0508379
5.5	25	33	5	93	5	6	FBK0508380
5.55	25	33	5.05	93	5	6	FBK0508381
5.6	25	33	5.1	93	5	6	FBK0508382
5.65	25	33	5.15	93	6	6	FBK0508383
5.7	25	33	5.2	93	6	6	FBK0508384
5.75	25	33	5.25	93	6	6	FBK0508385
5.8	25	33	5.3	93	6	6	FBK0508386
5.85	25	33	5.35	93	6	6	FBK0508387
5.9	25	33	5.4	93	6	6	FBK0508388
5.95	25	33	5.45	93	6	6	FBK0508389
5.96	25	33	5.46	93	6	6	FBK0508390
5.97	25	33	5.47	93	6	6	FBK0508391
5.98	25	33	5.48	93	6	6	FBK0508392
5.99	25	33	5.49	93	6	6	FBK0508393

TMRT

Totem multi flute reaming tools

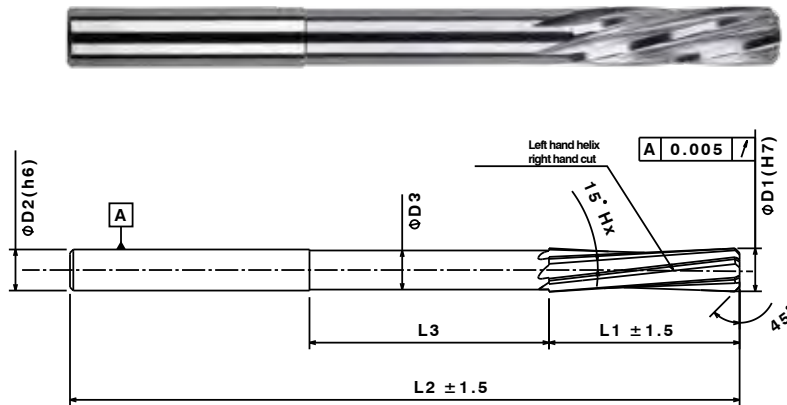
Carbide



BF



RH



P0-P6

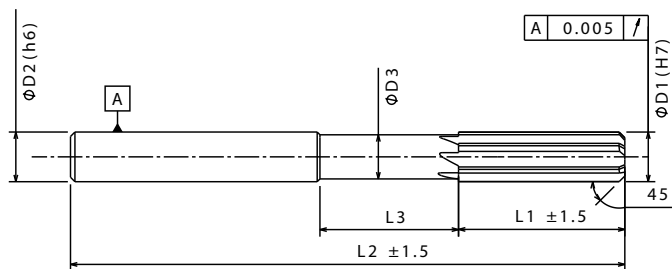
K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	SPIRAL FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
6.0	25	33	5.5	93	6	6	FBK0508394
6.01	25	33	5.51	93	6	6	FBK0508395
6.02	25	33	5.52	93	6	6	FBK0508396
6.03	25	33	5.53	93	6	6	FBK0508397
6.04	25	33	5.54	93	6	6	FBK0508398
6.05	25	33	5.55	93	6	6	FBK0508399
6.06	25	33	5.56	93	6	6	FBK0508400
6.1	29	36	5.6	101	6	6	FBK0508401
6.13	29	36	5.63	101	6	6	FBK0508402
6.2	29	36	5.7	101	6	6	FBK0508403
6.25	29	36	5.75	101	6	6	FBK0508404
6.3	29	36	5.8	101	6	6	FBK0508405
6.4	29	36	5.9	101	6	6	FBK0508406
6.5	29	36	6	101	6	6	FBK0508407
6.95	29	36	6.45	101	6	6	FBK0508408
6.96	29	36	6.46	101	6	6	FBK0508409
6.97	29	36	6.47	101	6	6	FBK0508410
6.98	29	36	6.48	101	6	6	FBK0508411
6.99	29	36	6.49	101	6	6	FBK0508412
7.0	29	36	6.5	101	6	6	FBK0508413
7.98	32	40	7.48	117	8	6	FBK0508414
8.01	32	40	7.51	117	8	6	FBK0508415
8.03	32	40	7.53	117	8	6	FBK0508416
8.0	32	40	7.5	117	8	6	FBK0508417
8.5	32	40	8	117	8	6	FBK0508418
9.0	32	40	8.5	117	9	6	FBK0508419
9.5	32	40	9	117	9	6	FBK0508420
10.0	38	50	9.5	133	10	6	FBK0508421
10.5	38	50	10	133	10	6	FBK0508422
11.0	38	50	10.5	133	11	6	FBK0508423
11.5	38	50	11	133	11	6	FBK0508424
12.0	38	50	11.5	133	12	6	FBK0508425



P0-P6

K1-K3

M1-M3

N1-N7

REAMERS

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	STRAIGHT FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
1.5	16	16	1.4	57	3	4	FBK0509075
1.95	16	16	1.7	57	3	4	FBK0509076
1.96	16	16	1.7	57	3	4	FBK0509077
1.97	16	16	1.7	57	3	4	FBK0509078
1.98	16	16	1.7	57	3	4	FBK0509079
1.99	16	16	1.7	57	3	4	FBK0509080
2.0	16	16	1.8	57	3	4	FBK0509081
2.01	16	16	1.8	57	3	4	FBK0509082
2.02	16	16	1.8	57	3	4	FBK0509083
2.03	16	16	1.8	57	3	4	FBK0509084
2.04	16	16	1.8	57	3	4	FBK0509085
2.05	16	16	1.8	57	3	4	FBK0509086
2.95	16	16	2.7	65	3	4	FBK0509087
2.96	16	16	2.7	65	3	4	FBK0509088
2.97	16	16	2.7	65	3	4	FBK0509089
2.98	16	16	2.7	65	3	4	FBK0509090
2.99	16	16	2.7	65	3	4	FBK0509091
3.0	16	20	2.5	65	3	4	FBK0509092
3.01	16	20	2.51	65	3	4	FBK0509093
3.02	16	20	2.52	65	3	4	FBK0509094
3.03	16	20	2.53	65	3	4	FBK0509095
3.04	16	20	2.54	65	3	4	FBK0509096
3.05	16	20	2.55	65	3	4	FBK0509097
3.1	16	20	2.6	65	3	4	FBK0509098
3.2	16	20	2.7	65	3	4	FBK0509099
3.3	19	20	2.8	65	3	4	FBK0509100
3.35	19	20	2.85	65	3	4	FBK0509101
3.4	19	20	2.9	70	3	4	FBK0509102
3.45	19	20	2.95	70	3	4	FBK0509103
3.55	19	20	3.05	70	3	4	FBK0509104
3.6	19	20	3.1	70	3	4	FBK0509105
3.65	19	20	3.15	70	3	4	FBK0509106

TMRT

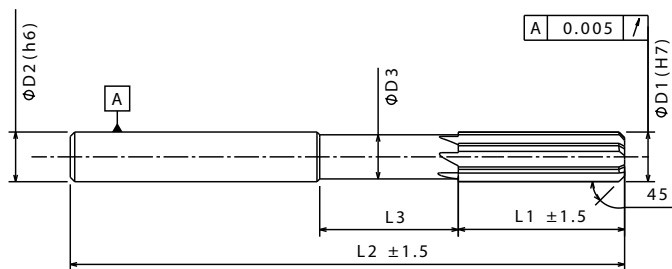
Totem multi flute reaming tools

Carbide



BF

RH



P0-P6

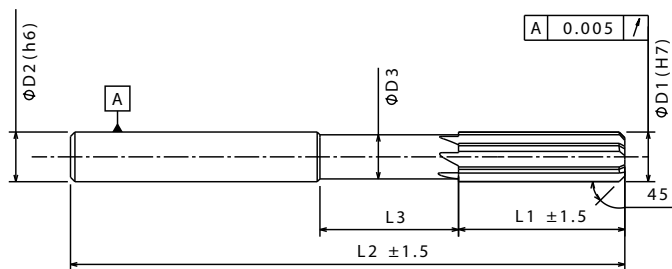
K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	STRAIGHT FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
3.7	19	25	3.2	70	4	4	FBK0509107
3.75	19	25	3.25	75	4	4	FBK0509108
3.8	19	25	3.3	75	4	4	FBK0509109
3.9	19	25	3.4	75	4	4	FBK0509110
3.95	19	25	3.45	75	4	4	FBK0509111
3.96	19	25	3.46	70	4	4	FBK0509112
3.97	19	25	3.47	70	4	4	FBK0509113
3.98	19	25	3.48	70	4	4	FBK0509114
3.99	19	25	3.49	70	4	4	FBK0509115
4.0	19	25	3.5	75	4	4	FBK0509116
4.01	19	25	3.51	70	4	4	FBK0509117
4.02	19	25	3.52	70	4	4	FBK0509118
4.03	19	25	3.53	70	4	4	FBK0509119
4.04	19	25	3.54	70	4	4	FBK0509120
4.05	19	25	3.55	75	4	4	FBK0509121
4.1	22	25	3.6	75	4	4	FBK0509122
4.15	22	25	3.65	75	4	4	FBK0509123
4.2	22	25	3.7	75	4	4	FBK0509124
4.25	22	25	3.75	80	4	4	FBK0509125
4.3	22	25	3.8	80	4	4	FBK0509126
4.35	22	25	3.85	80	4	4	FBK0509127
4.4	22	25	3.9	80	4	4	FBK0509128
4.45	22	25	3.95	80	4	4	FBK0509129
4.5	22	25	4	80	4	4	FBK0509130
4.55	22	25	4.05	80	4	4	FBK0509131
4.6	22	25	4.1	80	4	4	FBK0509132
4.65	22	25	4.15	80	5	6	FBK0509133
4.7	22	25	4.2	80	5	6	FBK0509134
4.74	7/8"	25	4.24	2-3/4"	5	6	FBK0509135
4.75	22	25	4.25	80	5	6	FBK0509136
4.8	22	29	4.3	86	5	6	FBK0509137
4.85	22	29	4.35	86	5	6	FBK0509138



P0-P6

K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	STRAIGHT FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
4.9	25	29	4.4	85	5	6	FBK0509139
4.95	25	29	4.45	86	5	6	FBK0509140
4.96	25	29	4.46	86	5	6	FBK0509141
4.97	25	29	4.47	86	5	6	FBK0509142
4.99	25	29	4.49	86	5	6	FBK0509143
5.0	25	29	4.5	86	5	6	FBK0509144
5.01	25	29	4.51	86	5	6	FBK0509145
5.02	25	29	4.52	86	5	6	FBK0509146
5.03	25	29	4.53	86	5	6	FBK0509147
5.04	25	29	4.54	86	5	6	FBK0509148
5.05	25	29	4.55	86	5	6	FBK0509149
5.1	25	29	4.6	86	5	6	FBK0509150
5.15	25	29	4.65	86	5	6	FBK0509151
5.2	25	29	4.7	86	5	6	FBK0509152
5.25	25	29	4.75	86	5	6	FBK0509153
5.3	25	29	4.8	86	5	6	FBK0509154
5.35	25	29	4.85	86	5	6	FBK0509155
5.4	25	33	4.9	93	5	6	FBK0509156
5.45	25	33	4.95	93	5	6	FBK0509157
5.5	25	33	5	93	5	6	FBK0509158
5.55	25	33	5.05	93	5	6	FBK0509159
5.6	25	33	5.1	93	5	6	FBK0509160
5.65	25	33	5.15	93	6	6	FBK0509161
5.7	25	33	5.2	93	6	6	FBK0509162
5.75	25	33	5.25	93	6	6	FBK0509163
5.8	25	33	5.3	93	6	6	FBK0509164
5.85	25	33	5.35	93	6	6	FBK0509165
5.9	25	33	5.4	93	6	6	FBK0509166
5.95	25	33	5.45	93	6	6	FBK0509167
5.96	25	33	5.46	93	6	6	FBK0509168
5.97	25	33	5.47	93	6	6	FBK0509169
5.98	25	33	5.48	93	6	6	FBK0509170
5.99	25	33	5.49	93	6	6	FBK0509171

TMRT

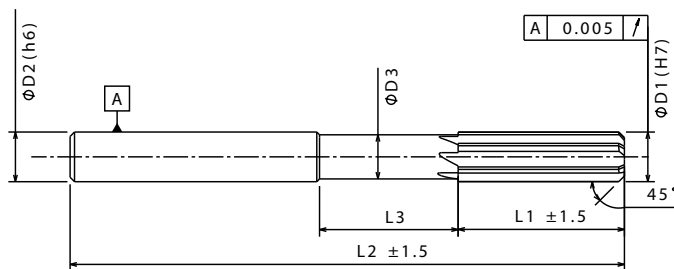
Totem multi flute reaming tools

Carbide



BF

RH



P0-P6

K1-K3

M1-M3

N1-N7

Unit : mm

ØD1	L1	L3	ØD3	L2	ØD2	z	STRAIGHT FLUTE
mm	mm	mm	mm	mm	mm	mm	EDP No
6.0	25	33	5.5	93	6	6	FBK0509172
6.01	25	33	5.51	93	6	6	FBK0509173
6.02	25	33	5.52	93	6	6	FBK0509174
6.03	25	33	5.53	93	6	6	FBK0509175
6.04	25	33	5.54	93	6	6	FBK0509176
6.05	25	33	5.55	93	6	6	FBK0509177
6.06	25	33	5.56	93	6	6	FBK0509178
6.1	29	36	5.6	101	6	6	FBK0509179
6.13	29	36	5.63	101	6	6	FBK0509180
6.2	29	36	5.7	101	6	6	FBK0509181
6.25	29	36	5.75	101	6	6	FBK0509182
6.3	29	36	5.8	101	6	6	FBK0509183
6.4	29	36	5.9	101	6	6	FBK0509184
6.5	29	36	6	101	6	6	FBK0509185
6.95	29	36	6.45	101	6	6	FBK0509186
6.96	29	36	6.46	101	6	6	FBK0509187
6.97	29	36	6.47	101	6	6	FBK0509188
6.98	29	36	6.48	101	6	6	FBK0509189
6.99	29	36	6.49	101	6	6	FBK0509190
7.0	29	36	6.5	101	6	6	FBK0509191
7.98	32	40	7.48	117	8	6	FBK0509192
8.01	32	40	7.51	117	8	6	FBK0509193
8.03	32	40	7.53	117	8	6	FBK0509194
8.0	32	40	7.5	117	8	6	FBK0509195
8.5	32	40	8	117	8	6	FBK0509196
9.0	32	40	8.5	117	9	6	FBK0509197
9.5	32	40	9	117	9	6	FBK0509198
10.0	38	50	9.5	133	10	6	FBK0509199
10.5	38	50	10	133	10	6	FBK0509200
11.0	38	50	10.5	133	11	6	FBK0509201
11.5	38	50	11	133	11	6	FBK0509202
12.0	38	50	11.5	133	12	6	FBK0509203

Cutting parameters

Series TMRT- Reaming Metric

Workpiece Material Group			Cutting Speed Vc (m/min)			Recommended Feed/tooth (fz)							
						Diameter in mm							
			min	max	mm	1.50-4.00		4.01-7.00		7.01-9.00		9.01-12.00	
					Range	min	max	min	max	min	max	min	max
Steel	P	1	40	70	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15
		2	40	70	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15
		3	35	60	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15
		4	25	45	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15
		5	15	25	fz	0.03	0.06	0.04	0.08	0.04	0.10	0.04	0.12
		6	15	25	fz	0.03	0.06	0.04	0.08	0.04	0.10	0.04	0.12
Stainless Steels	M	1	8	15	fz	0.03	0.06	0.04	0.08	0.04	0.09	0.04	0.10
		2	8	15	fz	0.03	0.06	0.04	0.08	0.04	0.09	0.04	0.10
		3	8	15	fz	0.03	0.06	0.04	0.08	0.04	0.09	0.04	0.10
Cast Iron	K	1	35	60	fz	0.04	0.14	0.05	0.16	0.05	0.18	0.05	0.20
		2	25	50	fz	0.04	0.12	0.05	0.14	0.05	0.16	0.05	0.18
		3	20	45	fz	0.04	0.10	0.05	0.12	0.05	0.14	0.05	0.16
Non- Ferrous	N	1	110	195	fz	0.05	0.14	0.06	0.16	0.06	0.18	0.06	0.20
		2	110	195	fz	0.05	0.14	0.06	0.16	0.06	0.18	0.06	0.20
		3	110	195	fz	0.05	0.14	0.06	0.16	0.06	0.18	0.06	0.20
		4	110	195	fz	0.05	0.14	0.06	0.16	0.06	0.18	0.06	0.20
		5	105	180	fz	0.05	0.14	0.06	0.16	0.06	0.18	0.06	0.20
Special Alloys	S	1	8	15	fz	0.03	0.06	0.04	0.08	0.04	0.10	0.04	0.12
		2	8	15	fz	0.03	0.06	0.04	0.08	0.04	0.10	0.04	0.12
		3	15	30	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15
		4	15	30	fz	0.04	0.08	0.05	0.10	0.05	0.12	0.05	0.15

#RPM(N) = Vc(m/min) X 318.18/Tool Dia.

#Vf(mm/min) = RPM(N) X frev (mm/rev)

Series TMRT- Reaming Inch

Workpiece Material Group			Cutting Speed Vc (ft/min)			Recommended inch/tooth (IPT)							
						Diameter in inch							
			min	max	Inch	1.50-4.00		4.01-7.00		7.01-9.00		9.01-12.00	
					Range	min	max	min	max	min	max	min	max
Steel	P	1	131	230	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059
		2	131	230	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059
		3	115	197	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059
		4	82	148	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059
		5	49	82	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0039	0.0016	0.0047
		6	49	82	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0039	0.0016	0.0047
Stainless Steels	M	1	26	49	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0035	0.0016	0.0039
		2	26	49	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0035	0.0016	0.0039
		3	26	49	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0035	0.0016	0.0039
Cast Iron	K	1	115	197	fz	0.0016	0.0055	0.0020	0.0063	0.0020	0.0071	0.0020	0.0079
		2	82	164	fz	0.0016	0.0047	0.0020	0.0055	0.0020	0.0063	0.0020	0.0071
		3	66	148	fz	0.0016	0.0039	0.0020	0.0047	0.0020	0.0055	0.0020	0.0063
Non- Ferrous	N	1	361	640	fz	0.0020	0.0055	0.0024	0.0063	0.0024	0.0071	0.0024	0.0079
		2	361	640	fz	0.0020	0.0055	0.0024	0.0063	0.0024	0.0071	0.0024	0.0079
		3	361	640	fz	0.0020	0.0055	0.0024	0.0063	0.0024	0.0071	0.0024	0.0079
		4	361	640	fz	0.0020	0.0055	0.0024	0.0063	0.0024	0.0071	0.0024	0.0079
		5	344	590	fz	0.0020	0.0055	0.0024	0.0063	0.0024	0.0071	0.0024	0.0079
Special Alloys	S	1	26	49	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0039	0.0016	0.0047
		2	26	49	fz	0.0012	0.0024	0.0016	0.0031	0.0016	0.0039	0.0016	0.0047
		3	49	98	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059
		4	49	98	fz	0.0016	0.0031	0.0020	0.0039	0.0020	0.0047	0.0020	0.0059

#RPM (N) = Vc (SFM) X 3.82/Tool Dia.

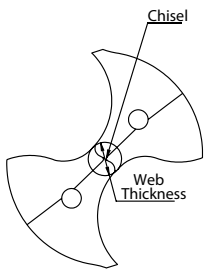
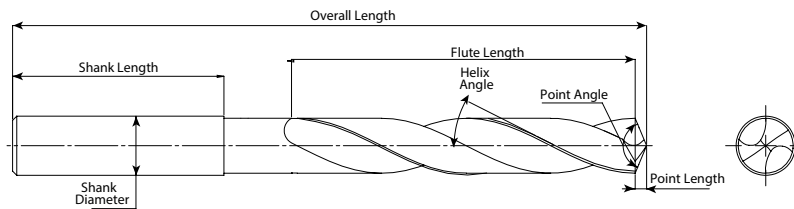
#Vf (Inch/min) = RPM (N) x frev (inch/rev)

The technical data are based upon theoretical values and are only intended for planning purposes and may vary based on the application. Actual results will vary. No responsibility from Forbes and Company Limited or their distributors is assumed.

Drill tolerance

Details	Cutting Dia. "D1" Range	Dia. "D1" Tolerance H7 ANSI B4.2	Shank Dia. D2	Shank "D2" Tolerance h6 ANSI B4.2
15° LH	1.50-3.00	+0.004/+0.008	3.00	-0.006
	3.00-6.00	+0.005/+0.010	3.00-6.00	-0.008
	6.00-10.00	+0.006/+0.012	6.00-10.00	-0.009
	10.00-12.00	+0.008/+0.015	10.00-12.00	-0.011
0°	1.50-3.00	+0.004/+0.008	3.00	-0.006
	3.00-6.00	+0.005/+0.010	3.00-6.00	-0.008
	6.00-10.00	+0.006/+0.012	6.00-10.00	-0.009
	10.00-12.00	+0.008/+0.015	10.00-12.00	-0.011

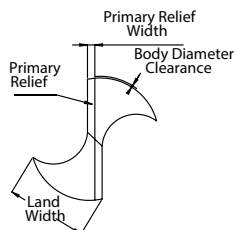
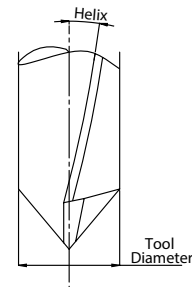
Solid carbide drill nomenclature



Chisel Edge – The non-cutting tip of the drill. Pushes, rather than cuts material. Having a smaller chisel means that a tool will cut more aggressively. A larger chisel means that a tool will be stronger.

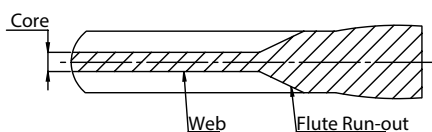
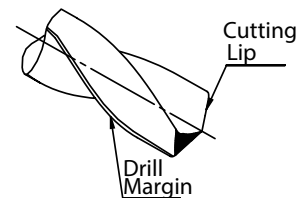
Web – The core of the drill that is left from the fluting operation. A thicker web means added rigidity, while a smaller web means more chip evacuation. On two flute drills, typically varies from 16% - 30% of the tool diameter.

Helix Angle - Varies from 0° to 35° helix on standard tools. Lower helix angle means more rigidity and strength and a higher helix angle means more aggressive drilling and better chip evacuation.



Margin Width – Provides a surface to support the drill inside the hole during the drilling operation. Totem® offers both single margin and double margin geometries. Margin widths are a balancing act between friction build-up vs. tool support in the drilling operation.

Cutting Lip - The cutting edges of a two flute drill extending from the chisel edge to the periphery.



Land Width – The amount of material left on the drill per side, from the fluting operation. Larger land widths mean more rigidity, while smaller land widths allow for better chip evacuation.

Having a problem with drill geometries? Circle the area where the problem exists. Include a detailed explanation of the issue and mail to sales@forbes.co.in

Drill troubleshooting

		Tool Deterioration													Chip Formation		
	Problem	Flank wear	Margin wear	Breakage	Flaking	Greater wear	Chisel edge wear	Corner chipping	Flute chipping	Cutting edge chipping	Cutting edge wear	Point center chipping	Rake face	Scoring on tool body	Long stringy	Varied chip form	Blue/brown chips
Speed & Feed	Reduce feed or reduce at exit	X		X			X	X	X	X		X	X	X			
	Reduce feed at entrance			X													
	Consistent feed rate			X											X	X	
	Increase feed	X					X								X		
	Reduce speed	X	X			X		X			X						
	Increase speed										X						
Coolant	Coolant mix		X	X	X					X				X			
	Coolant increase flow	X		X			X	X		X							X
	Coolant filter	X		X	X					X							
Setup	Workpiece clamp rigid		X	X			X	X		X				X			
	Collet accuracy			X						X							
	Tool holder fit .0008			X						X							
	Alignment			X						X							
	Peck drill			X													
	Concentricity		X	X	X			X	X					X			
	Do not extract tool during peck							X									

	Problem	Tool Life	Workpiece								Process						
		Tool Life	Undersized hole	Oversized hole	Poor alignment	Poor surface finish	Heavy burr breakout	Retract marks	Hole location	Hole straightness	Deflection	Point Deflection	Galling	Vibration	Abnormal noise	Chip packing	No drill penetration
Speed & Feed	Reduce feed or reduce at exit	X	X	X		X	X			X						X	
	Reduce feed at entrance		X			X			X		X			X		X	
	Consistent feed rate															X	
	Increase feed		X	X									X		X		
	Reduce speed	X	X													X	
	Increase speed					X											
Coolant	Coolant mix	X	X			X	X									X	
	Coolant increase flow	X	X			X	X									X	
	Coolant filter	X	X			X	X									X	
Setup	Workpiece clamp rigid	X		X	X	X	X	X	X	X							X
	Collet accuracy			X					X	X				X			
	Tool holder fit .0008			X					X	X				X			
	Alignment			X													X
	Peck drill																
	Concentricity				X	X		X	X	X		X		X			
	Do not extract tool during peck																

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

Drill troubleshooting

PROBLEM	CAUSE	SOLUTION
Hole expansion	Run out of drill when attached to the machine	Check holder and/or select another one
	Loose hold	Check run out after fixing to the chuck
	Non-symmetric point angle	Regrind correctly
	Different lip height	Check preciseness after reground
	Run out of chisel edge	
Irregular hole size	Non-symmetric point angle	Regrind correctly
	Large lip height	Check precision after regrind
	Run out of chisel edge	
	Margin wear is large	
	Large run out after attached to the machine	Check holder and select another one
	Loose hold	Check run out after fixing to the chuck
	Low work holding rigidity	
	Feed rate to high	Decrease feed rate
	Not enough lubrication	Use drill with an oil hole
Low position accuracy	Large run out when attached to the machine	Check holder and/or select another one
		Check run out after fixing to the collet
	Large spindle run out	Select more rigid tool and machine
	Run out when cutting material	Select more rigid tool and machine
		Increase work clamping rigidity
		Select a low cutting resistance thinning
		Use centering
		Work piece should be horizontal
		Use a drill bush
Hole perpendicularity	Excessive tool wear	Regrind
	Low position accuracy	Increase position accuracy
	Non-symmetric point angle	Regrind correctly
	Large lip height	Check precision after regrinding
	Run out of chisel edge	
	Not enough drill rigidity	Increase drill rigidity
	Drilling surface is not horizontal	Work piece must be horizontal
	Poor alignment	Make a center hole. Check alignment
Bad cylindrical accuracy	Non-symmetric point angle	Regrind correctly
		Check precision after regrinding
	Large lip height	
	Run out of chisel edge	
	Large run out after attached to machine	Check holder and/or select another one
	Loose hold	Check run out after fixing to the chuck
	Low work holding rigidity	
	Relief angle is too large	Regrind correctly
	Low drill rigidity	Use larger web drills

Drill troubleshooting

PROBLEM	CAUSE	SOLUTION
Poor surface finish	Poor regrinding	Take off all the wear
	Not suitable coolant for the material	Change supply method; increase volume
	Not enough coolant	Select higher coolant quality
	Large run out after attached to machine	Check holder and/or select another one
	Loose hold	Check run out after fixing to the chuck
	Feed rate is too high	Reduce feed rate
	Excessive tool wear	Regrind correctly
	Build up on margin is too large	Select a coated tool
	Chip packing	Select suitable drill (wide flute, high helix oil hole drill). Change cutting conditions (feed rate or adopt step drilling)
Bad cylindrical shape	Non-symmetric point angle	Regrind correctly
	Large lip height	Check precision after regrinding
	Run out of chisel edge	
	Large margin wear	
	Feed rate is too low	Increase the feed rate
Chipping of corner edge	In appropriate tool material	Choose suitable tool material
	Uneven hardness distribution on the work material	Iso static treatment
		Change tool, material & cutting conditions, machining method
	Cutting or feed speed is too high	Reduce cutting speed or feed
	Not enough coolant	Change lubrication method
Chipping of cutting edge	Large run out after attached to machine	Check holder and/or select another one
		Check run out after fixing to the collet
	Relief angle is too small	Regrind correctly
	Tool material is not suitable	Choose suitable tool material
	Cutting speed or feed is too high	Reduce cutting speed or feed
Abnormal wear on corner part	Too late regrinding	Regrind after a shorter time of use
	Bad alignment	Check/adjust the alignment
	Cutting speed too high	Decrease the cutting speed
	Point dimensions are not suitable	Select correct point dimensions
	Tool materials not suitable	Choose suitable tool material
	Coolant is not suitable	Change coolant
Large wear and chipping, crushing of the chisel edge	Feed rate is too large	Decrease feed rate
	Point dimensions are not suitable	Select correct point dimensions
	Tool materials is not suitable	Choose suitable tool material
	Relief angle is too small	Increase relief angle
Chipping of margin	Bush diameter is too small	Select correct bush diameter or select drill with chip breakers
	Chip packing between drill & bush	
Margin built-up	High heat generation due to large wear on the cutting edge	Regrind
	Lubrication is insufficient	Change lubrication method
	Coolant is not suitable	Change coolant
	Bad chip ejection	Change drill or the cutting conditions
	Ductile material	

Product development enquiry data sheet solid carbide tools

Company Name: Date:
 Address:
 Contact person: Tel. Nos.:
 Email Add.: Website Add.:

Component Details:

Component Name:
 Work Material: Detail Grade: Hardness: UTS:

Type of Operation: Drilling / Reaming / Milling

Drilling / Reaming:

Hole Depth:

Hole Type: Blind / Through / Interruption

Finish/Tolerance Req'd.:

Component shape: At tool entry:

Milling: Type: Slotting / profile /Contouring / other

Axial Depth:

Radial Depth:

Finish/ Tolerance Requirement.:

At Exit:

Machining Details:

Machine Type: Horizontal

Tool holding System:

Max. Spindle Speed:

Work Holding system:

Coolant Type :

Vertical:..... Other:

Tool run out after holding.....

Spindle HP:

Approach Length :

Coolant Pressure : Coolant Filtration

Current Tool Specification:

Size:.....

(Attach Drawing if available)

Competitor Name: Existing Tool Life: Tool Coating:.....

Application Details:

Cutting Speed: RPM: Feed: DOC: Pecking details:.....

Pecking details:

No. of Holes/Component:

Requirement per Month:.....

Current Cost per Component:

Commercial:

Total Potential for the size:

Business Potential Expected for us:.....

Trial Tool Requested:

Size:.....

Comments:

Sales Engineer: Mob No..... Product Manager:

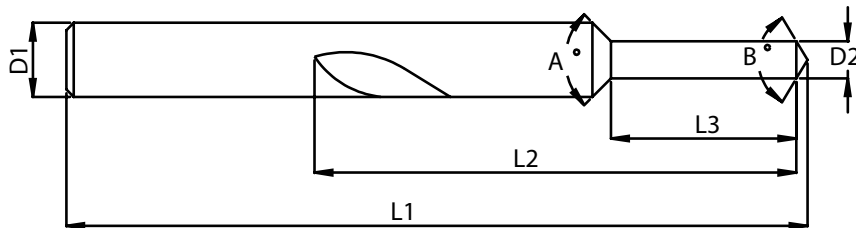
Note: Trial tool/custom tool request form can be downloaded from our website www.forbesprecision.co.in

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

Custom tool request form

Fill in information requested on drawing.
(*Required Fields)

☐ Request Approval Drawing



A = _____
B = _____
D1 = _____
D2 = _____
L1 = _____
L2 = _____
L3 = _____

*Material

- ☐ Solid Carbide
☐ Carbide Coolant Thru

*Number of Flutes

- ☐ Solid Carbide
☐ Carbide Coolant Thru

*Margin Style

- ☐ Single
☐ Double

*Margin Style

- ☐ Cutting
☐ Non-Cutting

*Flute Form

- ☐ Straight
☐ Helical _____ °Helix on Major Dia.

*Coating

- ☐ TiN
☐ TiCN
☐ TiAlN
☐ None
Other _____

Note:

This information enables us to engineer and manufacture a tool for your specific requirements.

Customer Name: _____

Phone: _____

* Work Material Machined: _____

Hardness: _____

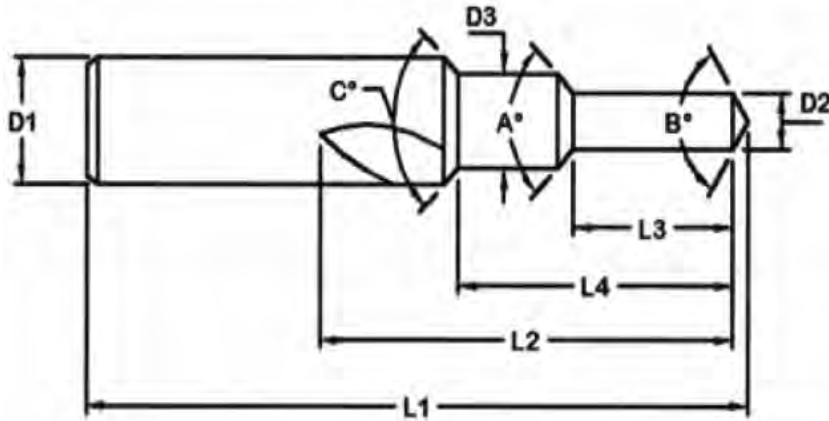
Distributor: _____

Quantities: _____

Note: Trial tool/custom tool request form can be downloaded from our website www.forbesprecision.co.in
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Custom tool request form

Step Drill Dimensions



A° (Inclusive) = _____

B° (Inclusive) = _____

C° (Inclusive) = _____

$D1$ = _____

$D2$ = _____

$D3$ = _____

$L1$ = _____

$L2$ = _____

$L3$ = _____

$L4$ = _____

M/C Type: _____

- ☐ Horizontal
☐ Vertical

Existing Data:

Speed = _____ Toollife = _____

Feed = _____ No. of Regrinds = _____

Tool Consumption/Year = _____

Cost/Component = _____

Cycle Time of Operations = _____

Material:

- ☐ Solid Carbide
☐ Carbide Coolant Thru

Customer Name: _____

Phone Number: _____

Work Material Machined: _____

Hardness: _____

Sales Engineer: _____

Number of Flutes:

- ☐ Two
☐ Three

Flute Form:

- ☐ Straight
☐ Helical _____ ☐ Helix on Major Dia.
☐ Square Drill

Coating:

- ☐ TiN ☐ TiCN ☐ TiAlN ☐ Other _____

Tolerances unless otherwise specified:

Angles $\pm 1^\circ$

Corners and Edges .25 Rad. Max

Trial tool results form

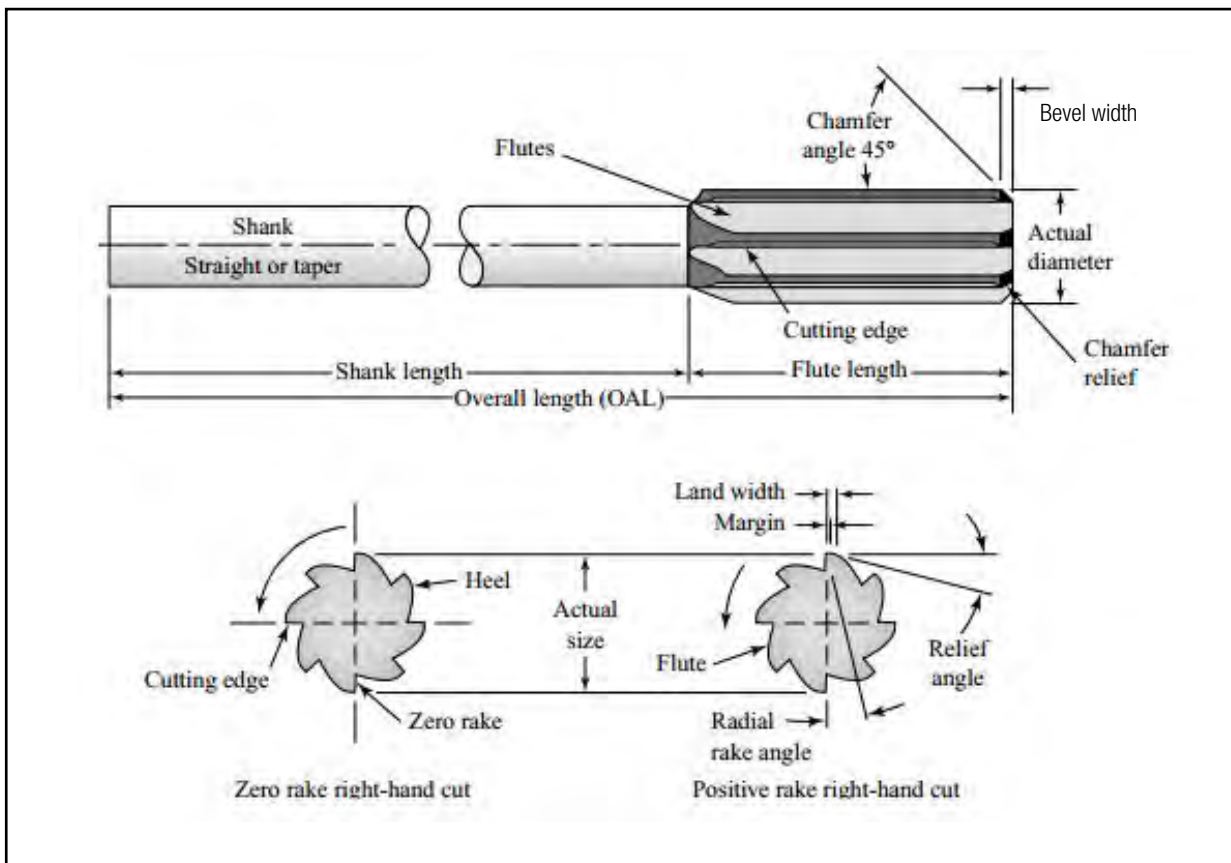
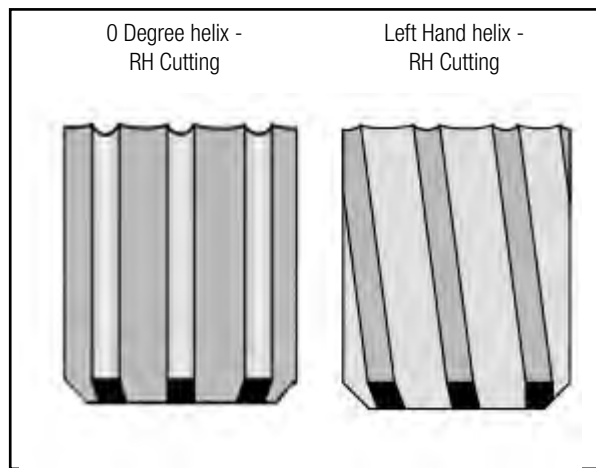
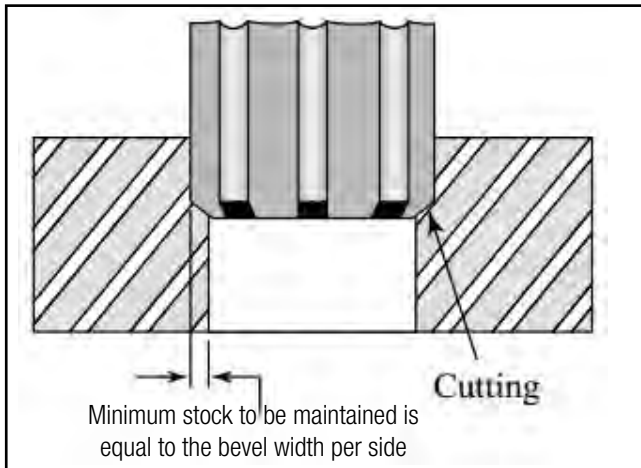
Customer Name		Ref No.	
Address		Date	
		Sales Engineer Name:	
		Contact No.:	
Contact Person :		Trial PO OA No:	
Tool Diameter :			
Component Details:		Operation Details:	
Name		Drilling Depth	
Material		No. of Holes/ Component	
Material Hardness		Drill Dia	
Machine Make /Model/No.		No. of Pecking	
Tool No.		Tol/Finish required :	
Machining Details :			
Parameters	Existing	Trial 1	
Holding			
M/c.Type			
Cycle Time			
Coolant			
Coolant Press.			
Tool Data:			
Parameters	Existing	Trial 1	Regrinding Trial
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

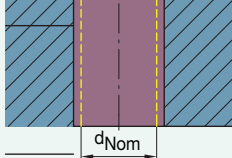
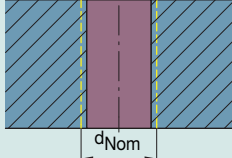
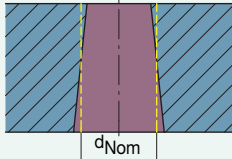
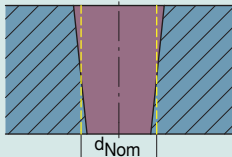
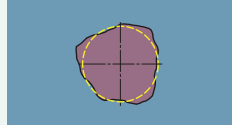
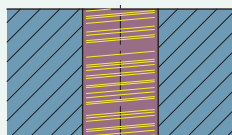
Authorised Signatory
CUSTOMER

Note: Trial tool/custom tool request form can be downloaded from our website www.forbesprecision.co.in
Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

Reamer nomenclature



Reamers troubleshooting

Problem	Cause	Possible Remedy
Hole diameter too large. 	- Reaming tool running out-of-centre. - Concentricity of pilot hole and ream machining unsatisfactory. - Built-up edge. - Unsuitable cooling lubricant. - Reaming tool diameter too large.	- Use equalising adaptor. - Change cooling lubricant. - Change cutting speed. - Measure reamers and send for repairs.
Hole diameter too small. 	- Reamer worn. - Unsuitable cooling lubricant. - Reaming allowance too small.	- Replace and refit tool. - Change cooling lubricant. - Increase reaming allowance.
Conical hole profile wider towards drill runout. 	- Concentricity of pilot hole and reaming unsatisfactory. - Positioning accuracy of pilot hole to reaming.	- Re-align, use equalising adaptor. - Correct positioning accuracy.
Conical hole profile wider at drill entry point. 	Concentricity of pilot hole and reaming unsatisfactory.	Securely clamp reaming tool axially.
Hole out-of-centre and/or showing chatter marks. 	- Reaming tool running out-of-centre. - Slanted cutting surface/asymmetrical cutting. - Workpiece twisted.	- Use equalising adaptor. - Spot face as drilling preparation. - Take the direction of impact into account when clamping the workpiece.
Surface quality does not meet specification. 	- Tool cutters worn. - Reaming tool running out-of-centre. - Incorrect technology data (cutting parameters). - Inadequate chip evacuation.	- Use equalising adaptor. - Change cooling lubricant. - Change cutting speed. - Measure reamers and send for repairs.
Feed grooves. 	Built-up edge.	- Change cooling lubricant. - Change cutting speed.

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

Deep Hole Drilling (DHD)- High Performance drills

Introducing the latest range of high performance solid carbide drills for deep hole drilling (DHD). DHD with through-coolant capabilities are tailor made to your specification. With an industry proven track record with its geometry, superior substrate and surface treatment, Totem drills command high wear resistance and micrograin structure to enable superior tool life and less breakage.

Application:- Oil Hole Drilling in Crankshaft

Material:- Forged Steel

Dia = 3.0–10,0mm

Length = 12D, 15D, 20D, 30D

Cutting conditions within a range of $vc = 60\text{--}100$ m/min, $fz = 0,10\text{--}0,25$ mm/rev



Connecting rod bolt hole high performance drills

Our expertise in Connecting rod application for drilling has no comparison. Custom-made high performance drills with proven geometry, latest surface treatment, sub-micron substrate result in giving you the lowest Cost-per-part.

Application :- Connecting rod bolt hole drilling

Material:- Drop forged steel (heat treated)

Dia - 3-32mm

Length- 5D, 8D, 10D

Cutting conditions within a range of $vc = 60\text{--}100$ m/min, $fz = 0,15\text{--}0,35$ mm/rev



High performance special drills

Ultimate flexibility in supply of special drills as per customer's application with quick turnaround time. Our trained sales and application experts are ready to visit you to understand your needs in-depth. We commit to deliver superior solutions with lowest Cost-per-part.

Industry:-

Aerospace, Automotive, Defense, Railways, General Engineering & Energy Equipments.

Dia 1.00- 32.00mm

Options:- Solid, Through Coolant 30 degree Helix, 40 Degree Helix, Axial Coolant Duct, Parallel Coolant Ducts.



High performance micro drills



Automotive:-

Fuel Injection Parts, Common Rail Parts, Turbo Charger Parts, Steering Components, Automatic Transmission Power Train Components.

Precision Machining:-

Jewellery Industry, Spinnerets & Spin Plates, Electronic Connector Parts, Screw & Machine Components.

Industry:-

Aerospace, Valve Bodies, Thermocouples, Integrated Sensors, Interior Cabin, Fixtures, Fuel System, Components Hydraulic & Pneumatic Parts, Writing Instruments Ball Pen Tips.

Medical:-

Traumatology Medical Devices Bone Screws & Plate Surgical Suture Needles Orthopedics Components Dental, Implants & Bridges Watch Industry, Watch Case, Watch Plates, Small Precision Parts, Watch Link Components.

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FORBES PRECISION TOOLS AND MACHINE PARTS LIMITED

VISION

To be a market leader by empowering customers with innovative solutions in precision cutting tools and machine parts through world-class practices.

MISSION

- To inculcate innovation led organizational culture to be a front runner in the field of technology
- To add value to the customer's business while adhering to our core value of QPD: Quality, Price, Delivery and 5C's: Convenience, Comfort, Care, Commitment and Customer Satisfaction (Customer Delight)
- To develop a strong inhouse Design and Development skill set to enhance the Quality of Solutions
- To establish the cost leadership through World Class Manufacturing and Operational Excellence
- To be accountable towards the interest of all stakeholders, environment and society at large through all our actions and decisions.

REGISTERED OFFICE

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DIVISIONAL SALES OFFICES ADDRESS / PH. NO.

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Opp. Bata Showroom, Near Times Of India,
Ashram Road, Ahmedabad - 380 009
Telephone: +91 (0) 79 - 26587769, 079 - 26583753

BENGALURU

24, 3rd Floor, Classic Building, Richmond Road,
Bangaluru - 560 025.
Telephone +91 80 25258713

CHENNAI

Ground Floor, Catholic Centre 108,
Armenian Street, Broadway,
Chennai - 600 001
Tel: 044-25390259 / 80126 96089

NEW DELHI

Flat No. 8F, 8th Floor,
Vandana Building, Tolstoy Marg,
New Delhi - 110 001

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Q-Road, South Park, Bistupur
Jamshedpur Pin - 831 001 (Jharkhand)
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PUNE

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CHHATRAPATI SAMBHAJINAGAR

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