TOTEM®

High Performance Cutting Tools

SOLID CARBIDE END MILLS & DRILLS

ICON GALLERY

TOOL MATERIAL

- Carbide

HELIX ANGLE

End Mill Drill

- 0°
- 30°
- 20°
- 25°
- 30°
- 35/38°
- 40°
- 45°
- VARI

POINT ANGLE

- 118 Degree
- 142 Degree

NUMBER OF FLUTES

- 2 Flutes
- 3 Flutes
- 4 Flutes
- 5 Flutes
- 6 Flutes
- Optimum Flutes
- 6 to 16 Flutes
- 6 to 8 Flutes
- 4 to 8 Flutes

CUTTING TYPE

- Center Cutting

CORNER STYLE

- Squre End
- Ball Nose
- Corner Chamfer
- Corner Radius

MACHINING STRATEGIES

- HSM High Speed Machining
- HPM High Performance Machining
- HVM High Volume Machining

SURFACE TREATMENT

- BF Bright Finish
- TiN Titanium Nitride Coating
- TiAlN Titanium Aluminium Nitride Coating
- Proton Plus Proton Plus Coating
- Cr Base Chromium Based Coating
- Diamond Tipped
- D Diamond Coating

SHANK TYPE

- 6535 HA Round Shank
- 6535 HB Weldon Shank

TOLERANCE

- e8 Cutting Dia Tolerance
- h5 Shank Tolerance
- f7 Cutting Dia Tolerance
- FHC Cutting Dia Tolerance (Forbes Std)

DRILL LENGTH

- 3X 3X Length
- 5X 5X Length
- 7X 7X Length

DRILL

- Solid Carbide
- Coolant Feed Drill

MILLING APPLICATIONS

- Plunge Milling
- Ramping Blank
- Slotting: Ball Nose
- Slotting: Square End
- SIde Milling/Shoulder Milling: Ball Nose
- Side Milling/Shoulder Milling: Square End
- Side Milling/ Shoulder Milling: Roughing
- Side Milling/ Shoulder Milling: Roughing
- 3D Profiling

END MILLS LENGTH

- STUB Stub Length
- REG Regular Length
- LONG Long Length
- EXTRA LONG Extra Long Length
- LONG REACH Long Reach Length

TOTEM®

High Performance Cutting Tools

SOLID CARBIDE END MILLS

END MILL SELECTION GUIDE

										
	For 55-70 HRc (HP)				For 45-70 HRc (HP)					
Description	Ball nose 2 flute	Torus 4 flute	Multi flute finisher	Multi flute finisher with corner radius	Ball nose 2 flute	Ball nose 4 flute	Torus 2 flute	Torus 4 flute	Multi flute finisher	Multi flute finisher with corner radius
Page No.	7	13	19	20	23	25	27	29	32	34
Length	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std	0.1-12.0	0.1-12.0	3.0-20.0	3.0-20.0	1.0-16.0	6.0-16.0	1.5-16.0	3.0-16.0	3.0-20.0	3.0-20.0
Dia Range Spl										
Length of Cut (Ap Max)										
No of Flutes	2	4	6-16	6-16	2	4	2	4	6-8	6-8
Helix	30^0	30^0	45^0	45^0	30^0	30^0	30^0	30^0	45^0	45^0
Coating	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End			√						√	
Ball Nose	√				√	√				
Corner Radius		√		√			√	√		v
Corner Chamfer										
Center Cutting	√	√	√	√	√	√	√	√	√	√
Chip Breaker										
Neck Type	√	√	√	√	√	√	√	v	√	√
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										

END MILL SELECTION GUIDE

										
	High feed (HP)	**Micro End Mill (HP)**					**Rougher/Semi Finisher for Exotic Material (HP)**			
Description	Torus cutter for high feed machining	2 Flute end mill	4 Flute end mill	2 Flute end mill with corner radius	4 Flute end mill with corner radius	2 Flute ball nose	4 Flute end mills	5 Flute end mills	Multi flute end mills	2 Flute ball nose
Page No.	37	39	45	49	56	60	70	73	77	79
Length	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std	2.0-12.0	0.1-3.0	0.2-3.0	0.1-3.0	0.2-3.0	0.1-3.0	3.0-25.0	3.0-25.0	6.0-20.0	0.4-12.0
Dia Range Spl										
Length of Cut (Ap Max)										
No of Flutes	4	2	4	2	4	2	4	5	6-8	2
Helix		30^0	30^0	30^0	30^0	30^0	Vari	Vari	45^0	30^0
Coating	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Square End		√	√							
Ball Nose						√				√
Corner Radius	√			√	√		√	√	√	
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										

END MILL SELECTION GUIDE

										
	Trochoidal Milling (HP)		Diamond Tipped (HP)		Graphite Milling (HP)					
Description	For stainless and titanium	For steel	End mill with corner radius	Ball nose end mill	Rougher	3 Flute end mill	End mill with corner radius	Ball nose	Micro end mill with corner radius	Micro ball nose
Page No.	82	84	87	89	92	94	95	98	101	104
Length	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std	3.0-20.0	3.0-20.0	3-12.0	3-12.0	4.0-16.0	2.0-12.0	2.0-12.0	2.0-12.0	0.3-1.5	0.3-1.5
Dia Range Spl										
Length of Cut (Ap Max)										
No of Flutes	4-7	4-7	2	2	2	3	2-3-4	2-3-4	2	2
Helix	Vari	Vari	0^0	0^0	25^0	40^0	40^0	40^0	40^0	40^0
Coating	TiAlN	TiAlN	Diamond Tipped	Diamond Tipped	Diamond Coating	Diamond Coating	Diamond Coating	Diamond Coating	Diamond Coating	Diamond Coating
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	√	√	√	√	√	√	√	√	√	√
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										

END MILL SELECTION GUIDE

										
	For 45 - 58 HRc Proton Plus (HP)					For 30- 45 HRc High Speed Machining (HP)				
Description	4 Flute end mill regular length	4 Flute end mill long length	4 Flute end mill long reach length	Ball nose 2 flute regular length	Ball nose 2 flute long length	Ball nose 2 flute long reach length	4 Flute end mill regular length	2 Flute end mill regular length	Ball nose 4 flute regular length	Ball nose 2 flute regular length
Page No.	107	109	111	112	113	114	116	117	118	119
Length	Reg	Long Length	Long Reach	Reg	Long Length	Long Reach	Reg	Reg	Reg	Reg
Dia Range Std	3.0-16.0	3.0-16.0	6.0-12.0	1.0-12.0	1.0-12.0	6.0-12.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Dia Range Spl	2.0-25.4	2.0-20.0	2.0-20.0	1.0-20.0	1.0-20.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Length of Cut (Ap Max)	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD	1XD
No of Flutes	4	4	4	2	2	2	4	2	4	2
Helix	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating	Proton Plus	Proton Plus	Proton Plus	Proton Plus	Proton Plus	Proton Plus	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		
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	√	√	√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

						
	For SS,Ti & High Temperature Alloys (HP)			**For Al & Al Alloys (HP)**		**Sinusoidal rougher (HP)**
Description	4 Flute Variable Helix End mill F177 TR	Ball Nose 4 flute variable helix F179 TR	5 Flute end mill F178 TR	2 Flute end mill F135 HP	2 flute end mill F136 HP	Sinusoidal regular length F192 HP
Page No.	121	122	125	128	131	134
Length	Reg	Reg	Reg	Reg	Reg	Reg
Dia Range Std	6.0-20.0	6.0-20.0	6.0-16.0	4.0-20.0	4.0-20.0	8.0-20.0
Dia Range Spl	1.5-25.4	3.0-25.4	1.5-25.4	3.0-25.4	3.0-25.4	6.0-25.4
Length of Cut (Ap Max)	1XD	1XD	1XD	1XD	1XD	1xD
No of Flutes	4	5	4	2	2	4
Helix	35^0/ 38^0	35^0/ 38^0	38^0	30^0	45^0	20^0
Coating	Cr Base	Cr Base	Cr Base	Bright	Bright	TiAlN
Shank	Round	Round	Round	Round	Round	Weldon
Square End	√	√		√	√	√
Ball Nose			√			
Corner Radius	Custom Solution	Custom Solution		Custom Solution	Custom Solution	
Corner Chamfer	Custom Solution	Custom Solution		Custom Solution	Custom Solution	
Center Cutting	√	√	√	√	√	√
Chip Breaker					Custom Solution	√
Neck Type			Custom Solution	Custom Solution		Custom Solution
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	√	√	√	√	√	√

END MILL SELECTION GUIDE

										
	For General Purpose Application on Variety of Materials (GP)									
Description	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	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
Page No.	140	142	143	144	145	146	147	148	149	150
Length	Reg	Stub	Long Length	Extra Long	Long Reach	Reg	Stub	Reg	Long Length	Long Reach
Dia Range Std	1.0-25.0	1.0-25.0	3.0-25.0	3.0-20.0	3.0-20.0	1.0-25.0	3.0-20.0	1.0-25.0	3.0-20.0	3.0-20.0
Dia Range Spl	0.3-32.0	0.3-32.0	3.0-25.0	3.0-20.0	3.0-20.0	1.0-32.0	0.5-20.0	1.0-32.0	3.0-25.4	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	4	4	3	2	2	2	2
Helix	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	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	Custom Solution	Custom Solution	Custom Solution
Corner Chamfer	Custom Solution	Custom Solution	Custom Solution	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
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	√	√	√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

								
	For General Purpose Application on Variety of Materials (GP)							
Description	Ball Nose 4 flute Stub Length F165 GP	Ball Nose 4 flute Regular Length F140 GP	Ball Nose 4 flute long reach F184 GP	Ball Nose 2 flute regular length F150 GP	Ball Nose 2 flute stub length F166 GP	Ball Nose 2 flute long reach F186 GP	Chip breaker regular length F114 CB GP	Chp breaker long length F132 CB GP
Page No.	151	152	153	154	155	156	159	160
Length	Stub	Reg	Long Reach	Reg	Stub	Long Reach	Reg	Long Length
Dia Range Std	3.0-20.0	1.0-25.0	3.0-20.0	1.0-25.0	3.0-20.0	3.0-20.0	4.0-20.0	6.0-16.0
Dia Range Spl	1.0-20.0	1.0-25.4	3.0-20.0	1.0-25.4	3.0-20.0	3.0-20.0	3.0-25.4	3.0-25.4
Length of Cut (Ap Max)	1xD	1xD	1xD	1xD	1xD	1xD	1xD	1xD
No of Flutes	4	4	4	2	2	2	4	4
Helix	30^0	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank	Round	Round	Round	Round	Round	Round	Round	Round
Square End							√	√
Ball Nose	√	√	√	√	√	√		
Corner Radius								
Corner Chamfer								
Center Cutting	√	√	√	√	√	√	√	√
Chip Breaker							√	√
Neck Type			Custom Solution			Custom Solution		
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	√	√	√	√	√	√	√	√

END MILL SELECTION GUIDE

							
	For General Purpose Application on Variety of Materials (GP)						
Description	2 Flute end mill regular length F121 XL	4 Flute end mill regular length F111 XL	Ball nose 2 flute regular length F150 XL	Ball nose 4 flute Regular Length F140 XL	2 flute end mill long length F123 XL	4 flute end mill long length F122 XL	4 flute ball nose long length F125 XL
Page No.	163	164	165	166	167	168	169
Length	Reg	Reg	Reg	Reg	Long Length	Long Length	Long Length
Dia Range Std	1.0-20.0	1.0-20.0	1.0-20.0	1.0-20.0	3.0-20.0	3.0-20.0	3.0-20.0
Dia Range Spl							
Length of Cut (Ap Max)	1xD	1XD	1xD	1xD	1xD	1xD	1xD
No of Flutes	2	4	2	4	2	4	4
Helix	30^0	30^0	30^0	30^0	30^0	30^0	30^0
Coating	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN	TiAlN
Shank	Round	Round	Round	Round	Round	Round	Round
Square End	√	√			√	√	√
Ball Nose			√	√			√
Corner Radius							
Corner Chamfer							
Center Cutting	√	√	√	√	√	√	√
Chip Breaker							
Neck Type							
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	√	√	√	√	√	√	√

USE YOUR ENDMILLS SELECTOR

Select length of tool **D**

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

Select corner style **C**

Select your work piece material from this table **B**

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

Find your tool on the page **E**

TOTEM Solid Carbide End Mills

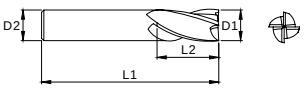
HSM Series

END MILLS

4 Flute — Centre cutting HSM end mill for 30-45 HRc steel

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

P2-P4



Unit : mm

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

Select tool diameter **F**

*Custom Solution possible Refer page 2.171

TOTEM®

High Performance Cutting Tools

HIGH PERFORMANCE END MILLS

CONTENTS

HIGH PERFORMANCE END MILLS

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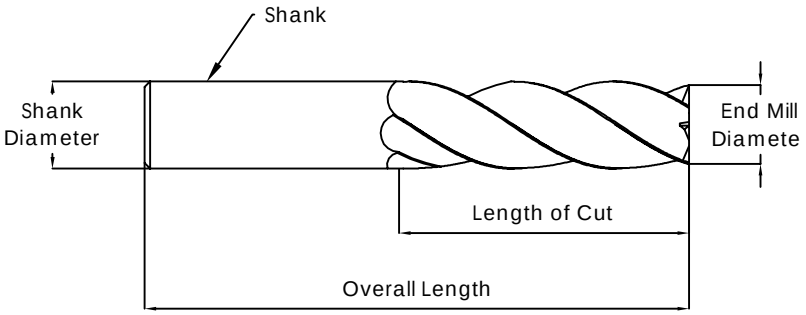
CONTENTS

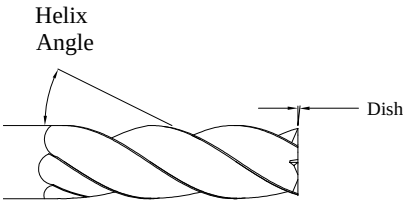
HIGH PERFORMANCE END MILLS

End mill nomenclature



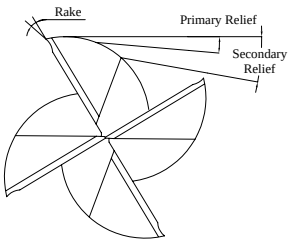
Length of Cut (Flute Length) – Always select the shortest Flute Length possible for your application. By selecting the shortest Flute Length, you can increase rigidity and allow for higher feed rates.

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

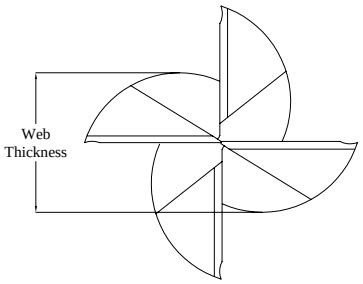


Helix Angle – Varies from 0 to 60 degrees. Higher helix angles can increase the number of teeth in a cut, and help in redirecting cutting forces. This is beneficial in harder to machine materials in particular. Changes in helix angle can also greatly affect the flute form of an end mill, and affect chip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

Rake Angle – 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 – 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.



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

How to reduce vibration & chatter in end milling

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

Typical methods to reduce chatter include reducing cutting forces by:

1. Reducing the number of flutes in cut.
2. Decreasing the chipload per tooth by reducing the feed or increasing the speed or RPM.
3. Reducing the axial or radical depth or cut.

Though these steps will reduce the chatter, slowing down the cutting process is not always the best course of action, and reducing the chipload can be detrimental to the cutter.
It is better to first improve rigidity and stability:

1. Use a larger end mill with a larger core diameter.
2. Use end mills with reduced clearance or a small circular margin.
3. Use the shortest overhang from spindle nose to tip of tool.
4. Use stub length end mills where possible.
5. Use balanced tool holders.
6. Rework fixture to hold the workpiece more securely.
7. Reprogram the cutter path to shift cutting forces into stiffer portions of the workpiece.
8. Look for ways to improve spindle speeds then adjust feed accordingly.

Chatter is common when machining corners. As the end mill enters the corner, the percentage of engagement increases the number of teeth in the cut. This drastically increases the cutting forces, causing chatter.

To reduce chatter when machining corners, consider using circular interpolation to produce a bigger corner radius than indicated by the part print. Then remove the remaining stock with a smaller end mill using circular interpretation.

Reducing Chatter in End Milling

Chatter in the form of vibration and noise is a frequent challenge when end milling. It can cause scalloping and uneven finishes.

To reduce chatter, try the following:

1. Ensure that the starting places for speeds and feeds are correct for the workpiece material and the cut.
2. Decrease the feed, or chipload per tooth/tool.
3. Make the workpiece as secure and rigid as possible.
4. Reduce excess overhang between the workpiece and spindle.
5. Select an end mill with less flutes.
6. Check the tool run-out.
7. Review the tool geometry to ensure the cutting face, relief, fluting and helix angle are appropriate for the workplace material.
8. If conventional, try climb milling.

End Mill Accuracy and Deflection

Because end mills are supported only at the shank end, they are subject to deflection, which can reduce the accuracy of the milled part. Several factors affect the amount of deflection that will occur.

1. Overall Length and Length of Cut: As the length of the mill increases, difficulty in maintaining dimensional accuracy also increases. Rigidity decreases in proportion to length of cut to the 3rd power. Thus, a 4th length of cut is 1/8 as rigid as a 2" length of cut. A regular length end mill cutting 7075 aluminium can deflect <.002", while an extra long end mill can deflect >.006".

2. End Mill Diameter: Rigidity increases in proportion to diameter to the 4th power. A 1" – diameter end mill is 16 times more rigid than a ½" end mill. A 1" – diameter end mill over a 5/8" length of cut in 1040 steel will cut to size, while a 3/8" – diameter end mill may deflect to >.003".

3. End Mill Material Composition: Solid carbide is about three times more rigid and resistant to deflection than high-speed steel end mills, but not as tough.

4. Radial Depth of Cut and Axial Length of Cut: Heavy radical cuts as well as long axial lengths of cuts will deflect the end mill much more. A light-finishing pass is generally required to produce accurate parallel cuts.

Tips:

- Always use the shortest tool possible.
- Shorter tools can reduce chatter.
- Increase coolant.
- Try left-hand spiral end mills.
- Try using higher helix end mills.
- Increase overall system rigidity.
- Reduce overhang.
- Conventional milling can resist deflection better than climb milling.
- Dull tools deflect more than sharp tools.

End mills for hardened steels from 55-70 HRc

Advantages

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

Several strategies are possible

HPM (High Perfomance Machining)	HSM (High Speed Machining)
High cutting speed (Vc)	High cutting speed (Vc)
Large cutting depth (Ap)	Small cutting depth (Ap)
Small cutting width (Ae)	Small cutting width (Ae)
Medium feed per tooth (Fz)/ table feed (Vf)	High feed per tooth (Fz) / table feed (Vf)

Workpiece material: 1.2379
Hardness: 62HRC

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

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

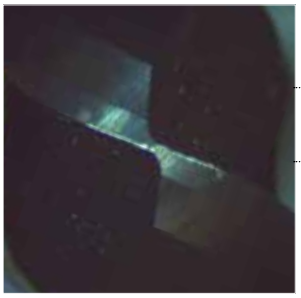
Program

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

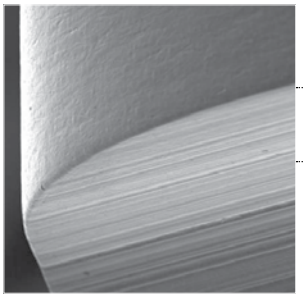
Coating Details

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

Optimized center



Wear



Edge preparation

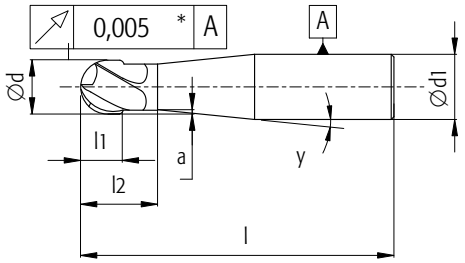
For multi flute finisher with corner radius the tolerance on the corner radius is ±0.005mm.

2 Flute

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

HSM | 30° | f7 | 6535 HA | h5

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0506053	0.05	4	51	0.15	-	-	2	15	0.684	0.706	0.755	0.812
0.1	FBK0506054	0.05	4	51	0.15	2	0.005	2	15	2.357	2.437	2.616	2.825
0.2	FBK0506055	0.1	4	51	0.3	-	-	2	15	0.786	0.810	0.863	0.925
0.2	FBK0506056	0.1	4	51	0.3	2	0.005	2	15	2.355	2.434	2.609	2.812
0.2	FBK0506057	0.1	4	51	0.3	4	0.005	2	15	4.423	4.573	4.909	5.299
0.2	FBK0506058	0.1	4	51	0.3	6	0.005	2	15	6.490	6.713	7.208	7.785
0.4	FBK0506059	0.2	4	51	0.5	-	-	2	15	1.299	1.337	1.423	1.522
0.4	FBK0506060	0.2	4	51	0.5	2	0.01	2	15	2.371	2.447	2.615	2.811
0.4	FBK0506061	0.2	4	51	0.5	4	0.01	2	15	4.439	4.586	4.915	5.298
0.4	FBK0506062	0.2	4	51	0.5	6	0.01	2	15	6.506	6.726	7.215	7.784
0.4	FBK0506063	0.2	4	51	0.5	8	0.01	2	15	8.573	8.865	9.515	10.270
0.5	FBK0506064	0.25	4	51	0.7	-	-	2	15	1.504	1.548	1.645	1.758
0.5	FBK0506065	0.25	4	51	0.7	2	0.02	2	15	2.408	2.483	2.651	2.846
0.5	FBK0506066	0.25	4	51	0.7	4	0.02	2	15	4.476	4.623	4.951	5.332
0.5	FBK0506067	0.25	4	51	0.7	6	0.02	2	15	6.543	6.762	7.250	7.818
0.5	FBK0506068	0.25	4	51	0.7	8	0.02	2	15	8.610	8.902	9.550	10.304
0.6	FBK0506069	0.3	4	51	0.8	-	-	2	15	2.259	2.327	2.479	2.656
0.6	FBK0506070	0.3	4	51	0.8	2	0.02	2	15	2.543	2.621	2.795	2.997
0.8	FBK0506071	0.4	4	51	1	-	-	2	15	2.462	2.534	2.694	2.880
1	FBK0506072	0.5	4	51	1.2	-	-	2	15	2.665	2.741	2.909	3.104
1	FBK0506073	0.5	4	51	1.2	2.2	0.02	2	15	2.743	2.821	2.995	3.197
1	FBK0506074	0.5	4	51	1.2	4	0.02	2	15	4.603	4.746	5.064	5.435
1	FBK0506075	0.5	4	51	1.2	6	0.02	2	15	6.671	6.886	7.364	7.921

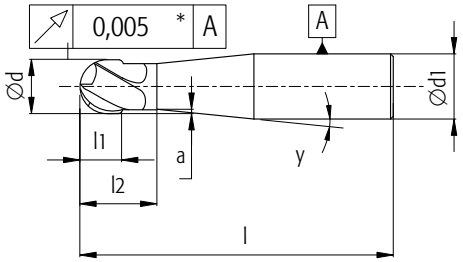
∞ Remark ∞ means no collusion in projection length area

2 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H2-H3



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
1	FBK0506076	0.5	4	51	1.2	8	0.02	2	15	8.738	9.025	9.664	10.407
1	FBK0506077	0.5	4	51	1.2	10	0.02	2	15	10.805	11.164	11.964	12.894
1.5	FBK0506078	0.75	4	51	1.8	-	-	2	15	4.066	4.182	4.439	4.738
1.5	FBK0506079	0.75	4	51	1.8	3.3	0.025	2	15	4.163	4.282	4.546	4.854
1.5	FBK0506080	0.75	4	51	1.8	4	0.025	2	15	4.886	5.030	5.351	5.725
1.5	FBK0506081	0.75	4	51	1.8	6	0.025	2	15	6.954	7.170	7.651	8.211
1.5	FBK0506082	0.75	4	51	1.8	8	0.025	2	15	9.021	9.309	9.951	10.697
1.5	FBK0506083	0.75	4	51	1.8	10	0.025	2	15	11.088	11.448	12.250	13.183
2	FBK0506084	1	4	51	2.5	-	-	2	15	4.781	4.913	5.206	5.548
2	FBK0506085	1	4	51	2.5	4	0.05	2	15	4.974	5.113	5.421	5.780
2	FBK0506086	1	4	51	2.5	6	0.05	2	15	7.042	7.252	7.721	8.266
2	FBK0506087	1	4	51	2.5	8	0.05	2	15	9.109	9.392	10.020	10.752
2	FBK0506088	1	4	51	2.5	10	0.05	2	15	11.176	11.531	12.320	13.239
2.5	FBK0506089	1.25	4	51	3	-	-	2	15	5.290	5.431	5.744	6.109
2.5	FBK0506090	1.25	4	51	3	4.5	0.05	2	15	5.483	5.630	5.959	6.341
2.5	FBK0506091	1.25	4	51	3	6	0.05	2	15	7.033	7.235	7.683	8.205
2.5	FBK0506092	1.25	4	51	3	8	0.05	2	15	9.101	9.374	9.983	10.692
2.5	FBK0506093	1.25	4	51	3	10	0.05	2	15	11.168	11.513	12.283	13.178
3	FBK0506094	1.5	4	51	3.5	-	-	2	15	5.798	5.948	6.281	6.669
3	FBK0506095	1.5	4	51	3.5	5	0.05	2	15	5.991	6.148	6.496	6.901
3	FBK0506096	1.5	4	51	3.5	6	0.05	2	15	7.025	7.217	7.646	8.144
3	FBK0506097	1.5	4	51	3.5	7	0.05	2	15	8.058	8.287	8.796	9.388
3	FBK0506098	1.5	4	51	3.5	8	0.05	2	15	9.092	9.357	9.946	10.631
3	FBK0506099	1.5	4	51	3.5	10	0.05	2	15	11.159	11.496	12.245	∞

∞ Remark ∞ means no collusion in projection length area

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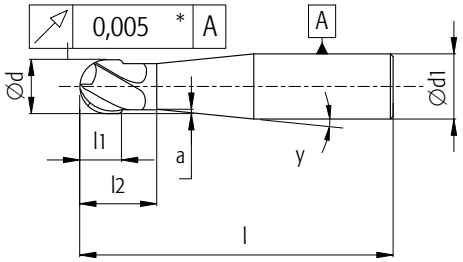
2 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0505685	0.05	6	64	0.15	-	-	2	15	0.684	0.706	0.755	0.812
0.1	FBK0505686	0.05	6	64	0.15	2	0.005	2	15	2.357	2.437	2.616	2.825
0.2	FBK0505687	0.1	6	64	0.3	-	-	2	15	0.786	0.810	0.863	0.925
0.2	FBK0505688	0.1	6	64	0.3	2	0.005	2	15	2.355	2.434	2.609	2.812
0.2	FBK0505689	0.1	6	64	0.3	4	0.005	2	15	4.423	4.573	4.909	5.299
0.2	FBK0505690	0.1	6	64	0.3	6	0.005	2	15	6.490	6.713	7.208	7.785
0.4	FBK0505691	0.2	6	64	0.5	-	-	2	15	1.299	1.337	1.423	1.522
0.4	FBK0505692	0.2	6	64	0.5	2	0.01	2	15	2.371	2.447	2.615	2.811
0.4	FBK0505693	0.2	6	64	0.5	4	0.01	2	15	4.439	4.586	4.915	5.298
0.4	FBK0505694	0.2	6	64	0.5	6	0.01	2	15	6.506	6.726	7.215	7.784
0.4	FBK0505695	0.2	6	64	0.5	8	0.01	2	15	8.573	8.865	9.515	10.270
0.5	FBK0504418	0.25	6	64	0.7	-	-	2	15	1.504	1.548	1.645	1.758
0.5	FBK0505696	0.25	6	64	0.7	2	0.02	2	15	2.408	2.483	2.651	2.846
0.5	FBK0505697	0.25	6	64	0.7	4	0.02	2	15	4.476	4.623	4.951	5.332
0.5	FBK0505698	0.25	6	64	0.7	6	0.02	2	15	6.543	6.762	7.250	7.818
0.5	FBK0505699	0.25	6	64	0.7	8	0.02	2	15	8.610	8.902	9.550	10.304
0.6	FBK0504419	0.3	6	64	0.8	-	-	2	15	2.259	2.327	2.479	2.656
0.6	FBK0504420	0.3	6	64	0.8	2	0.02	2	15	2.543	2.621	2.795	2.997
0.8	FBK0504421	0.4	6	64	1	-	-	2	15	2.462	2.534	2.694	2.880
1	FBK0504422	0.5	6	64	1.2	-	-	2	15	2.665	2.741	2.909	3.104
1	FBK0505700	0.5	6	64	1.2	2.2	0.02	2	15	2.743	2.821	2.995	3.197
1	FBK0504424	0.5	6	64	1.2	4	0.02	2	15	4.603	4.746	5.064	5.435

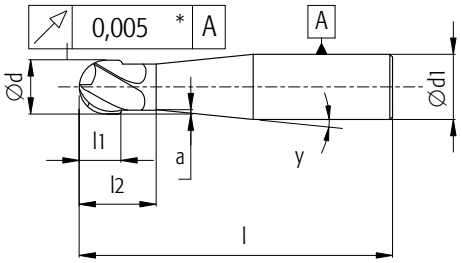
∞ Remark ∞ means no collision in projection length area

2 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1	FBK0505701	0.5	6	64	1.2	6	0.02	2	15	6.671	6.886	7.364	7.921
1	FBK0505702	0.5	6	64	1.2	8	0.02	2	15	8.738	9.025	9.664	10.407
1	FBK0505703	0.5	6	64	1.2	10	0.02	2	15	10.805	11.164	11.964	12.894
1.5	FBK0504425	0.75	6	64	1.8	-	-	2	15	4.066	4.182	4.439	4.738
1.5	FBK0505704	0.75	6	64	1.8	3.3	0.025	2	15	4.163	4.282	4.546	4.854
1.5	FBK0505705	0.75	6	64	1.8	4	0.025	2	15	4.886	5.030	5.351	5.725
1.5	FBK0505706	0.75	6	64	1.8	6	0.025	2	15	6.954	7.170	7.651	8.211
1.5	FBK0505707	0.75	6	64	1.8	8	0.025	2	15	9.021	9.309	9.951	10.697
1.5	FBK0505708	0.75	6	64	1.8	10	0.025	2	15	11.088	11.448	12.250	13.183
2	FBK0504426	1	6	64	2.5	-	-	2	15	4.781	4.913	5.206	5.548
2	FBK0504427	1	6	64	2.5	4	0.05	2	15	4.974	5.113	5.421	5.780
2	FBK0505709	1	6	64	2.5	6	0.05	2	15	7.042	7.252	7.721	8.266
2	FBK0505710	1	6	64	2.5	8	0.05	2	15	9.109	9.392	10.020	10.752
2	FBK0505711	1	6	64	2.5	10	0.05	2	15	11.176	11.531	12.320	13.239
2.5	FBK0504428	1.25	6	64	3	-	-	2	15	5.290	5.431	5.744	6.109
2.5	FBK0505712	1.25	6	64	3	4.5	0.05	2	15	5.483	5.630	5.959	6.341
2.5	FBK0505713	1.25	6	64	3	6	0.05	2	15	7.033	7.235	7.683	8.205
2.5	FBK0505714	1.25	6	64	3	8	0.05	2	15	9.101	9.374	9.983	10.692
2.5	FBK0505715	1.25	6	64	3	10	0.05	2	15	11.168	11.513	12.283	13.178
3	FBK0504429	1.5	6	64	3.5	-	-	2	15	5.798	5.948	6.281	6.669
3	FBK0505716	1.5	6	64	3.5	5	0.05	2	15	5.991	6.148	6.496	6.901
3	FBK0505717	1.5	6	64	3.5	6	0.05	2	15	7.025	7.217	7.646	8.144
3	FBK0504430	1.5	6	64	3.5	7	0.05	2	15	8.058	8.287	8.796	9.388

∞ Remark ∞ means no collusion in projection length area

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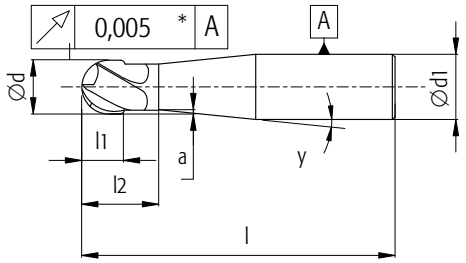
2 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
3	FBK0505718	1.5	6	64	3.5	8	0.05	2	15	9.092	9.357	9.946	10.631
3	FBK0505719	1.5	6	64	3.5	10	0.05	2	15	11.159	11.496	12.245	13.117
4	FBK0504431	2	6	64	4.5	-	-	2	15	6.815	6.983	7.356	7.791
4	FBK0504432	2	6	64	4.5	8	0.1	2	15	9.268	9.521	10.085	10.741
5	FBK0504433	2.5	6	64	6	-	-	2	15	8.349	8.553	9.006	9.534
5	FBK0504434	2.5	6	64	6	10	0.15	2	15	11.512	11.826	12.525	∞
6	FBK0503535	3	6	64	7	-	-	2	-	∞	∞	∞	∞
6	FBK0504435	3	6	64	7	12	0.15	2	-	∞	∞	∞	∞
6	FBK0504436	3	6	64	7	25	0.15	2	-	∞	∞	∞	∞
8	FBK0504437	4	8	64	9	-	-	2	-	∞	∞	∞	∞
8	FBK0504438	4	8	64	9	16	0.2	2	-	∞	∞	∞	∞
8	FBK0503536	4	8	64	9	25	0.2	2	-	∞	∞	∞	∞
10	FBK0504439	5	10	78	12	-	-	2	-	∞	∞	∞	∞
10	FBK0503537	5	10	78	12	20	0.2	2	-	∞	∞	∞	∞
12	FBK0504440	6	12	78	15	-	-	2	-	∞	∞	∞	∞

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

∞ Remark ∞ means no collusion in projection length area

Cutting conditions

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

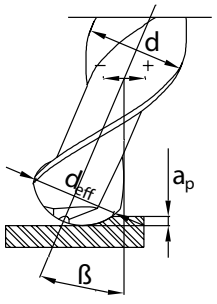
Material group	Hardness	Cutting speed Vc m/min	Coolant
H3	55-60 HRc	150 - 220	min.lub.
H4	60-70 HRc	200 - 250	min.lub.

Advantages

- Consistency
- Higher Tool Life

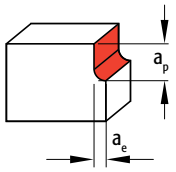
Tips:

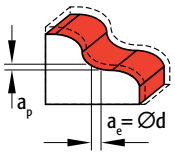
- Use a rigid milling machine and clamping method
- Try to minimize entering and exiting the workpiece
- Use minimum lubrication or oil-mist-spray



For the cutting speed Vc calculation the effective cutting diameter d_{eff} has to be taken into account. See formula.

$$ß \neq 0; \quad d_{eff} = d \times \sin\left[ß \pm \arccos\left(1-2a_p/d\right)\right]$$





Profiling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.1	< 0.02	< 0.003	0.002 - 0.007
0.2	< 0.04	< 0.006	0.004 - 0.010
0.4	< 0.08	< 0.012	0.006 - 0.013
0.5	< 0.10	< 0.015	0.007 - 0.015
0.6	< 0.12	< 0.018	0.009 - 0.018
0.8	< 0.16	< 0.024	0.012 - 0.021
1	< 0.20	< 0.030	0.015 - 0.025
1.5	< 0.30	< 0.045	0.020 - 0.035
2	< 0.40	< 0.060	0.030 - 0.050
2.5	< 0.50	< 0.075	0.035 - 0.055
3	< 0.60	< 0.090	0.040 - 0.060
4	< 0.80	< 0.120	0.050 - 0.080
5	< 1.00	< 0.150	0.060 - 0.110
6	< 1.20	< 0.180	0.065 - 0.125
8	< 1.60	< 0.240	0.080 - 0.130
10	< 2.00	< 0.300	0.085 - 0.135
12	< 2.40	< 0.360	0.100 - 0.140

FBK0503535

Workpiece material: 1.2379
Hardness: 62 HRc

	Competitor	Forbes
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

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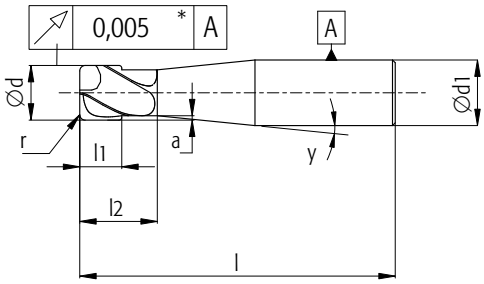
4 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
0.2	FBK0505720	0.01	4	51	0.2	-	-	4	15	0.685	0.709	0.761	0.822
0.2	FBK0505721	0.01	4	51	0.2	0.4	0.01	4	15	0.724	0.749	0.804	0.869
0.4	FBK0505722	0.01	4	51	0.4	-	-	4	15	1.202	1.244	1.336	1.444
0.4	FBK0505723	0.01	4	51	0.4	0.9	0.01	4	15	1.241	1.284	1.379	1.490
0.4	FBK0505724	0.01	4	51	0.4	1.6	0.01	4	15	1.964	2.032	2.184	2.360
0.5	FBK0505725	0.03	4	51	0.5	-	-	4	15	1.305	1.349	1.448	1.563
0.5	FBK0505726	0.03	4	51	0.5	1	0.01	4	15	1.343	1.389	1.491	1.610
0.5	FBK0505727	0.03	4	51	0.5	2	0.01	4	15	2.377	2.459	2.641	2.853
0.6	FBK0505728	0.05	4	51	0.6	-	-	4	15	2.060	2.130	2.286	2.468
0.6	FBK0505729	0.05	4	51	0.6	1.6	0.02	4	15	2.138	2.210	2.372	2.561
0.6	FBK0505730	0.05	4	51	0.6	2.4	0.02	4	15	2.965	3.066	3.292	3.555
0.8	FBK0505731	0.05	4	51	0.8	-	-	4	15	2.267	2.344	2.516	2.716
0.8	FBK0505732	0.05	4	51	0.8	1.8	0.02	4	15	2.344	2.424	2.602	2.809
0.8	FBK0505733	0.05	4	51	0.8	3.2	0.02	4	15	3.791	3.922	4.212	4.550
1	FBK0505734	0.05	4	51	1	-	-	4	15	2.474	2.558	2.746	2.965
1	FBK0505735	0.05	4	51	1	2	0.02	4	15	2.551	2.638	2.832	3.058
1	FBK0505736	0.05	4	51	1	4	0.02	4	15	4.618	4.778	5.132	5.544
1	FBK0505737	0.05	4	51	1	6	0.02	4	15	6.686	6.917	7.432	8.030
1	FBK0505738	0.10	4	51	1	-	-	4	15	2.472	2.555	2.739	2.953
1	FBK0505739	0.10	4	51	1	2	0.02	4	15	2.549	2.635	2.825	3.046
1	FBK0505740	0.10	4	51	1	4	0.02	4	15	4.617	4.774	5.124	5.532
1	FBK0505741	0.10	4	51	1	6	0.02	4	15	6.684	6.913	7.424	8.018
1.5	FBK0505742	0.10	4	51	1.5	-	-	4	15	3.778	3.906	4.191	4.523
1.5	FBK0505743	0.10	4	51	1.5	3	0.025	4	15	3.874	4.006	4.299	4.639
1.5	FBK0505744	0.10	4	51	1.5	6	0.025	4	15	6.975	7.215	7.748	8.369
1.5	FBK0505745	0.10	4	51	1.5	9	0.025	4	15	10.076	10.424	11.198	12.098
1.5	FBK0505746	0.20	4	51	1.5	-	-	4	15	3.775	3.899	4.177	4.499

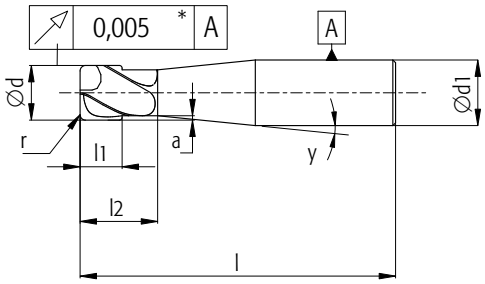
∞ Remark ∞ means no collusion in projection length area

4 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1.5	FBK0505747	0.20	4	51	1.5	3	0.025	4	15	3.871	3.999	4.284	4.615
1.5	FBK0505748	0.20	4	51	1.5	6	0.025	4	15	6.972	7.208	7.733	8.345
1.5	FBK0505749	0.20	4	51	1.5	9	0.025	4	15	10.073	10.417	11.183	12.074
2	FBK0505750	0.10	4	51	2	-	-	4	15	4.295	4.441	4.766	5.145
2	FBK0505751	0.10	4	51	2	4	0.05	4	15	5.005	5.175	5.556	5.999
2	FBK0505752	0.10	4	51	2	8	0.05	4	15	9.139	9.454	10.155	10.971
2	FBK0505753	0.10	4	51	2	12	0.05	4	15	13.274	13.733	14.755	15.944
2	FBK0505754	0.30	4	51	2	-	-	4	15	4.288	4.427	4.736	5.096
2	FBK0505755	0.30	4	51	2	4	0.05	4	15	4.998	5.162	5.526	5.950
2	FBK0505756	0.30	4	51	2	8	0.05	4	15	9.133	9.440	10.125	10.923
2	FBK0505757	0.30	4	51	2	12	0.05	4	15	13.267	13.719	14.725	15.895
2.5	FBK0505758	0.10	4	51	2.5	-	-	4	15	4.812	4.976	5.341	5.767
2.5	FBK0505759	0.10	4	51	2.5	5	0.05	4	15	6.038	6.245	6.706	7.242
2.5	FBK0505760	0.10	4	51	2.5	10	0.05	4	15	11.207	11.594	12.455	13.457
2.5	FBK0505761	0.10	4	51	2.5	15	0.05	4	15	16.375	16.942	18.204	∞
2.5	FBK0505762	0.30	4	51	2.5	-	-	4	15	4.805	4.962	5.311	5.718
2.5	FBK0505763	0.30	4	51	2.5	5	0.05	4	15	6.032	6.231	6.676	7.193
2.5	FBK0505764	0.30	4	51	2.5	10	0.05	4	15	11.200	11.580	12.425	13.409
2.5	FBK0505765	0.30	4	51	2.5	15	0.05	4	15	16.368	16.928	18.174	∞
3	FBK0505766	0.20	4	51	3	-	-	4	15	5.325	5.504	5.901	6.364
3	FBK0505767	0.20	4	51	3	6	0.05	4	15	7.069	7.308	7.841	8.461
3	FBK0505768	0.20	4	51	3	12	0.05	4	15	13.271	13.726	14.740	∞
3	FBK0505769	0.20	4	51	3	18	0.05	4	15	19.473	20.144	∞	∞
3	FBK0505770	0.20	4	51	3	-	-	4	15	5.325	5.504	5.901	6.364
3	FBK0505771	0.50	4	51	3	6	0.05	4	15	7.058	7.287	7.796	8.388
3	FBK0505772	0.50	4	51	3	12	0.05	4	15	13.260	13.705	14.695	∞
3	FBK0505773	0.50	4	51	3	18	0.05	4	15	19.462	20.123	∞	∞

∞ Remark ∞ means no collusion in projection length area

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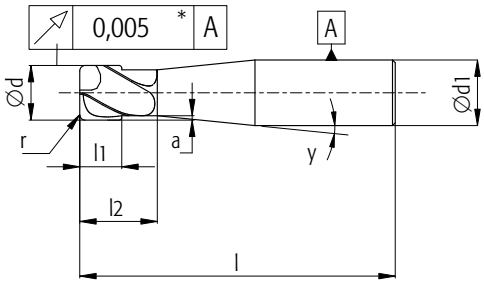
4 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505774	0.01	6	64	0.2	-	-	4	15	0.685	0.709	0.761	0.822
0.2	FBK0505775	0.01	6	64	0.2	0.4	0.01	4	15	0.724	0.749	0.804	0.869
0.4	FBK0505776	0.01	6	64	0.4	-	-	4	15	1.202	1.244	1.336	1.444
0.4	FBK0505777	0.01	6	64	0.4	0.9	0.01	4	15	1.241	1.284	1.379	1.490
0.4	FBK0505778	0.01	6	64	0.4	1.6	0.01	4	15	1.964	2.032	2.184	2.360
0.5	FBK0505779	0.03	6	64	0.5	-	-	4	15	1.305	1.349	1.448	1.563
0.5	FBK0505780	0.03	6	64	0.5	1	0.01	4	15	1.343	1.389	1.491	1.610
0.5	FBK0505781	0.03	6	64	0.5	2	0.01	4	15	2.377	2.459	2.641	2.853
0.6	FBK0505782	0.05	6	64	0.6	-	-	4	15	2.060	2.130	2.286	2.468
0.6	FBK0505783	0.05	6	64	0.6	1.6	0.02	4	15	2.138	2.210	2.372	2.561
0.6	FBK0505784	0.05	6	64	0.6	2.4	0.02	4	15	2.965	3.066	3.292	3.555
0.8	FBK0505785	0.05	6	64	0.8	-	-	4	15	2.267	2.344	2.516	2.716
0.8	FBK0505786	0.05	6	64	0.8	1.8	0.02	4	15	2.344	2.424	2.602	2.809
0.8	FBK0505787	0.05	6	64	0.8	3.2	0.02	4	15	3.791	3.922	4.212	4.550
1	FBK0505788	0.05	6	64	1	-	-	4	15	2.474	2.558	2.746	2.965
1	FBK0505789	0.05	6	64	1	2	0.02	4	15	2.551	2.638	2.832	3.058
1	FBK0505790	0.05	6	64	1	4	0.02	4	15	4.618	4.778	5.132	5.544
1	FBK0505791	0.05	6	64	1	6	0.02	4	15	6.686	6.917	7.432	8.030
1	FBK0505792	0.1	6	64	1	-	-	4	15	2.472	2.555	2.739	2.953
1	FBK0505793	0.1	6	64	1	2	0.02	4	15	2.549	2.635	2.825	3.046
1	FBK0505794	0.1	6	64	1	4	0.02	4	15	4.617	4.774	5.124	5.532
1	FBK0505795	0.1	6	64	1	6	0.02	4	15	6.684	6.913	7.424	8.018
1.5	FBK0505796	0.1	6	64	1.5	-	-	4	15	3.778	3.906	4.191	4.523
1.5	FBK0505797	0.1	6	64	1.5	3	0.025	4	15	3.874	4.006	4.299	4.639
1.5	FBK0505798	0.1	6	64	1.5	6	0.025	4	15	6.975	7.215	7.748	8.369

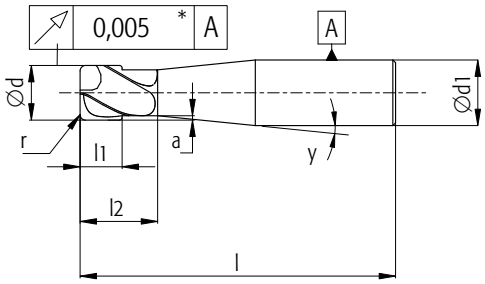
∞ Remark ∞ means no collusion in projection length area

4 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1.5	FBK0505799	0.1	6	64	1.5	9	0.025	4	15	10.076	10.424	11.198	12.098
1.5	FBK0505800	0.2	6	64	1.5	-	-	4	15	3.775	3.899	4.177	4.499
1.5	FBK0505801	0.2	6	64	1.5	3	0.025	4	15	3.871	3.999	4.284	4.615
1.5	FBK0505802	0.2	6	64	1.5	6	0.025	4	15	6.972	7.208	7.733	8.345
1.5	FBK0505803	0.2	6	64	1.5	9	0.025	4	15	10.073	10.417	11.183	12.074
2	FBK0505804	0.1	6	64	2	-	-	4	15	4.295	4.441	4.766	5.145
2	FBK0504441	0.1	6	64	2	4	0.05	4	15	5.005	5.175	5.556	5.999
2	FBK0504442	0.1	6	64	2	8	0.05	4	15	9.139	9.454	10.155	10.971
2	FBK0504443	0.1	6	64	2	12	0.05	4	15	13.274	13.733	14.755	15.944
2	FBK0505805	0.3	6	64	2	-	-	4	15	4.288	4.427	4.736	5.096
2	FBK0504444	0.3	6	64	2	4	0.05	4	15	4.998	5.162	5.526	5.950
2	FBK0504445	0.3	6	64	2	8	0.05	4	15	9.133	9.440	10.125	10.923
2	FBK0504446	0.3	6	64	2	12	0.05	4	15	13.267	13.719	14.725	15.895
2.5	FBK0505806	0.1	6	64	2.5	-	-	4	15	4.812	4.976	5.341	5.767
2.5	FBK0505807	0.1	6	64	2.5	5	0.05	4	15	6.038	6.245	6.706	7.242
2.5	FBK0505808	0.1	6	64	2.5	10	0.05	4	15	11.207	11.594	12.455	13.457
2.5	FBK0505809	0.1	6	64	2.5	15	0.05	4	15	16.375	16.942	18.204	19.673
2.5	FBK0505810	0.3	6	64	2.5	-	-	4	15	4.805	4.962	5.311	5.718
2.5	FBK0505811	0.3	6	64	2.5	5	0.05	4	15	6.032	6.231	6.676	7.193
2.5	FBK0505812	0.3	6	64	2.5	10	0.05	4	15	11.200	11.580	12.425	13.409
2.5	FBK0505813	0.3	6	64	2.5	15	0.05	4	15	16.368	16.928	18.174	19.625
3	FBK0505814	0.2	6	64	3	-	-	4	15	5.325	5.504	5.901	6.364
3	FBK0504447	0.2	6	64	3	6	0.05	4	15	7.069	7.308	7.841	8.461
3	FBK0504448	0.2	6	64	3	12	0.05	4	15	13.271	13.726	14.740	15.919
3	FBK0504449	0.2	6	64	3	18	0.05	4	15	19.473	20.144	21.639	23.378

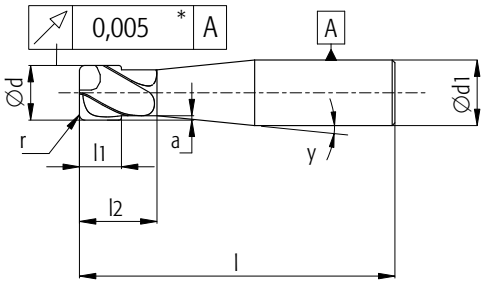
∞ Remark ∞ means no collusion in projection length area

4 Flute

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

HSM | 30° | f7 | 6535 HA | h5 | TiAlN

H3-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
3	FBK0505815	0.5	6	64	3	-	-	4	15	5.325	5.504	5.901	6.364
3	FBK0504450	0.5	6	64	3	6	0.05	4	15	7.058	7.287	7.796	8.388
3	FBK0504451	0.5	6	64	3	12	0.05	4	15	13.260	13.705	14.695	15.846
3	FBK0504452	0.5	6	64	3	18	0.05	4	15	19.462	20.123	21.594	23.305
4	FBK0503544	0.2	6	64	4	8	0.1	4	15	9.329	9.647	10.355	11.179
4	FBK0503545	0.2	6	64	4	16	0.1	4	15	17.598	18.204	19.554	∞
4	FBK0503546	0.2	6	64	4	24	0.1	4	15	25.867	26.762	28.753	∞
4	FBK0503547	0.5	6	64	4	8	0.1	4	15	9.319	9.626	10.310	11.106
4	FBK0503548	0.5	6	64	4	16	0.1	4	15	17.588	18.183	19.509	∞
4	FBK0503549	0.5	6	64	4	24	0.1	4	15	25.857	26.741	28.708	∞
6	FBK0503550	0.5	6	64	6	12	0.15	4	-	-	-	-	-
6	FBK0503551	0.5	6	64	6	24	0.15	4	-	-	-	-	-
6	FBK0503538	1	6	64	6	12	0.15	4	-	-	-	-	-
6	FBK0503539	1	6	64	6	24	0.15	4	-	-	-	-	-
8	FBK0503554	0.5	8	78	8	16	0.2	4	-	-	-	-	-
8	FBK0503555	0.5	8	78	8	32	0.2	4	-	-	-	-	-
8	FBK0503556	1	8	78	8	16	0.2	4	-	-	-	-	-
8	FBK0503540	1	8	78	8	32	0.2	4	-	-	-	-	-
10	FBK0503558	0.5	10	100	10	20	0.2	4	-	-	-	-	-
10	FBK0503559	0.5	10	100	10	40	0.2	4	-	-	-	-	-
10	FBK0503560	1	10	100	10	20	0.2	4	-	-	-	-	-
10	FBK0503561	1	10	100	10	40	0.2	4	-	-	-	-	-
12	FBK0503562	0.5	12	100	12	24	0.2	4	-	-	-	-	-
12	FBK0503563	0.5	12	100	12	48	0.2	4	-	-	-	-	-
12	FBK0503564	1	12	100	12	24	0.2	4	-	-	-	-	-
12	FBK0503565	1	12	100	12	48	0.2	4	-	-	-	-	-

∞ Remark ∞ means no collusion in projection length area

Cutting conditions

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

Material group	Hardness	Cutting speed Vc m/min	Coolant
H3	50-60 HRc	150 - 220	min.lub.
H4	60-70 HRc	200 - 250	min.lub.

Advantages

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

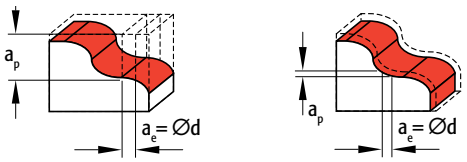
FBK0503554

Workpiece material: 1.2162
Hardness: 60 HRc

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

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

Finishing application
6 times faster than competitor



Profiling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.2	< 0.15	< 0.005	0.004 - 0.010
0.4	< 0.30	< 0.010	0.006 - 0.013
0.5	< 0.38	< 0.013	0.007 - 0.015
0.6	< 0.45	< 0.015	0.009 - 0.018
0.8	< 0.60	< 0.020	0.012 - 0.021
1	< 0.75	< 0.025	0.015 - 0.025
1.5	< 1.13	< 0.038	0.020 - 0.035
2	< 1.50	< 0.050	0.030 - 0.050
2.5	< 1.88	< 0.063	0.035 - 0.055
3	< 2.25	< 0.075	0.040 - 0.060
4	< 3.00	< 0.100	0.050 - 0.080
5	< 3.75	< 0.125	0.060 - 0.110
6	< 4.50	< 0.150	0.065 - 0.125
8	< 6.00	< 0.200	0.080 - 0.130
10	< 7.50	< 0.250	0.085 - 0.135
12	< 9.00	< 0.300	0.100 - 0.140

FBK0505796

Workpiece material: Elmax hardened
Hardness: 62 HRc

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

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

Finishing application
42% Higher MRR

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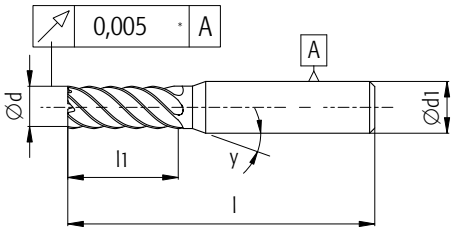
Multi Flute

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

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

H3-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0503566	-	6	64	8	15	0.05	6	15
4	FBK0503567	-	6	64	10	16	0.1	6	15
5	FBK0503568	-	6	64	12	18	0.15	6	15
6	FBK0503569	-	6	64	14	20	0.2	6	-
8	FBK0503570	-	8	78	18	25	0.2	6	-
10	FBK0503571	-	10	78	22	30	0.3	6	-
12	FBK0503572	-	12	89	26	35	0.3	6	-
16.	FBK0504453	-	16	89	34	40	0.3	6	-
20	FBK0504454	-	20	102	42	48	0.3	8	-

Also available with extra teeth for higher productivity

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
8	FBK0504455	-	8	78	18	25	0.2	8	-
10	FBK0504456	-	10	78	22	30	0.3	10	-
12	FBK0504457	-	12	89	26	35	0.3	12	-
16	FBK0504458	-	16	89	34	40	0.3	16	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

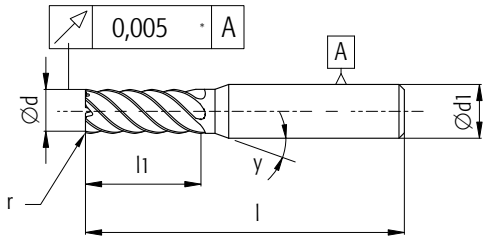
∞ Remark ∞ means no collusion in projection length area

Multi Flute

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

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

H3-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0504459	0.3	6	64	8	15	0.05	6	15
4	FBK0504460	0.3	6	64	10	16	0.1	6	15
5	FBK0504461	0.3	6	64	12	18	0.15	6	15
5	FBK0504462	0.5	6	64	12	18	0.15	6	15
6	FBK0504463	0.5	6	64	14	20	0.2	6	-
6	FBK0504464	1	6	64	14	20	0.2	6	-
8	FBK0504465	0.5	8	70	18	25	0.3	6	-
8	FBK0503542	1	8	70	18	25	0.3	6	-
10	FBK0504466	0.5	10	78	22	30	0.3	6	-
10	FBK0503543	1	10	78	22	30	0.3	6	-
10	FBK0504467	1.5	10	78	22	30	0.3	6	-
12	FBK0503573	0.5	12	78	26	35	0.3	6	-
12	FBK0504468	1	12	78	26	35	0.3	6	-
12	FBK0504469	2	12	78	26	35	0.3	6	-
16	FBK0504470	1	16	89	34	40	0.3	6	-
16	FBK0504471	2	16	89	34	40	0.3	6	-
20	FBK0504472	1	20	102	42	48	0.3	8	-
20	FBK0504473	2	20	102	42	48	0.3	8	-

Also available with extra teeth for higher productivity

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
8	FBK0504474	0.5	8	78	18	25	0.2	8	-
10	FBK0504475	0.5	10	78	22	30	0.3	10	-
12	FBK0504476	0.5	12	89	26	35	0.3	12	-
16	FBK0504477	0.5	16	89	34	40	0.3	16	-

∞ Remark ∞ means no collusion in projection length area

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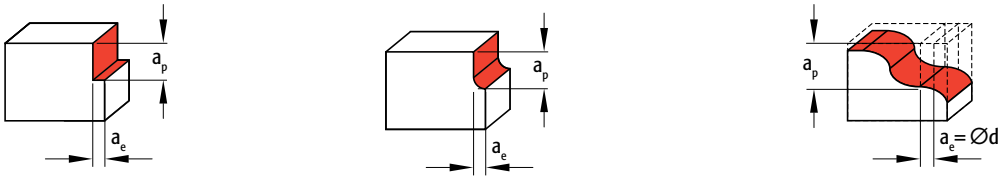
Cutting conditions

- 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

Material group	Hardness	Cutting speed Vc m/min	Coolant
H3	50-60 HRc	110 - 170	min.lub.
H4	60-70 HRc	80 - 140	min.lub.



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3	< 3.0	< 0.03	0.020 - 0.035
4	< 6.0	< 0.05	0.030 - 0.045
5	< 7.5	< 0.07	0.035 - 0.055
6	< 12.0	< 0.10	0.045 - 0.065
8	< 16.0	< 0.13	0.060 - 0.080
10	< 20.0	< 0.17	0.070 - 0.095
12	< 24.0	< 0.21	0.085 - 0.110
16	< 32.0	< 0.28	0.095 - 0.125
20	< 40.0	< 0.35	0.105 - 0.140

End mills for hardened steels 45-70 HRc

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

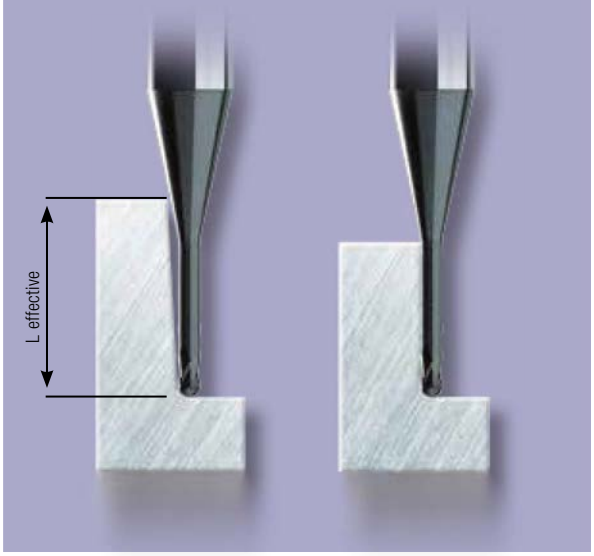
Program

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

Ballnose geometries

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

Effective length compared with incline angle-
Increases the effective length



FBK0503554

Workpiece material: 1.2162

Hardness: 60 HRc

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

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

Higher productivity

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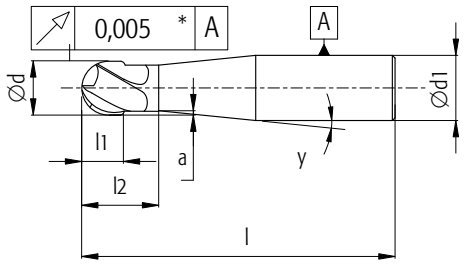
2 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
1	FBK0504478	0.5	6	64	2	4	0.05	2	7
1	FBK0504479	0.5	6	78	2	4	0.05	2	4
1.5	FBK0504480	0.8	6	64	2	4	0.05	2	6
1.5	FBK0504481	0.8	6	78	2	4	0.05	2	4
2	FBK0504482	1.0	6	64	3	5	0.05	2	6
2	FBK0505816	1.0	6	64	3	8	0.05	2	9
2	FBK0505817	1.0	6	78	3	8	0.05	2	4
2	FBK0504483	1.0	6	78	3	15	0.05	2	5
3	FBK0504484	1.5	6	64	4	7	0.05	2	5
3	FBK0504485	1.5	6	78	4	15	0.05	2	4
3	FBK0504486	1.5	6	100	4	7	0.05	2	2
4	FBK0504487	2.0	6	64	5	8	0.1	2	4
4	FBK0504488	2.0	6	78	5	15	0.1	2	3
4	FBK0504489	2.0	6	100	5	8	0.1	2	1
5	FBK0504490	2.5	6	64	5	10	0.15	2	2
5	FBK0504491	2.5	6	78	5	20	0.15	2	2
6	FBK0504492	3.0	6	64	6	25	0.2	2	-
6	FBK0504493	3.0	6	78	6	35	0.2	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

TOTEM

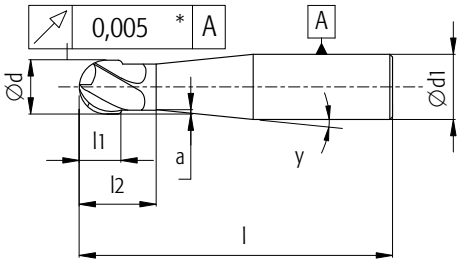
Solid Carbide End Mills

2 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
6	FBK0504494	3.0	8	100	6	25	0.2	2	2
8	FBK0504495	4.0	8	64	8	25	0.3	2	-
8	FBK0504496	4.0	8	78	8	35	0.3	2	-
8	FBK0504497	4.0	8	100	8	50	0.3	2	-
8	FBK0504498	4.0	10	120	8	30	0.3	2	2
10	FBK0504499	5.0	10	78	10	35	0.3	2	-
10	FBK0504500	5.0	10	100	10	55	0.3	2	-
10	FBK0504501	5.0	12	120	10	30	0.3	2	2
12	FBK0504502	6.0	12	78	12	35	0.3	2	-
12	FBK0504503	6.0	12	100	12	55	0.3	2	-
12	FBK0504504	6.0	16	120	12	40	0.3	2	5
16	FBK0504505	8.0	16	100	20	50	0.3	2	-
16	FBK0504506	8.0	16	150	20	100	0.3	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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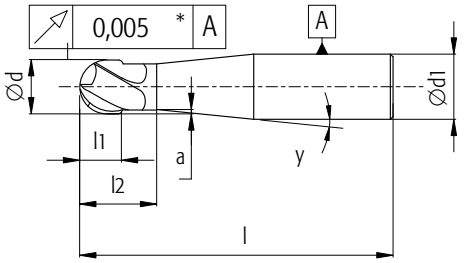
4 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
6	FBK0504511	3	6	64	6	25	0.2	4	-
6	FBK0504512	3	6	78	6	35	0.2	4	-
6	FBK0504513	3	8	100	6	25	0.2	4	2
8	FBK0504514	4	8	64	8	25	0.3	4	-
8	FBK0504515	4	8	78	8	35	0.3	4	-
8	FBK0504516	4	8	100	8	50	0.3	4	-
8	FBK0504517	4	10	120	8	30	0.3	4	2
10	FBK0504518	5	10	78	10	35	0.3	4	-
10	FBK0504519	5	10	100	10	55	0.3	4	-
10	FBK0504520	5	12	120	10	30	0.3	4	2
12	FBK0504521	6	12	78	12	35	0.3	4	-
12	FBK0504522	6	12	100	12	55	0.3	4	-
12	FBK0504523	6	16	120	12	40	0.3	4	5
16	FBK0504524	8	16	100	20	50	0.3	4	-
16	FBK0504525	8	16	150	20	100	0.3	4	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

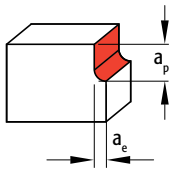
Cutting conditions

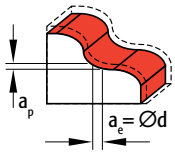
- Centre cutting high performance ball nose 2 flute for 45-70 HRc
- Centre cutting high performance ball nose 4 flute for 45-70 HRc

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	150 - 250	emulsion
P4	< 1000	< 35-48 HRc	120 - 200	emulsion
P4	< 1400	< 35 HRc	100 - 160	emulsion
H1		42-50 HRc	120 - 180	min.lub.
H2		50-55 HRc	150 - 200	min.lub.
H3		55-60 HRc	200 - 250	min.lub.
H4		60-70 HRc	200 - 250	min.lub.

Tips:

Radial runout determines tool life- manufactured with precison tolerance





Roughing P3 / P4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1	< 1.0	< 0.30	0.015 - 0.025
1.5	< 1.5	< 0.45	0.020 - 0.030
2	< 2.0	< 0.60	0.025 - 0.035
3	< 3.0	< 0.90	0.028 - 0.040
4	< 4.0	< 1.20	0.030 - 0.045
5	< 5.0	< 1.50	0.035 - 0.050
6	< 6.0	< 1.80	0.040 - 0.055
8	< 8.0	< 2.40	0.050 - 0.065
10	< 10.0	< 3.00	0.055 - 0.080
12	< 12.0	< 3.60	0.065 - 0.090
16	< 16.0	< 4.80	0.075 - 0.110

Finishing P3 / P4

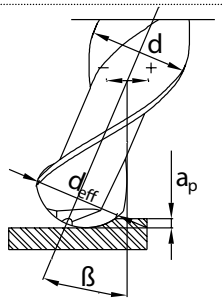
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1	< 1.0	< 0.10	0.020 - 0.030
1.5	< 1.5	< 0.15	0.025 - 0.040
2	< 2.0	< 0.20	0.030 - 0.050
3	< 3.0	< 0.30	0.040 - 0.060
4	< 4.0	< 0.40	0.050 - 0.080
5	< 5.0	< 0.50	0.060 - 0.110
6	< 6.0	< 0.60	0.065 - 0.125
8	< 8.0	< 0.80	0.080 - 0.130
10	< 10.0	< 1.00	0.085 - 0.135
12	< 12.0	< 1.20	0.100 - 0.140
16	< 16.0	< 1.60	0.120 - 0.160

Roughing H1 / H2 / H3 / H4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1	< 0.5	< 0.05	0.015 - 0.025
1.5	< 0.75	< 0.08	0.020 - 0.030
2	< 1.0	< 0.10	0.025 - 0.035
3	< 1.5	< 0.15	0.028 - 0.040
4	< 2.0	< 0.20	0.030 - 0.045
5	< 2.5	< 0.25	0.035 - 0.050
6	< 3.0	< 0.30	0.040 - 0.055
8	< 4.0	< 0.40	0.050 - 0.065
10	< 5.0	< 0.50	0.055 - 0.080
12	< 6.0	< 0.60	0.065 - 0.090
16	< 8.0	< 0.80	0.075 - 0.110

Finishing H1 / H2 / H3 / H4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1	< 0.5	< 0.02	0.020 - 0.030
1.5	< 0.75	< 0.03	0.025 - 0.040
2	< 1.0	< 0.04	0.030 - 0.050
3	< 1.5	< 0.06	0.040 - 0.060
4	< 2.0	< 0.08	0.050 - 0.080
5	< 2.5	< 0.10	0.060 - 0.110
6	< 3.0	< 0.12	0.065 - 0.125
8	< 4.0	< 0.16	0.080 - 0.130
10	< 5.0	< 0.20	0.085 - 0.135
12	< 6.0	< 0.24	0.100 - 0.140
16	< 8.0	< 0.32	0.120 - 0.160



For the cutting speed Vc calculation the effective cutting diameter d_{eff} has to be taken into account. See formula.

$$ß \neq 0; \quad d_{eff} = d \times \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$$

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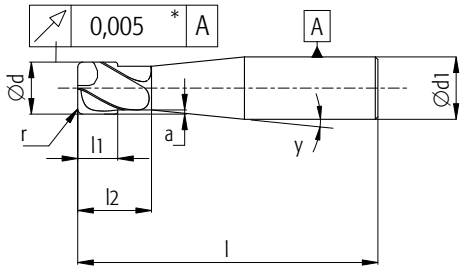
2 Flute

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

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

P3-P4
H1-H4



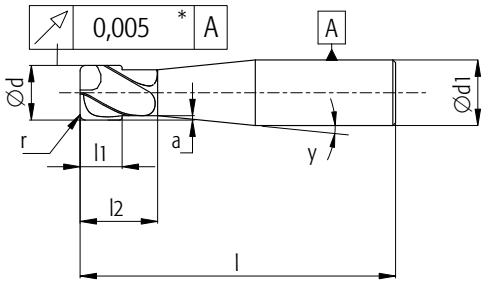
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
1.5	FBK0504534	0.3	6	64	2	5	0.05	2	7
1.5	FBK0504535	0.3	6	64	2	10	0.05	2	9
2	FBK0504536	0.5	6	64	3	5	0.05	2	6
2	FBK0505818	0.5	6	64	3	8	0.05	2	7
2	FBK0504537	0.5	6	64	3	10	0.05	2	8
2	FBK0504538	0.5	6	78	3	15	0.05	2	5
2	FBK0505819	0.5	6	78	3	8	0.05	2	4
3	FBK0504539	0.5	6	64	4	7	0.05	2	5
3	FBK0504540	0.5	6	78	4	15	0.05	2	4
4	FBK0504541	0.5	6	64	5	8	0.1	2	4
4	FBK0504542	1.0	6	64	5	8	0.1	2	4
4	FBK0504543	0.5	6	78	5	15	0.1	2	3
4	FBK0504544	1.0	6	78	5	15	0.1	2	3
5	FBK0504545	0.5	6	64	5	10	0.15	2	3
5	FBK0504546	1.0	6	64	5	10	0.15	2	3
5	FBK0504547	0.5	6	78	5	20	0.15	2	3
5	FBK0504548	1.0	6	78	5	20	0.15	2	2
6	FBK0504549	0.5	6	64	6	25	0.2	2	-
6	FBK0504550	1.0	6	64	6	25	0.2	2	-
6	FBK0504551	1.5	6	64	6	25	0.2	2	-
6	FBK0504552	0.5	6	78	6	35	0.2	2	-
6	FBK0504553	1.0	6	78	6	35	0.2	2	-
6	FBK0504554	1.5	6	78	6	35	0.2	2	-
6	FBK0504555	0.5	8	100	6	25	0.2	2	2
6	FBK0504556	1.0	8	100	6	25	0.2	2	2

2 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
6	FBK0504557	1.5	8	100	6	25	0.2	2	2
8	FBK0504558	0.5	8	64	8	25	0.3	2	-
8	FBK0504559	1.0	8	64	8	25	0.3	2	-
8	FBK0504560	2.0	8	64	8	25	0.3	2	-
8	FBK0504561	0.5	8	78	8	25	0.3	2	-
8	FBK0504562	1.0	8	78	8	35	0.3	2	-
8	FBK0504563	2.0	8	78	8	35	0.3	2	-
8	FBK0504564	1.0	8	100	8	50	0.3	2	-
8	FBK0504565	2.0	8	100	8	50	0.3	2	-
8	FBK0504566	1.0	10	120	8	30	0.3	2	2
8	FBK0504567	2.0	10	120	8	30	0.3	2	2
10	FBK0504568	0.5	10	78	10	35	0.3	2	-
10	FBK0504569	1.0	10	78	10	35	0.3	2	-
10	FBK0504570	2.0	10	78	10	35	0.3	2	-
10	FBK0504571	1.0	10	100	10	55	0.3	2	-
10	FBK0504572	2.0	10	100	10	55	0.3	2	-
10	FBK0504573	2.0	12	120	10	30	0.3	2	2
12	FBK0504574	0.5	12	78	12	35	0.3	2	-
12	FBK0504575	2.0	12	78	12	35	0.3	2	-
12	FBK0504576	1.0	12	100	12	55	0.3	2	-
12	FBK0504577	2.0	12	100	12	55	0.3	2	-
12	FBK0504578	2.0	16	120	12	40	0.3	2	5
16	FBK0504579	3.5	16	100	20	50	0.3	2	-
16	FBK0504580	3.5	16	150	20	100	0.3	2	-

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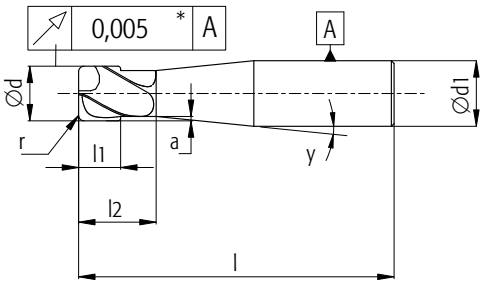
4 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0505820	0.5	6	64	4	7	0.05	4	5
3	FBK0505821	0.5	6	78	4	15	0.05	4	4
4	FBK0505822	0.5	6	64	5	8	0.1	4	4
4	FBK0505823	1.0	6	64	5	8	0.1	4	4
4	FBK0505824	0.5	6	78	5	15	0.1	4	3
4	FBK0505825	1.0	6	78	5	15	0.1	4	3
5	FBK0505826	0.5	6	64	5	10	0.15	4	2
5	FBK0505827	1.0	6	64	5	10	0.15	4	2
5	FBK0505828	0.5	6	78	5	20	0.15	4	2
5	FBK0505829	1.0	6	78	5	20	0.15	4	2
6	FBK0504581	0.5	6	64	6	25	0.2	4	-
6	FBK0504582	1.0	6	64	6	25	0.2	4	-
6	FBK0504583	1.5	6	64	6	25	0.2	4	-
6	FBK0504584	0.5	6	78	6	35	0.2	4	-
6	FBK0504585	1.5	6	78	6	35	0.2	4	-
6	FBK0504586	0.5	8	100	6	25	0.2	4	2
6	FBK0504587	1.5	8	100	6	25	0.2	4	2
8	FBK0504588	0.5	8	64	8	25	0.3	4	-
8	FBK0504589	1.0	8	64	8	25	0.3	4	-
8	FBK0504590	2.0	8	64	8	25	0.3	4	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

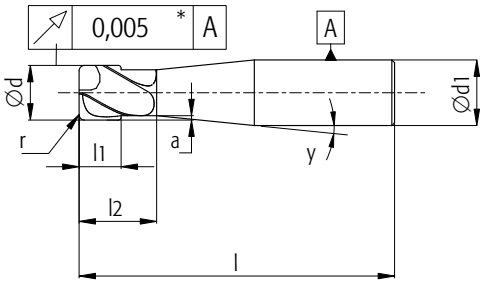
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute

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

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

P3-P4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
8	FBK0504591	0.5	8	78	8	25	0.3	4	-
8	FBK0504592	1.0	8	78	8	35	0.3	4	-
8	FBK0504593	2.0	8	78	8	35	0.3	4	-
8	FBK0505830	0.5	8	100	8	50	0.3	4	-
8	FBK0504594	1.0	8	100	8	50	0.3	4	-
8	FBK0504595	2.0	8	100	8	50	0.3	4	-
8	FBK0504596	1.0	10	120	8	30	0.3	4	-
8	FBK0504597	2.0	10	120	8	30	0.3	4	2
10	FBK0504598	0.5	10	78	10	35	0.3	4	2
10	FBK0504599	2.0	10	78	10	35	0.3	4	-
10	FBK0504600	1.0	10	100	10	55	0.3	4	-
10	FBK0504601	2.0	10	100	10	55	0.3	4	-
10	FBK0504602	2.0	12	120	10	30	0.3	4	-
12	FBK0504603	0.5	12	78	12	35	0.3	4	2
12	FBK0504604	2.0	12	78	12	35	0.3	4	-
12	FBK0504605	1.0	12	100	12	55	0.3	4	-
12	FBK0504606	2.0	12	100	12	55	0.3	4	-
12	FBK0504607	2.0	16	120	12	40	0.3	4	-
16	FBK0504608	3.5	16	100	20	50	0.3	4	5
16	FBK0504609	3.5	16	150	20	100	0.3	4	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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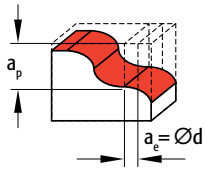
Cutting conditions

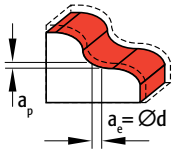
- Centre cutting high performance torus 2 flute for 45-70 HRc
- Centre cutting high performance torus 4 flute for 45-70 HRc

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	150 - 250	emulsion
P4	< 1000	< 35-48 HRc	120 - 200	emulsion
P4	< 1400	< 35 HRc	100 - 160	emulsion
H1		42-50 HRc	120 - 180	min.lub.
H2		50-55 HRc	150 - 200	min.lub.
H3		55-60 HRc	200 - 250	min.lub.
H4		60-70 HRc	200 - 250	min.lub.

Tips:

Radial runout determines tool life- manufactured with precison tolerance



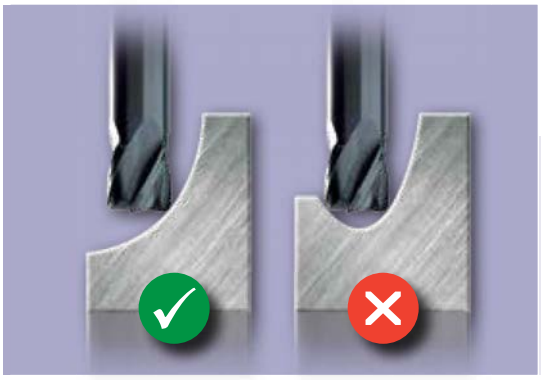


Shoulder milling P3 / P4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1.5	< 1.5	< 0.15	0.025 - 0.040
2	< 2.0	< 0.2	0.030 - 0.050
3	< 3.0	< 0.30	0.040 - 0.060
4	< 4.0	< 0.40	0.050 - 0.080
5	< 5.0	< 0.50	0.060 - 0.110
6	< 6.0	< 0.60	0.065 - 0.125
8	< 8.0	< 0.80	0.080 - 0.130
10	< 10.0	< 1.00	0.085 - 0.135
12	< 12.0	< 1.20	0.100 - 0.140
16	< 16.0	< 1.60	0.100 - 0.150

Shoulder milling H1 / H2 / H3 / H4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
1.5	< 0.7	< 0.03	0.025 - 0.040
2	< 1.0	< 0.04	0.030 - 0.050
3	< 1.5	< 0.06	0.040 - 0.060
4	< 2.0	< 0.10	0.050 - 0.080
5	< 2.5	< 0.13	0.060 - 0.110
6	< 3.0	< 0.18	0.065 - 0.125
8	< 4.0	< 0.24	0.080 - 0.130
10	< 5.0	< 0.30	0.085 - 0.135
12	< 6.0	< 0.36	0.100 - 0.140
16	< 8.0	< 0.50	0.100 - 0.150



Torus endmills:

- High effective cutting speed
- Optimized surface finish
- Available in 2 Flute and 4 flute
- Finishing – Semi finishing (Roughing) with a single tool

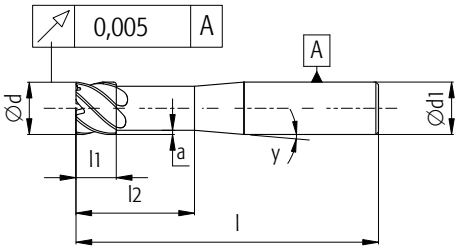
Multi Flute

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

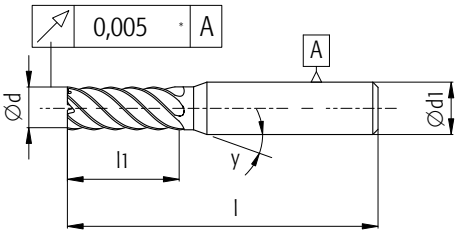
HPM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

P1-P3
H1-H4

Short



Standard



* For endmills L 100 mm.

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Short									
3	FBK0504610	-	6	64	3	10	0.05	6	15
4	FBK0504611	-	6	64	4	10	0.1	6	15
5	FBK0504612	-	6	64	5	15	0.15	6	15
6	FBK0504613	-	6	64	6	20	0.2	6	-
8	FBK0504614	-	8	64	8	20	0.3	6	-
10	FBK0504615	-	10	70	10	25	0.3	6	-
12	FBK0504616	-	12	78	12	25	0.3	6	-
16	FBK0504617	-	16	89	16	35	0.3	6	-
20	FBK0504618	-	20	102	20	40	0.3	8	-
Standard									
3	FBK0504619	-	6	64	10	-	-	6	15
4	FBK0504620	-	6	64	10	-	-	6	15
5	FBK0504621	-	6	64	15	-	-	6	15
6	FBK0504622	-	6	64	20	-	-	6	15
8	FBK0504623	-	8	64	20	-	-	6	-
10	FBK0504624	-	10	70	25	-	-	6	-
12	FBK0504625	-	12	78	25	-	-	6	-
16	FBK0504626	-	16	89	30	-	-	6	-
20	FBK0504627	-	20	102	40	-	-	8	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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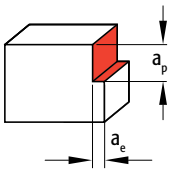
Cutting conditions

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

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	130 - 180	emulsion
P4	< 1000	< 35-48 HRc	100 - 160	emulsion
P4	< 1400	< 35 HRc	90 - 140	emulsion
H1		42-50 HRc	150 - 200	min.lub.
H2		50-55 HRc	120 - 180	min.lub.
H3		55-60 HRc	80 - 150	min.lub.
H4		60-70 HRc	80 - 150	min.lub.

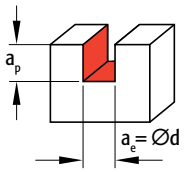
Tips:

Radial runout determines tool life- manufactured with precison tolerance



Shoulder milling
P3 / P4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3	< 6.0	< 0.30	0.020 - 0.035
4	< 8.0	< 0.40	0.030 - 0.045
5	< 10.0	< 0.50	0.035 - 0.055
6	< 12.0	< 0.60	0.045 - 0.65
8	< 16.0	< 0.80	0.060 - 0.080
10	< 20.0	< 1.00	0.070 - 0.095
12	< 24.0	< 1.20	0.085 - 0.110
16	< 32.0	< 1.60	0.095 - 0.125
20	< 40.0	< 2.00	0.105 - 0.140



Slot milling
H1 / H2 / H3 / H4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
< 6.0	< 0.06	0.020 - 0.035	0.3 - 0.6
< 8.0	< 0.10	0.030 - 0.045	0.3 - 0.6
< 10.0	< 0.12	0.035 - 0.055	0.3 - 0.6
< 12.0	< 0.18	0.045 - 0.650	0.4 - 0.9
< 16.0	< 0.24	0.060 - 0.080	0.4 - 0.9
< 20.0	< 0.30	0.070 - 0.095	0.4 - 0.9
< 24.0	< 0.36	0.085 - 0.110	0.4 - 0.9
< 32.0	< 0.48	0.095 - 0.125	
< 40.0	< 0.60	0.105 - 0.140	0.4 - 0.9

Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

TOTEM

Solid Carbide End Mills

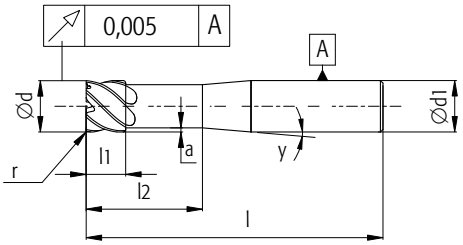
Multi Flute

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

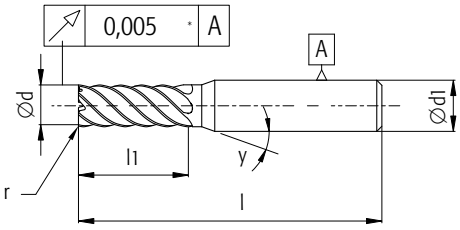
HPM HSM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

P1-P3
H1-H4

Short



Standard



* For endmills L l 100 mm.

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Short									
3	FBK0504632	0.3	6	64	3	10	0.05	6	15
4	FBK0504633	0.3	6	64	4	10	0.1	6	15
5	FBK0504634	0.3	6	64	5	15	0.15	6	15
5	FBK0504635	0.5	6	64	5	15	0.15	6	15
6	FBK0504636	0.5	6	64	6	20	0.2	6	-
6	FBK0504637	1	6	64	6	20	0.2	6	-
8	FBK0504638	0.5	8	64	8	20	0.3	6	-
8	FBK0504639	1	8	64	8	20	0.3	6	-
10	FBK0504640	0.5	10	70	10	25	0.3	6	-
10	FBK0504641	1	10	70	10	25	0.3	6	-
10	FBK0504642	1.5	10	70	10	25	0.3	6	-
12	FBK0504643	0.5	12	78	12	25	0.3	6	-
12	FBK0504644	1	12	78	12	25	0.3	6	-
12	FBK0504645	2	12	78	12	25	0.3	6	-
16	FBK0504646	1	16	89	16	35	0.3	6	-
16	FBK0504647	2	16	89	16	35	0.3	6	-
20	FBK0504648	1	20	102	20	40	0.3	8	-
20	FBK0504649	2	20	102	20	40	0.3	8	-
Standard									
3	FBK0504650	0.3	6	64	10	-	-	6	15
4	FBK0504651	0.3	6	64	10	-	-	6	15
5	FBK0504652	0.3	6	64	15	-	-	6	15
5	FBK0504653	0.5	6	64	15	-	-	6	15

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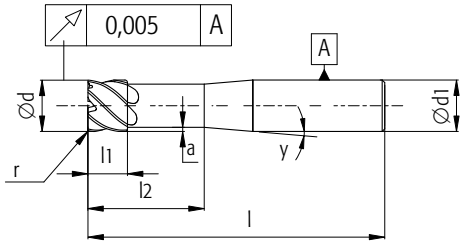
Multi Flute

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

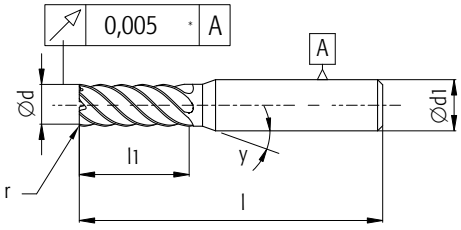
HPM HSM | 6-8 | 45° | f7 | 6535 HA | h5 | TiAlN

P1-P3
H1-H4

Short



Standard



* For endmills L l 100 mm.

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
6	FBK0504654	0.5	6	64	20	-	-	6	-
6	FBK0504655	1	6	64	20	-	-	6	-
8	FBK0504656	0.5	8	64	20	-	-	6	-
8	FBK0504657	1	8	64	20	-	-	6	-
10	FBK0504658	0.5	10	70	25	-	-	6	-
10	FBK0504659	1	10	70	25	-	-	6	-
10	FBK0504660	1.5	10	70	25	-	-	6	-
12	FBK0504661	0.5	12	78	25	-	-	6	-
12	FBK0504662	1	12	78	25	-	-	6	-
12	FBK0504663	2	12	78	25	-	-	6	-
16	FBK0504664	1	16	89	35	-	-	6	-
16	FBK0504665	2	16	89	35	-	-	6	-
20	FBK0504666	1	20	102	40	-	-	8	-
20	FBK0504667	2	20	102	40	-	-	8	-

Tensile strength: N/mm² | Hardness: HRC

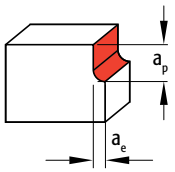
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting conditions

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

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	130 - 180	emulsion
P4	< 1000	< 35-48 HRc	100 - 160	emulsion
P4	< 1400	< 35 HRc	90 - 140	emulsion
H1		42-50 HRc	150 - 200	min.lub.
H2		50-55 HRc	120 - 180	min.lub.
H3		55-60 HRc	80 - 150	min.lub.
H4		60-70 HRc	80 - 150	min.lub.

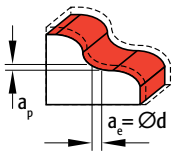


Roughing

Shoulder milling

P3 / P4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3	< 6.0	< 0.30	0.020 - 0.035
4	< 8.0	< 0.40	0.030 - 0.045
5	< 10.0	< 0.50	0.035 - 0.055
6	< 12.0	< 0.60	0.045 - 0.65
8	< 16.0	< 0.80	0.060 - 0.080
10	< 20.0	< 1.00	0.070 - 0.095
12	< 24.0	< 1.20	0.085 - 0.110
16	< 32.0	< 1.60	0.095 - 0.125
20	< 40.0	< 2.00	0.105 - 0.140



Finishing

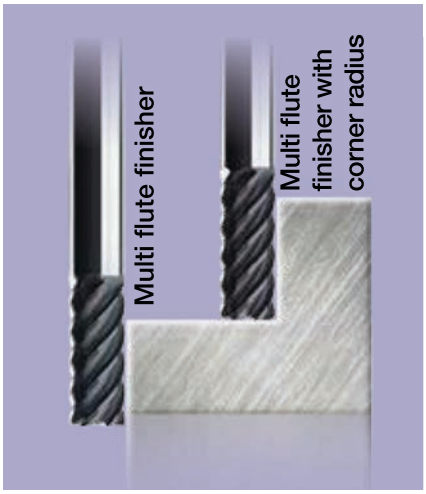
Shoulder milling

H1 / H2 / H3 / H4

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3	< 6.0	< 0.06	0.020 - 0.035
4	< 8.0	< 0.10	0.030 - 0.045
5	< 10.0	< 0.12	0.035 - 0.055
6	< 12.0	< 0.18	0.045 - 0.650
8	< 16.0	< 0.24	0.060 - 0.080
10	< 20.0	< 0.30	0.070 - 0.095
12	< 24.0	< 0.36	0.085 - 0.110
16	< 32.0	< 0.48	0.095 - 0.125
20	< 40.0	< 0.60	0.105 - 0.140

Multi flute finisher
Recommended for Side milling.

Multi flute finisher with corner radius
Recommended for Shoulder milling.



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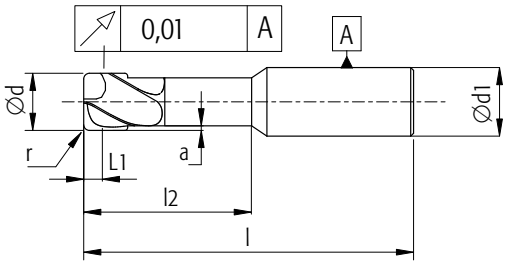
4 Flute

Centre cutting high performance torus cutter for high feed machining

HVM HPM | e8 | 6535 HA | h5 | TiAlN

P3-P4
K1-K2
H1



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
2	FBK0503979	0.5	6	60	1	4	0.1	4	15
2	FBK0503980	0.5	6	60	1	8	0.1	4	15
3	FBK0503981	0.75	6	60	1.5	6	0.15	4	15
3	FBK0503982	0.75	6	60	1.5	12	0.15	4	15
4	FBK0503983	1	6	60	2	8	0.2	4	15
4	FBK0503984	1	6	60	2	16	0.2	4	15
6	FBK0503659	1.5	6	80	3	12	0.25	4	-
6	FBK0503986	1.5	6	80	3	24	0.25	4	-
8	FBK0503987	2	8	90	4	16	0.3	4	-
8	FBK0503988	2	8	90	4	32	0.3	4	-
10	FBK0503989	2.5	10	100	5	20	0.4	4	-
10	FBK0503990	2.5	10	100	5	40	0.4	4	-
12	FBK0503991	3	12	110	6	24	0.5	4	-
12	FBK0503992	3	12	110	6	48	0.5	4	-

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

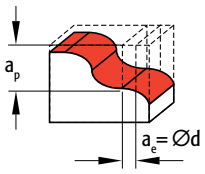
Cutting conditions

Centre cutting high performance torus cutter for high feed machining

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	200 - 300	emulsion
P4	< 1000	< 35-48 HRc	150 - 200	emulsion
P4	< 1400	< 35 HRc	120 - 180	emulsion
H1		42-50 HRc	80 - 120	min.lub.
K1	125-500	< 32 HRc	100 - 200	emulsion

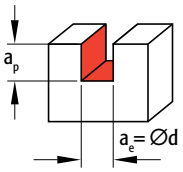
Tips:

Radial runout determines tool life- manufactured with precison tolerance



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
2	< 0.1	< 1.2	0.3 - 0.7
3	< 0.2	< 1.8	0.3 - 0.7
4	< 0.3	< 2.4	0.3 - 0.7
6	< 0.4	< 4.0	0.5 - 1.0
8	< 0.5	< 5.5	0.5 - 1.0
10	< 0.6	< 7.0	0.5 - 1.0
12	< 0.8	< 8.4	0.5 - 1.0



Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
2	< 0.1	< 2.0	0.3 - 0.6
3	< 0.2	< 3.0	0.3 - 0.6
4	< 0.3	< 4.0	0.3 - 0.6
6	< 0.4	< 6.0	0.4 - 0.9
8	< 0.5	< 8.0	0.4 - 0.9
10	< 0.6	< 10.0	0.4 - 0.9
12	< 0.8	< 12.0	0.4 - 0.9

FBK0503987

Workpiece material: 1.2311

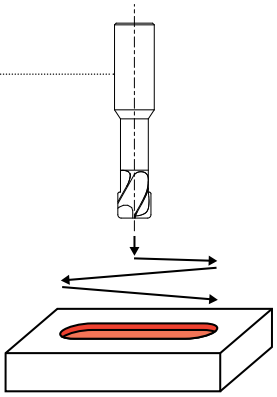
	Forbes
Ø	8mm
Z	4 Flute
vc	150 m/min
n	6000 rpm
fz	0.,70 mm/t
vf	16800 mm/min
ap	0.,5 mm
ae	8.0 mm
Coolant	emulsion

Q	67.2 cm³/min

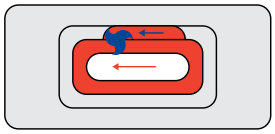
Advantages

- High feed rates
- Lower cycle time for roughing

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



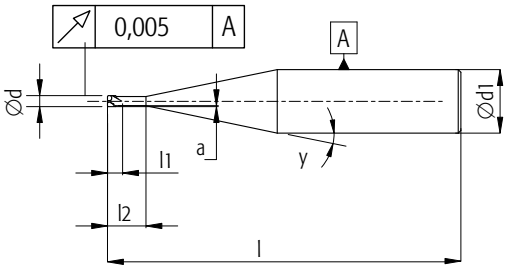
Always mill from inside to outside. If possible use helicoidal down-milling, otherwise ramping down.



2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

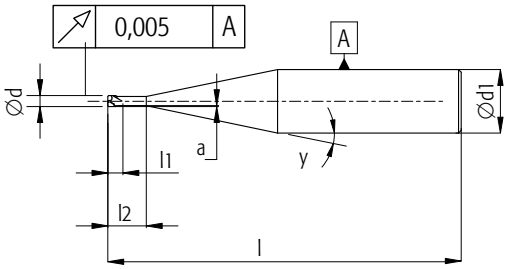
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0505434	-	4	51	0.15	-	-	2	15	0.634	0.656	0.705	0.762
0.2	FBK0505435	-	4	51	0.25	-	-	2	15	0.737	0.763	0.820	0.887
0.3	FBK0505436	-	4	51	0.3	-	-	2	15	1.099	1.137	1.223	1.322
0.3	FBK0505437	-	4	51	0.3	1.5	0.01	2	15	1.861	1.926	2.070	2.238
0.3	FBK0505438	-	4	51	0.3	3	0.01	2	15	3.412	3.531	3.795	4.103
0.4	FBK0505439	-	4	51	0.4	-	-	2	15	1.202	1.244	1.338	1.446
0.4	FBK0505440	-	4	51	0.4	2	0.01	2	15	2.378	2.461	2.645	2.860
0.4	FBK0505441	-	4	51	0.4	4	0.01	2	15	4.445	4.600	4.945	5.346
0.5	FBK0505442	-	4	51	0.5	-	-	2	15	1.306	1.351	1.453	1.570
0.5	FBK0505443	-	4	51	0.5	3	0.015	2	15	3.431	3.551	3.817	4.126
0.5	FBK0505444	-	4	51	0.5	6	0.015	2	15	6.532	6.760	7.266	7.856
0.5	FBK0505445	-	4	51	0.5	8	0.015	2	15	8.599	8.899	9.566	10.342
0.5	FBK0505446	-	4	51	0.5	10	0.015	2	15	10.667	11.038	11.866	12.828
0.6	FBK0505447	-	4	51	0.6	-	-	2	15	2.062	2.134	2.294	2.480
0.6	FBK0505448	-	4	51	0.6	2	0.025	2	15	2.572	2.662	2.861	3.093
0.6	FBK0505449	-	4	51	0.6	4	0.025	2	15	4.639	4.801	5.161	5.580
0.6	FBK0505450	-	4	51	0.6	6	0.025	2	15	6.707	6.940	7.461	8.066
0.6	FBK0505451	-	4	51	0.6	8	0.025	2	15	8.774	9.080	9.760	10.552
0.6	FBK0505452	-	4	51	0.6	10	0.025	2	15	10.841	11.219	12.060	13.038
0.8	FBK0505453	-	4	51	0.8	-	-	2	15	2.269	2.348	2.524	2.729
0.8	FBK0505454	-	4	51	0.8	2.5	0.025	2	15	3.089	3.196	3.436	3.715
0.8	FBK0505455	-	4	51	0.8	5	0.025	2	15	5.673	5.871	6.311	6.823
0.8	FBK0505456	-	4	51	0.8	8	0.025	2	15	8.774	9.080	9.760	10.552
0.8	FBK0505457	-	4	51	0.8	10	0.025	2	15	10.841	11.219	12.060	13.038
1	FBK0505458	-	4	51	1	-	-	2	15	2.476	2.562	2.754	2.977

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1	FBK0505459	-	4	51	1	4	0.025	2	15	4.639	4.801	5.161	5.580
1	FBK0505460	-	4	51	1	6	0.025	2	15	6.707	6.940	7.461	8.066
1	FBK0505461	-	4	51	1	8	0.025	2	15	8.774	9.080	9.760	10.552
1	FBK0505462	-	4	51	1	10	0.025	2	15	10.841	11.219	12.060	13.038
1	FBK0505463	-	4	51	1	12	0.025	2	15	12.909	13.358	14.360	15.525
1	FBK0505464	-	4	51	1	15	0.025	2	15	16.010	16.568	17.809	19.254
1	FBK0505465	-	4	60	1	20	0.025	2	15	21.178	21.916	23.559	25.470
1	FBK0505466	-	4	60	1	25	0.025	2	15	26.346	27.264	29.308	
1.2	FBK0505467	-	4	51	1.2	-	-	2	15	3.471	3.592	3.862	4.175
1.2	FBK0505468	-	4	51	1.2	4	0.025	2	15	4.912	5.083	5.464	5.907
1.2	FBK0505469	-	4	51	1.2	6	0.025	2	15	6.979	7.222	7.763	8.393
1.2	FBK0505470	-	4	51	1.2	8	0.025	2	15	9.046	9.361	10.063	10.879
1.2	FBK0505471	-	4	51	1.2	12	0.025	2	15	13.181	13.640	14.662	15.852
1.2	FBK0505472	-	4	51	1.2	16	0.025	2	15	17.316	17.919	19.262	20.825
1.5	FBK0505473	-	4	51	1.5	-	-	2	15	3.781	3.913	4.206	4.548
1.5	FBK0505474	-	4	51	1.5	4	0.025	2	15	4.912	5.083	5.464	5.907
1.5	FBK0505475	-	4	51	1.5	6	0.025	2	15	6.979	7.222	7.763	8.393
1.5	FBK0505476	-	4	51	1.5	8	0.025	2	15	9.046	9.361	10.063	10.879
1.5	FBK0505477	-	4	51	1.5	10	0.025	2	15	11.114	11.501	12.363	13.366
1.5	FBK0505478	-	4	51	1.5	12	0.025	2	15	13.181	13.640	14.662	15.852
1.5	FBK0505479	-	4	51	1.5	15	0.025	2	15	16.282	16.849	18.112	19.581
1.5	FBK0505480	-	4	60	1.5	20	0.025	2	15	21.450	22.198	23.861	
1.5	FBK0505481	-	4	60	1.5	25	0.025	2	15	26.619	27.546	29.611	
2	FBK0505482	-	4	51	2	-	-	2	15	4.298	4.448	4.781	5.169
2	FBK0505483	-	4	51	2	6	0.05	2	15	7.075	7.322	7.871	8.509
2	FBK0505484	-	4	51	2	8	0.05	2	15	9.143	9.461	10.170	10.995

∞ Remark ∞ means no collusion in projection length area

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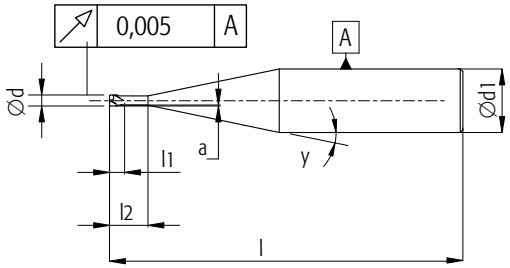
2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

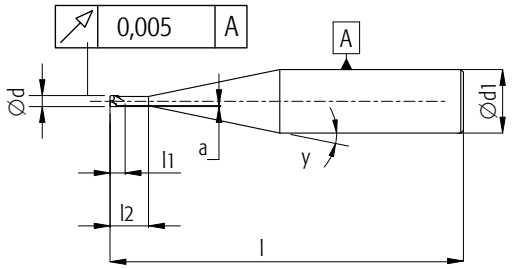
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
2	FBK0505485	-	4	51	2	10	0.05	2	15	11.210	11.601	12.470	13.482
2	FBK0505486	-	4	51	2	12	0.05	2	15	13.277	13.740	14.770	15.968
2	FBK0505487	-	4	51	2	16	0.05	2	15	17.412	18.019	19.369	
2	FBK0505488	-	4	60	2	20	0.05	2	15	21.547	22.297	23.969	
2	FBK0505489	-	4	60	2	25	0.05	2	15	26.715	27.646		
2	FBK0505490	-	4	64	2	30	0.05	2	15	31.883	32.994		
2.5	FBK0505491	-	4	51	2.5	-	-	2	15	4.815	4.983	5.356	5.791
2.5	FBK0505492	-	4	51	2.5	6	0.05	2	15	7.075	7.322	7.871	8.509
2.5	FBK0505493	-	4	51	2.5	8	0.05	2	15	9.143	9.461	10.170	10.995
2.5	FBK0505494	-	4	51	2.5	10	0.05	2	15	11.210	11.601	12.470	13.482
2.5	FBK0505495	-	4	51	2.5	12	0.05	2	15	13.277	13.740	14.770	
2.5	FBK0505496	-	4	51	2.5	16	0.05	2	15	17.412	18.019	19.369	
2.5	FBK0505497	-	4	60	2.5	20	0.05	2	15	21.547	22.297		
2.5	FBK0505498	-	4	60	2.5	25	0.05	2	15	26.715	27.646		
2.5	FBK0505499	-	4	64	2.5	30	0.05	2	15	31.883	32.994		
3	FBK0505500	-	4	51	3	-	-	2	15	5.332	5.518	5.931	6.412
3	FBK0505501	-	4	51	3	6	0.05	2	15	7.075	7.322	7.871	8.509
3	FBK0505502	-	4	51	3	8	0.05	2	15	9.143	9.461	10.170	
3	FBK0505503	-	4	51	3	10	0.05	2	15	11.210	11.601	12.470	
3	FBK0505504	-	4	51	3	12	0.05	2	15	13.277	13.740		
3	FBK0505505	-	4	51	3	16	0.05	2	15	17.412	18.019		
3	FBK0505506	-	4	60	3	20	0.05	2	15	21.547	22.297		
3	FBK0505507	-	4	60	3	25	0.05	2	15	26.715	27.646		
3	FBK0505508	-	4	64	3	30	0.05	2	15	31.883			

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0503664	-	6	64	0.15	-	-	2	10	0.552	0.583	0.655	0.747
0.2	FBK0505831	-	6	64	0.5	-	-	2	10	0.710	0.749	0.842	0.960
0.3	FBK0505546	-	6	64	0.5	-	-	2	10	1.236	1.304	1.465	1.672
0.3	FBK0503667	-	6	64	0.5	1.5	0.01	2	11	1.826	1.916	2.126	2.388
0.3	FBK0503668	-	6	64	0.5	3	0.01	2	12	3.397	3.549	3.898	4.323
0.4	FBK0505547	-	6	64	0.6	-	-	2	10	1.341	1.415	1.590	1.814
0.4	FBK0503670	-	6	64	0.6	2	0.01	2	11	2.350	2.465	2.735	3.072
0.4	FBK0503671	-	6	64	0.6	4	0.01	2	13	4.439	4.621	5.032	5.525
0.5	FBK0505548	-	6	64	0.8	-	-	2	10	1.552	1.637	1.839	2.099
0.5	FBK0503673	-	6	64	0.8	3	0.015	2	12	3.421	3.574	3.926	4.354
0.5	FBK0503674	-	6	64	0.8	6	0.015	2	15	6.532	6.760	7.266	7.856
0.5	FBK0503675	-	6	64	0.8	8	0.015	2	15	8.599	8.899	9.566	10.342
0.5	FBK0503676	-	6	64	0.8	10	0.015	2	15	10.667	11.038	11.866	12.828
0.6	FBK0505549	-	6	64	0.9	-	-	2	10	1.749	1.845	2.073	2.366
0.6	FBK0503678	-	6	64	0.9	2	0.025	2	11	2.531	2.656	2.947	3.310
0.6	FBK0503679	-	6	64	0.9	4	0.025	2	12	4.623	4.830	5.304	5.884
0.6	FBK0503680	-	6	64	0.9	6	0.025	2	15	6.707	6.940	7.461	8.066
0.6	FBK0503681	-	6	64	0.9	8	0.025	2	15	8.774	9.080	9.760	10.552
0.6	FBK0503682	-	6	64	0.9	10	0.025	2	15	10.841	11.219	12.060	13.038
0.8	FBK0505550	-	6	64	1.2	-	-	2	10	2.591	2.733	3.071	3.504
0.8	FBK0503684	-	6	64	1.2	2.5	0.025	2	11	3.055	3.205	3.556	3.994
0.8	FBK0503685	-	6	64	1.2	5	0.025	2	13	5.664	5.896	6.421	7.051
0.8	FBK0503686	-	6	64	1.2	8	0.025	2	15	8.774	9.080	9.760	10.552
0.8	FBK0503687	-	6	64	1.2	10	0.025	2	15	10.841	11.219	12.060	13.038

∞ Remark ∞ means no collusion in projection length area

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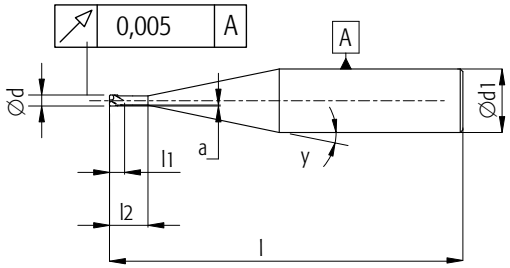
2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

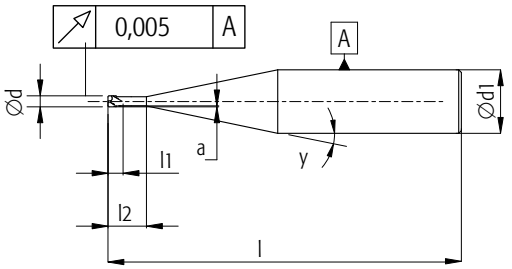
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
1	FBK0505551	-	6	64	1.5	-	-	2	10	2.906	3.066	3.445	3.931
1	FBK0503689	-	6	64	1.5	4	0.025	2	11	4.625	4.853	5.385	6.048
1	FBK0503690	-	6	64	1.5	6	0.025	2	14	6.703	6.956	7.522	8.190
1	FBK0505195	-	6	64	1.5	8	0.025	2	15	8.774	9.080	9.760	10.552
1	FBK0503691	-	6	64	1.5	10	0.025	2	15	10.841	11.219	12.060	13.038
1	FBK0505196	-	6	64	1.5	12	0.025	2	15	12.909	13.358	14.360	15.525
1	FBK0503692	-	6	64	1.5	15	0.025	2	15	16.010	16.568	17.809	19.254
1	FBK0503693	-	6	64	1.5	20	0.025	2	15	21.178	21.916	23.559	25.470
1	FBK0503694	-	6	64	1.5	25	0.025	2	15	26.346	27.264	29.308	31.686
1.2	FBK0505552	-	6	64	1.8	-	-	2	10	3.932	4.148	4.660	5.318
1.2	FBK0503696	-	6	64	1.8	4	0.025	2	11	4.827	5.065	5.620	6.312
1.2	FBK0503697	-	6	64	1.8	6	0.025	2	13	6.940	7.224	7.868	8.639
1.2	FBK0503698	-	6	64	1.8	8	0.025	2	15	9.046	9.361	10.063	10.879
1.2	FBK0503699	-	6	64	1.8	12	0.025	2	15	13.181	13.640	14.662	15.852
1.2	FBK0503700	-	6	64	1.8	16	0.025	2	15	17.316	17.919	19.262	20.825
1.5	FBK0505553	-	6	64	2.3	-	-	2	9	4.438	4.713	5.380	6.267
1.5	FBK0505197	-	6	64	2.3	4	0.025	2	10	4.818	5.082	5.710	6.516
1.5	FBK0503702	-	6	64	2.3	6	0.025	2	12	6.928	7.237	7.949	8.817
1.5	FBK0505198	-	6	64	2.3	8	0.025	2	15	9.046	9.361	10.063	10.879
1.5	FBK0503703	-	6	64	2.3	10	0.025	2	15	11.114	11.501	12.363	13.366
1.5	FBK0505199	-	6	64	2.3	12	0.025	2	15	13.181	13.640	14.662	15.852
1.5	FBK0503704	-	6	64	2.3	15	0.025	2	15	16.282	16.849	18.112	19.581
1.5	FBK0503705	-	6	64	2.3	20	0.025	2	15	21.450	22.198	23.861	25.797
1.5	FBK0503706	-	6	64	2.3	25	0.025	2	15	26.619	27.546	29.611	32.013
2	FBK0503707	-	6	64	3	-	-	2	8	5.171	5.537	6.453	7.733

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
2	FBK0503708	-	6	64	3	6	0.05	2	11	7.055	7.403	8.214	9.226
2	FBK0505200	-	6	64	3	8	0.05	2	14	9.134	9.478	10.250	11.160
2	FBK0503709	-	6	64	3	10	0.05	2	15	11.210	11.601	12.470	13.482
2	FBK0505201	-	6	64	3	12	0.05	2	15	13.277	13.740	14.770	15.968
2	FBK0503710	-	6	64	3	16	0.05	2	15	17.412	18.019	19.369	20.941
2	FBK0503711	-	6	64	3	20	0.05	2	15	21.547	22.297	23.969	25.913
2	FBK0503712	-	6	64	3	25	0.05	2	15	26.715	27.646	29.718	32.129
2	FBK0503713	-	6	64	3	30	0.05	2	15	31.883	32.994	35.467	38.345
2.5	FBK0503714	-	6	64	3	-	-	2	8	5.171	5.537	6.453	7.733
2.5	FBK0503715	-	6	64	3	6	0.05	2	10	7.071	7.459	8.381	9.563
2.5	FBK0505202	-	6	64	3	8	0.05	2	12	9.136	9.545	10.483	11.628
2.5	FBK0503716	-	6	64	3	10	0.05	2	15	11.210	11.601	12.470	13.482
2.5	FBK0505203	-	6	64	3	12	0.05	2	15	13.277	13.740	14.770	15.968
2.5	FBK0503717	-	6	64	3	16	0.05	2	15	17.412	18.019	19.369	20.941
2.5	FBK0503718	-	6	64	3	20	0.05	2	15	21.547	22.297	23.969	25.913
2.5	FBK0503719	-	6	64	3	25	0.05	2	15	26.715	27.646	29.718	32.129
2.5	FBK0505204	-	6	64	3	30	0.05	2	15	31.883	32.994	35.467	38.345
3	FBK0503720	-	6	64	3	-	-	2	7	5.174	5.602	6.716	8.385
3	FBK0503721	-	6	64	3	6	0.05	2	8	7.149	7.656	8.922	10.693
3	FBK0505205	-	6	64	3	8	0.05	2	10	9.175	9.679	10.875	12.409
3	FBK0503722	-	6	64	3	10	0.05	2	13	11.210	11.668	12.709	13.954
3	FBK0505206	-	6	64	3	12	0.05	2	15	13.277	13.740	14.770	15.968
3	FBK0503723	-	6	64	3	16	0.05	2	15	17.412	18.019	19.369	20.941
3	FBK0503724	-	6	64	3	20	0.05	2	15	21.547	22.297	23.969	25.913
3	FBK0503725	-	6	64	3	25	0.05	2	15	26.715	27.646	29.718	32.129
3	FBK0503726	-	6	64	3	30	0.05	2	15	31.883	32.994	35.467	38.345

∞ Remark ∞ means no collusion in projection length area

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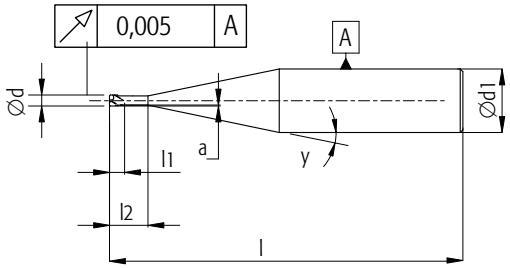
4 Flute

Centre cutting high performance 4 flute micro end mill

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505509	-	4	51	0.25	2	0.01	4	15	2.378	2.461	2.645	2.860
0.2	FBK0505510	-	4	51	0.25	4	0.01	4	15	4.445	4.600	4.945	5.346
0.4	FBK0505511	-	4	51	0.40	2	0.01	4	15	2.378	2.461	2.645	2.860
0.4	FBK0505512	-	4	51	0.40	4	0.01	4	15	4.445	4.600	4.945	5.346
0.4	FBK0505513	-	4	51	0.40	6	0.01	4	15	6.513	6.740	7.245	7.833
0.4	FBK0505514	-	4	51	0.40	8	0.01	4	15	8.580	8.879	9.545	10.319
0.4	FBK0505515	-	4	51	0.40	10	0.01	4	15	10.647	11.018	11.844	12.805
0.5	FBK0505516	-	4	51	0.50	2	0.02	4	15	2.397	2.481	2.667	2.883
0.5	FBK0505517	-	4	51	0.50	4	0.02	4	15	4.465	4.620	4.967	5.369
0.5	FBK0505518	-	4	51	0.50	6	0.02	4	15	6.532	6.760	7.266	7.856
0.5	FBK0505519	-	4	51	0.50	8	0.02	4	15	8.599	8.899	9.566	10.342
0.5	FBK0505520	-	4	51	0.50	10	0.02	4	15	10.667	11.038	11.866	12.828
1	FBK0505521	-	4	51	1.00	2	0.03	4	15	2.572	2.662	2.861	3.093
1	FBK0505522	-	4	51	1.00	4	0.03	4	15	4.639	4.801	5.161	5.580
1	FBK0505523	-	4	51	1.00	6	0.03	4	15	6.707	6.940	7.461	8.066
1	FBK0505524	-	4	51	1.00	8	0.03	4	15	8.774	9.080	9.760	10.552
1	FBK0505525	-	4	51	1.00	10	0.03	4	15	10.841	11.219	12.060	13.038
1.5	FBK0505526	-	4	51	1.50	-	-	4	15	3.781	3.913	4.206	4.548
1.5	FBK0505527	-	4	51	1.50	4	0.03	4	15	4.912	5.083	5.464	5.907

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

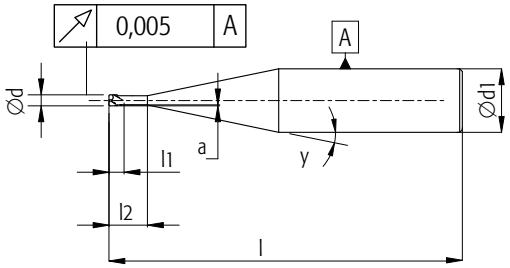
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

∞ Remark ∞ means no collusion in projection length area

4 Flute

Centre cutting high performance 4 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1.5	FBK0505528	-	4	51	1.50	6	0.03	4	15	6.979	7.222	7.763	8.393
1.5	FBK0505529	-	4	51	1.50	8	0.03	4	15	9.046	9.361	10.063	10.879
1.5	FBK0505530	-	4	51	1.50	10	0.03	4	15	11.114	11.501	12.363	13.366
2	FBK0505531	-	4	51	2.00	-	-	4	15	4.298	4.448	4.781	5.169
2	FBK0505532	-	4	51	2.00	4	0.05	4	15	5.008	5.182	5.571	6.023
2	FBK0505533	-	4	51	2.00	6	0.05	4	15	7.075	7.322	7.871	8.509
2	FBK0505534	-	4	51	2.00	8	0.05	4	15	9.143	9.461	10.170	10.995
2	FBK0505535	-	4	51	2.00	10	0.05	4	15	11.210	11.601	12.470	13.482
2.5	FBK0505536	-	4	51	2.50	-	-	4	15	4.815	4.983	5.356	5.791
2.5	FBK0505537	-	4	51	2.50	4	0.05	4	15	5.008	5.182	5.571	6.023
2.5	FBK0505538	-	4	51	2.50	6	0.05	4	15	7.075	7.322	7.871	8.509
2.5	FBK0505539	-	4	51	2.50	8	0.05	4	15	9.143	9.461	10.170	10.995
2.5	FBK0505540	-	4	51	2.50	10	0.05	4	15	11.210	11.601	12.470	13.482
3	FBK0505541	-	4	51	3.00	-	-	4	15	5.332	5.518	5.931	6.412
3	FBK0505542	-	4	51	3.00	5	0.05	4	15	5.525	5.717	6.146	6.644
3	FBK0505543	-	4	51	3.00	6	0.05	4	15	7.075	7.322	7.871	8.509
3	FBK0505544	-	4	51	3.00	8	0.05	4	15	9.143	9.461	10.170	∞
3	FBK0505545	-	4	51	3.00	10	0.05	4	15	11.210	11.601	12.470	∞

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H3
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	56-60

∞ Remark ∞ means no collusion in projection length area

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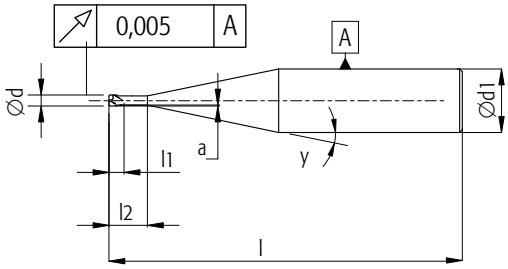
4 Flute

Centre cutting high performance 4 flute micro end mill

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



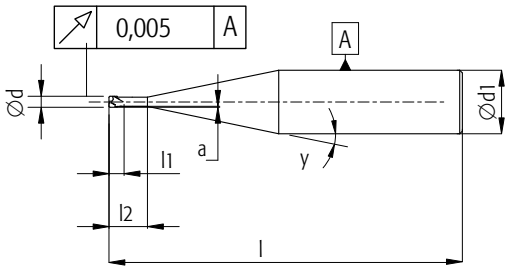
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505554	-	6	64	0.3	2	0.01	4	11	2.350	2.465	2.735	3.072
0.2	FBK0505555	-	6	64	0.3	4	0.01	4	13	4.439	4.621	5.032	5.525
0.2	FBK0505832	-	6	64	0.3	6	0.01	4	15	6.513	6.740	7.245	7.833
0.2	FBK0505833	-	6	64	0.3	8	0.01	4	15	8.580	8.879	9.545	10.319
0.2	FBK0505834	-	6	64	0.3	10	0.01	4	15	10.647	11.018	11.844	12.805
0.4	FBK0505556	-	6	64	0.6	2	0.01	4	11	2.350	2.465	2.735	3.072
0.4	FBK0505557	-	6	64	0.6	4	0.01	4	13	4.439	4.621	5.032	5.525
0.4	FBK0505558	-	6	64	0.6	6	0.01	4	15	6.513	6.740	7.245	7.833
0.4	FBK0505559	-	6	64	0.6	8	0.01	4	15	8.580	8.879	9.545	10.319
0.4	FBK0505560	-	6	64	0.6	10	0.01	4	15	10.647	11.018	11.844	12.805
0.5	FBK0505561	-	6	64	0.8	2	0.015	4	11	2.376	2.494	2.767	3.108
0.5	FBK0505562	-	6	64	0.8	4	0.015	4	12	4.464	4.664	5.122	5.682
0.5	FBK0505563	-	6	64	0.8	6	0.015	4	15	6.532	6.760	7.266	7.856
0.5	FBK0505564	-	6	64	0.8	8	0.015	4	15	8.599	8.899	9.566	10.342
0.5	FBK0505565	-	6	64	0.8	10	0.015	4	15	10.667	11.038	11.866	12.828
1	FBK0505566	-	6	64	1.5	-	-	4	10	3.055	3.223	3.621	4.133
1	FBK0505567	-	6	64	1.5	4	0.025	4	11	4.625	4.853	5.385	6.048
1	FBK0505568	-	6	64	1.5	6	0.025	4	14	6.703	6.956	7.522	8.190
1	FBK0505569	-	6	64	1.5	8	0.025	4	15	8.774	9.080	9.760	10.552
1	FBK0505570	-	6	64	1.5	10	0.025	4	15	10.841	11.219	12.060	13.038
1.5	FBK0505571	-	6	64	2.3	-	-	4	9	4.438	4.713	5.380	6.267

∞ Remark ∞ means no collusion in projection length area

4 Flute

Centre cutting high performance 4 flute micro end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
1.5	FBK0505572	-	6	64	2.3	4	0.025	4	10	4.818	5.082	5.710	6.516
1.5	FBK0505573	-	6	64	2.3	6	0.025	4	12	6.928	7.237	7.949	8.817
1.5	FBK0505574	-	6	64	2.3	8	0.025	4	15	9.046	9.361	10.063	10.879
1.5	FBK0505575	-	6	64	2.3	10	0.025	4	15	11.114	11.501	12.363	13.366
2	FBK0505576	-	6	64	3	-	-	4	8	5.171	5.537	6.453	7.733
2	FBK0505577	-	6	64	3	4.5	0.05	4	9	5.513	5.854	6.683	7.785
2	FBK0505578	-	6	64	3	6	0.05	4	11	7.055	7.403	8.214	9.226
2	FBK0505579	-	6	64	3	8	0.05	4	14	9.134	9.478	10.250	11.160
2	FBK0505580	-	6	64	3	10	0.05	4	15	11.210	11.601	12.470	13.482
2.5	FBK0505581	-	6	64	3	-	-	4	8	5.171	5.537	6.453	7.733
2.5	FBK0505582	-	6	64	3	4.5	0.05	4	9	5.513	5.854	6.683	7.785
2.5	FBK0505583	-	6	64	3	6	0.05	4	11	7.055	7.403	8.214	9.226
2.5	FBK0505584	-	6	64	3	8	0.05	4	14	9.134	9.478	10.250	11.160
2.5	FBK0505585	-	6	64	3	10	0.05	4	15	11.210	11.601	12.470	13.482
3	FBK0505586	-	6	64	3	-	-	4	6	5.193	5.710	7.131	9.498
3	FBK0505587	-	6	64	3	4.5	0.05	4	7	5.612	6.077	7.285	9.095
3	FBK0505588	-	6	64	3	6	0.05	4	8	7.149	7.656	8.922	10.693
3	FBK0505589	-	6	64	3	8	0.05	4	10	9.175	9.679	10.875	12.409
3	FBK0505590	-	6	64	3	10	0.05	4	13	11.210	11.668	12.709	13.954

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H3
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	56-60

∞ Remark ∞ means no collusion in projection length area

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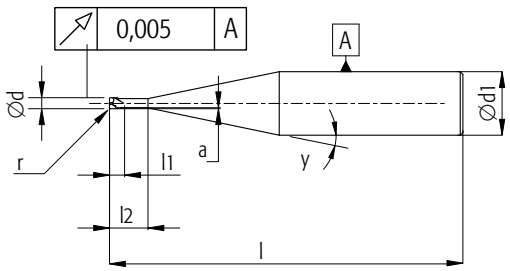
2 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

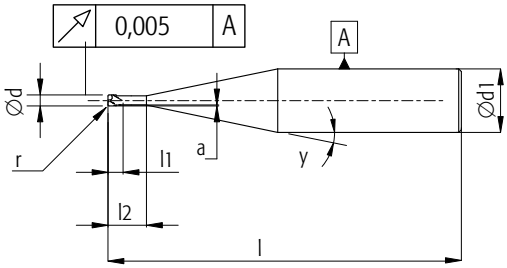
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0505835	0.03	4	51	0.2	-	-	2	7	0.560	0.604	0.718	0.889
0.1	FBK0505293	0.03	4	51	0.15	-	-	2	15	0.633	0.654	0.701	0.755
0.2	FBK0505294	0.03	4	51	0.25	-	-	2	15	0.736	0.761	0.816	0.879
0.3	FBK0505295	0.05	4	51	0.3	-	-	2	15	1.097	1.134	1.215	1.310
0.3	FBK0505296	0.05	4	51	0.3	1.5	0.01	2	15	1.860	1.923	2.063	2.226
0.3	FBK0505297	0.05	4	51	0.3	3	0.01	2	15	3.410	3.527	3.788	4.091
0.4	FBK0505298	0.05	4	51	0.4	-	-	2	15	1.201	1.241	1.330	1.434
0.4	FBK0505299	0.05	4	51	0.4	2	0.01	2	15	2.376	2.457	2.638	2.848
0.4	FBK0505300	0.05	4	51	0.4	4	0.01	2	15	4.444	4.597	4.938	5.334
0.5	FBK0505301	0.05	4	51	0.5	-	-	2	15	1.304	1.348	1.445	1.558
0.5	FBK0505302	0.05	4	51	0.5	1	0.015	2	15	1.362	1.408	1.509	1.628
0.5	FBK0505303	0.05	4	51	0.5	3	0.015	2	15	3.429	3.547	3.809	4.114
0.5	FBK0505304	0.05	4	51	0.5	6	0.015	2	15	6.530	6.756	7.259	7.844
0.5	FBK0505305	0.05	4	51	0.5	8	0.015	2	15	8.598	8.896	9.558	10.330
0.5	FBK0505306	0.05	4	51	0.5	10	0.015	2	15	10.665	11.035	11.858	12.816
0.6	FBK0505307	0.05	4	51	0.6	-	-	2	15	2.060	2.130	2.286	2.468
0.6	FBK0505308	0.05	4	51	0.6	2	0.025	2	15	2.570	2.658	2.854	3.081
0.6	FBK0505309	0.05	4	51	0.6	4	0.025	2	15	4.638	4.798	5.153	5.567
0.6	FBK0505310	0.05	4	51	0.6	6	0.025	2	15	6.705	6.937	7.453	8.054
0.6	FBK0505311	0.05	4	51	0.6	8	0.025	2	15	8.772	9.076	9.753	10.540
0.6	FBK0505312	0.05	4	51	0.6	10	0.025	2	15	10.840	11.216	12.052	13.026
0.8	FBK0505313	0.05	4	51	0.8	-	-	2	15	2.267	2.344	2.516	2.716
0.8	FBK0505314	0.05	4	51	0.8	2.5	0.025	2	15	3.087	3.193	3.429	3.703

∞ Remark ∞ means no collusion in projection length area

2 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.8	FBK0505315	0.05	4	51	0.8	5	0.025	2	15	5.671	5.867	6.303	6.811
0.8	FBK0505316	0.05	4	51	0.8	8	0.025	2	15	8.772	9.076	9.753	10.540
0.8	FBK0505317	0.05	4	51	0.8	10	0.025	2	15	10.840	11.216	12.052	13.026
1	FBK0505318	0.1	4	51	1	-	-	2	15	2.472	2.555	2.739	2.953
1	FBK0505319	0.1	4	51	1	2	0.025	2	15	2.569	2.655	2.846	3.069
1	FBK0505320	0.1	4	51	1	4	0.025	2	15	4.636	4.794	5.146	5.555
1	FBK0505321	0.1	4	51	1	6	0.025	2	15	6.703	6.933	7.446	8.042
1	FBK0505322	0.1	4	51	1	8	0.025	2	15	8.771	9.073	9.745	10.528
1	FBK0505323	0.1	4	51	1	10	0.025	2	15	10.838	11.212	12.045	13.014
1	FBK0505324	0.1	4	51	1	12	0.025	2	15	12.905	13.352	14.345	15.500
1	FBK0505325	0.1	4	51	1	15	0.025	2	15	16.006	16.561	17.794	19.230
1	FBK0505326	0.1	4	60	1	20	0.025	2	15	21.175	21.909	23.544	25.446
1	FBK0505327	0.1	4	60	1	25	0.025	2	15	26.343	27.257	29.293	∞
1.2	FBK0505328	0.1	4	51	1.2	-	-	2	15	3.468	3.585	3.847	4.150
1.2	FBK0505329	0.1	4	51	1.2	4	0.025	2	15	4.908	5.076	5.449	5.883
1.2	FBK0505330	0.1	4	51	1.2	6	0.025	2	15	6.975	7.215	7.748	8.369
1.2	FBK0505331	0.1	4	51	1.2	8	0.025	2	15	9.043	9.354	10.048	10.855
1.2	FBK0505332	0.1	4	51	1.2	12	0.025	2	15	13.177	13.633	14.647	15.828
1.2	FBK0505333	0.1	4	51	1.2	16	0.025	2	15	17.312	17.912	19.247	20.800
1.5	FBK0505334	0.15	4	51	1.5	-	-	2	15	3.776	3.903	4.184	4.511
1.5	FBK0505335	0.15	4	51	1.5	3	0.025	2	15	3.873	4.003	4.291	4.627
1.5	FBK0505336	0.15	4	51	1.5	4	0.025	2	15	4.906	5.072	5.441	5.870
1.5	FBK0505337	0.15	4	51	1.5	6	0.025	2	15	6.974	7.212	7.741	8.357

∞ Remark ∞ means no collusion in projection length area

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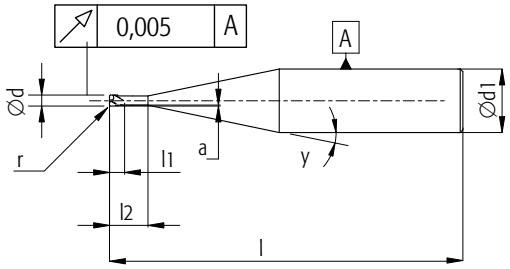
2 Flute

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

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1.5	FBK0505338	0.15	4	51	1.5	8	0.025	2	15	9.041	9.351	10.041	10.843
1.5	FBK0505339	0.15	4	51	1.5	10	0.025	2	15	11.108	11.490	12.340	13.329
1.5	FBK0505340	0.15	4	51	1.5	12	0.025	2	15	13.176	13.630	14.640	15.816
1.5	FBK0505341	0.15	4	51	1.5	15	0.025	2	15	16.277	16.839	18.090	19.545
1.5	FBK0505342	0.15	4	60	1.5	20	0.025	2	15	21.445	22.187	23.839	∞
1.5	FBK0505343	0.15	4	60	1.5	25	0.025	2	15	26.613	27.536	29.588	∞
2	FBK0505344	0.2	4	51	2	-	-	2	15	4.292	4.434	4.751	5.121
2	FBK0505345	0.2	4	51	2	4	0.05	2	15	5.001	5.169	5.541	5.974
2	FBK0505346	0.2	4	51	2	6	0.05	2	15	7.069	7.308	7.841	8.461
2	FBK0505347	0.2	4	51	2	8	0.05	2	15	9.136	9.447	10.140	10.947
2	FBK0505348	0.2	4	51	2	10	0.05	2	15	11.203	11.587	12.440	13.433
2	FBK0505349	0.2	4	51	2	12	0.05	2	15	13.271	13.726	14.740	15.919
2	FBK0505350	0.2	4	51	2	16	0.05	2	15	17.405	18.005	19.339	∞
2	FBK0505351	0.2	4	60	2	20	0.05	2	15	21.540	22.283	23.939	∞
2	FBK0505352	0.2	4	60	2	25	0.05	2	15	26.708	27.632	∞	∞
2	FBK0505353	0.2	4	64	2	30	0.05	2	15	31.877	32.980	∞	∞
2.5	FBK0505354	0.2	4	51	2.5	-	-	2	15	4.808	4.969	5.326	5.742

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

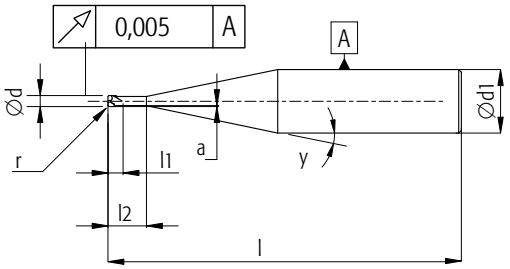
∞ Remark ∞ means no collusion in projection length area

2 Flute

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

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
2.5	FBK0505355	0.2	4	51	2.5	4	0.05	2	15	5.001	5.169	5.541	5.974
2.5	FBK0505356	0.2	4	51	2.5	6	0.05	2	15	7.069	7.308	7.841	8.461
2.5	FBK0505357	0.2	4	51	2.5	8	0.05	2	15	9.136	9.447	10.140	10.947
2.5	FBK0505358	0.2	4	51	2.5	10	0.05	2	15	11.203	11.587	12.440	13.433
2.5	FBK0505359	0.2	4	51	2.5	12	0.05	2	15	13.271	13.726	14.740	∞
2.5	FBK0505360	0.2	4	51	2.5	16	0.05	2	15	17.405	18.005	19.339	∞
2.5	FBK0505361	0.2	4	60	2.5	20	0.05	2	15	21.540	22.283	∞	∞
2.5	FBK0505362	0.2	4	60	2.5	25	0.05	2	15	26.708	27.632	∞	∞
2.5	FBK0505363	0.2	4	64	2.5	30	0.05	2	15	31.877	32.980	∞	∞
3	FBK0505364	0.3	4	51	3	-	-	2	15	5.322	5.497	5.886	6.340
3	FBK0505365	0.3	4	51	3	6	0.05	2	15	7.065	7.301	7.826	∞
3	FBK0505366	0.3	4	51	3	8	0.05	2	15	9.133	9.440	10.125	∞
3	FBK0505367	0.3	4	51	3	10	0.05	2	15	11.200	11.580	12.425	∞
3	FBK0505368	0.3	4	51	3	12	0.05	2	15	13.267	13.719	14.725	∞
3	FBK0505369	0.3	4	51	3	16	0.05	2	15	17.402	17.998	∞	∞
3	FBK0505370	0.3	4	60	3	20	0.05	2	15	21.537	22.276	∞	∞
3	FBK0505371	0.3	4	60	3	25	0.05	2	15	26.705	27.625	∞	∞
3	FBK0505372	0.3	4	64	3	30	0.05	2	15	31.873	∞	∞	∞

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H3
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	56-60

∞ Remark ∞ means no collusion in projection length area

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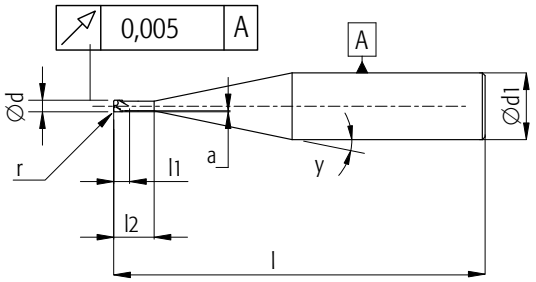
2 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

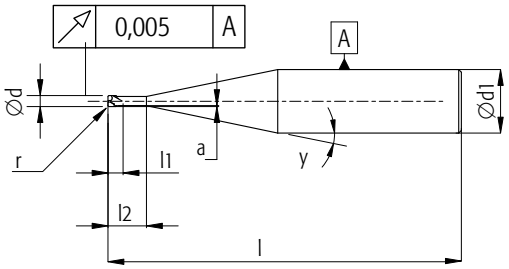
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505137	0.03	6	64	0.3	-	-	2	10	0.709	0.746	0.834	0.948
0.3	FBK0505410	0.05	6	64	0.5	-	-	2	10	1.234	1.299	1.453	1.651
0.3	FBK0503728	0.05	6	64	0.5	1.5	0.01	2	11	1.824	1.911	2.115	2.369
0.3	FBK0503729	0.05	6	64	0.5	3	0.01	2	12	3.395	3.544	3.888	4.307
0.4	FBK0505411	0.05	6	64	0.6	-	-	2	10	1.339	1.410	1.577	1.793
0.4	FBK0503731	0.05	6	64	0.6	2	0.01	2	11	2.347	2.460	2.725	3.054
0.4	FBK0503732	0.05	6	64	0.6	4	0.01	2	13	4.437	4.616	5.023	5.511
0.5	FBK0505412	0.05	6	64	0.8	-	-	2	10	1.549	1.632	1.827	2.078
0.5	FBK0503734	0.05	6	64	0.8	3	0.015	2	12	3.419	3.570	3.916	4.338
0.5	FBK0503735	0.05	6	64	0.8	6	0.015	2	15	6.530	6.756	7.259	7.844
0.5	FBK0503736	0.05	6	64	0.8	8	0.015	2	15	8.598	8.896	9.558	10.330
0.5	FBK0503737	0.05	6	64	0.8	10	0.015	2	15	10.665	11.035	11.858	12.816
0.6	FBK0505413	0.05	6	64	0.9	-	-	2	10	2.272	2.395	2.684	3.056
0.6	FBK0503739	0.05	6	64	0.9	2	0.025	2	11	2.529	2.651	2.936	3.291
0.6	FBK0503740	0.05	6	64	0.9	4	0.025	2	12	4.621	4.825	5.295	5.867
0.6	FBK0503741	0.05	6	64	0.9	6	0.025	2	15	6.705	6.937	7.453	8.054
0.6	FBK0503742	0.05	6	64	0.9	8	0.025	2	15	8.772	9.076	9.753	10.540
0.6	FBK0503743	0.05	6	64	0.9	10	0.025	2	15	10.840	11.216	12.052	13.026
0.8	FBK0505414	0.05	6	64	1.2	-	-	2	10	2.588	2.728	3.058	3.483
0.8	FBK0503745	0.05	6	64	1.2	2.5	0.025	2	11	3.052	3.200	3.545	3.976
0.8	FBK0503746	0.05	6	64	1.2	5	0.025	2	13	5.662	5.892	6.412	7.036
0.8	FBK0503747	0.05	6	64	1.2	8	0.025	2	15	8.772	9.076	9.753	10.540
0.8	FBK0503748	0.05	6	64	1.2	10	0.025	2	15	10.840	11.216	12.052	13.026
1	FBK0505415	0.1	6	64	1.5	-	-	2	9	2.890	3.063	3.482	4.040
1	FBK0503750	0.1	6	64	1.5	4	0.025	2	11	4.620	4.843	5.363	6.011

∞ Remark ∞ means no collusion in projection length area

2 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1	FBK0503751	0.1	6	64	1.5	6	0.025	2	14	6.700	6.948	7.506	8.164
1	FBK0505138	0.1	6	64	1.5	8	0.025	2	15	8.771	9.073	9.745	10.528
1	FBK0503752	0.1	6	64	1.5	10	0.025	2	15	10.838	11.212	12.045	13.014
1	FBK0505139	0.1	6	64	1.5	12	0.025	2	15	12.905	13.352	14.345	15.500
1	FBK0503753	0.1	6	64	1.5	15	0.025	2	15	16.006	16.561	17.794	19.230
1	FBK0503754	0.1	6	64	1.5	20	0.025	2	15	21.175	21.909	23.544	25.446
1	FBK0503755	0.1	6	64	1.5	25	0.025	2	15	26.343	27.257	29.293	31.661
1.2	FBK0505416	0.1	6	64	1.8	-	-	2	9	3.903	4.139	4.710	5.471
1.2	FBK0503757	0.1	6	64	1.8	4	0.025	2	11	4.822	5.055	5.598	6.275
1.2	FBK0503758	0.1	6	64	1.8	6	0.025	2	13	6.936	7.216	7.850	8.610
1.2	FBK0503759	0.1	6	64	1.8	8	0.025	2	15	9.043	9.354	10.048	10.855
1.2	FBK0503760	0.1	6	64	1.8	12	0.025	2	15	13.177	13.633	14.647	15.828
1.2	FBK0503761	0.1	6	64	1.8	16	0.025	2	15	17.312	17.912	19.247	20.800
1.5	FBK0505417	0.15	6	64	2.3	-	-	2	9	4.429	4.694	5.337	6.193
1.5	FBK0505140	0.15	6	64	2.3	4	0.025	2	10	4.810	5.066	5.673	6.452
1.5	FBK0503763	0.15	6	64	2.3	6	0.025	2	12	6.921	7.224	7.920	8.768
1.5	FBK0505141	0.15	6	64	2.3	8	0.025	2	15	9.041	9.351	10.041	10.843
1.5	FBK0503764	0.15	6	64	2.3	10	0.025	2	15	11.108	11.490	12.340	13.329
1.5	FBK0505142	0.15	6	64	2.3	12	0.025	2	15	13.176	13.630	14.640	15.816
1.5	FBK0503765	0.15	6	64	2.3	15	0.025	2	15	16.277	16.839	18.090	19.545
1.5	FBK0503766	0.15	6	64	2.3	20	0.025	2	15	21.445	22.187	23.839	25.761
1.5	FBK0503767	0.15	6	64	2.3	25	0.025	2	15	26.613	27.536	29.588	31.976
2	FBK0503768	0.2	6	64	3	-	-	2	8	5.157	5.509	6.387	7.615
2	FBK0505143	0.2	6	64	3	4	0.05	2	9	4.972	5.268	5.985	6.939
2	FBK0503769	0.2	6	64	3	6	0.05	2	11	7.046	7.384	8.171	9.152

∞ Remark ∞ means no collusion in projection length area

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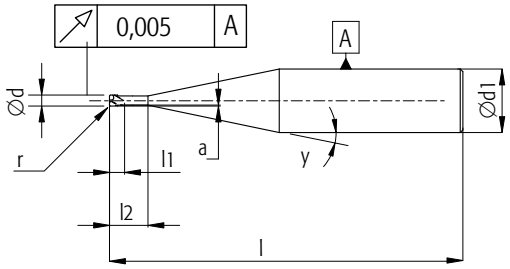
2 Flute

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

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



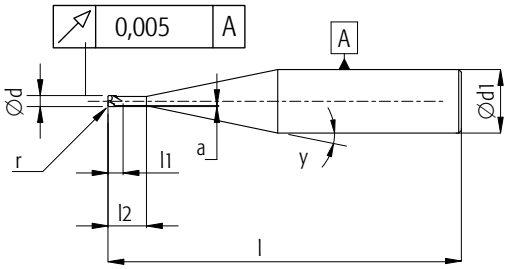
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	Effective length compared with Inclined Angle 0.5°	1.0°	2.0°	3.0°
2	FBK0505144	0.2	6	64	3	8	0.05	2	14	9.127	9.463	10.218	11.107
2	FBK0503770	0.2	6	64	3	10	0.05	2	15	11.203	11.587	12.440	13.433
2	FBK0505145	0.2	6	64	3	12	0.05	2	15	13.271	13.726	14.740	15.919
2	FBK0503771	0.2	6	64	3	16	0.05	2	15	17.405	18.005	19.339	20.892
2	FBK0503772	0.2	6	64	3	20	0.05	2	15	21.540	22.283	23.939	25.865
2	FBK0503773	0.2	6	64	3	25	0.05	2	15	26.708	27.632	29.688	32.080
2	FBK0503774	0.2	6	64	3	30	0.05	2	15	31.877	32.980	35.437	38.296
2.5	FBK0503775	0.2	6	64	3	-	-	2	7	5.158	5.569	6.636	8.236
2.5	FBK0503776	0.2	6	64	3	6	0.05	2	10	7.061	7.437	8.331	9.479
2.5	FBK0505146	0.2	6	64	3	8	0.05	2	12	9.127	9.527	10.444	11.562
2.5	FBK0503777	0.2	6	64	3	10	0.05	2	15	11.203	11.587	12.440	13.433
2.5	FBK0505147	0.2	6	64	3	12	0.05	2	15	13.271	13.726	14.740	15.919
2.5	FBK0503778	0.2	6	64	3	16	0.05	2	15	17.405	18.005	19.339	20.892
2.5	FBK0503779	0.2	6	64	3	20	0.05	2	15	21.540	22.283	23.939	25.865
2.5	FBK0503780	0.2	6	64	3	25	0.05	2	15	26.708	27.632	29.688	32.080
2.5	FBK0505148	0.2	6	64	3	30	0.05	2	15	31.877	32.980	35.437	38.296
3	FBK0503781	0.3	6	64	3	-	-	2	6	5.166	5.651	6.982	9.200
3	FBK0503782	0.3	6	64	3	6	0.05	2	8	7.129	7.614	8.823	10.514
3	FBK0505149	0.3	6	64	3	8	0.05	2	10	9.159	9.646	10.801	12.282
3	FBK0503783	0.3	6	64	3	10	0.05	2	13	11.198	11.644	12.655	13.866
3	FBK0505418	0.3	6	64	3	12	0.05	2	15	13.267	13.719	14.725	15.895
3	FBK0503784	0.3	6	64	3	16	0.05	2	15	17.402	17.998	19.324	20.868
3	FBK0503785	0.3	6	64	3	20	0.05	2	15	21.537	22.276	23.924	25.840
3	FBK0503786	0.3	6	64	3	25	0.05	2	15	26.705	27.625	29.673	32.056
3	FBK0503787	0.3	6	64	3	30	0.05	2	15	31.873	32.973	35.422	38.272

∞ Remark ∞ means no collusion in projection length area

4 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505373	0.03	4	51	0.25	2	0.01	4	15	2.377	2.459	2.641	2.853
0.2	FBK0505374	0.03	4	51	0.25	4	0.01	4	15	4.444	4.598	4.941	5.339
0.4	FBK0505375	0.05	4	51	0.4	2	0.01	4	15	2.376	2.457	2.638	2.848
0.4	FBK0505376	0.05	4	51	0.4	4	0.01	4	15	4.444	4.597	4.938	5.334
0.4	FBK0505377	0.05	4	51	0.4	6	0.01	4	15	6.511	6.736	7.237	7.820
0.4	FBK0505378	0.05	4	51	0.4	8	0.01	4	15	8.578	8.876	9.537	10.307
0.4	FBK0505379	0.05	4	51	0.4	10	0.01	4	15	10.646	11.015	11.837	12.793
0.5	FBK0505380	0.05	4	51	0.5	2	0.015	4	15	2.396	2.477	2.659	2.871
0.5	FBK0505381	0.05	4	51	0.5	4	0.015	4	15	4.463	4.617	4.959	5.357
0.5	FBK0505382	0.05	4	51	0.5	6	0.015	4	15	6.530	6.756	7.259	7.844
0.5	FBK0505383	0.05	4	51	0.5	8	0.015	4	15	8.598	8.896	9.558	10.330
0.5	FBK0505384	0.05	4	51	0.5	10	0.015	4	15	10.665	11.035	11.858	12.816
1.0	FBK0505385	0.10	4	51	1	2	0.025	4	15	2.569	2.655	2.846	3.069
1.0	FBK0505386	0.10	4	51	1	4	0.025	4	15	4.636	4.794	5.146	5.555
1.0	FBK0505387	0.10	4	51	1	6	0.025	4	15	6.703	6.933	7.446	8.042
1.0	FBK0505388	0.10	4	51	1	8	0.025	4	15	8.771	9.073	9.745	10.528
1.0	FBK0505389	0.10	4	51	1	10	0.025	4	15	10.838	11.212	12.045	13.014
1.5	FBK0505390	0.15	4	51	1.5	-	-	4	15	3.776	3.903	4.184	4.511
1.5	FBK0505391	0.15	4	51	1.5	4	0.025	4	15	4.906	5.072	5.441	5.870
1.5	FBK0505392	0.15	4	51	1.5	6	0.025	4	15	6.974	7.212	7.741	8.357
1.5	FBK0505393	0.15	4	51	1.5	8	0.025	4	15	9.041	9.351	10.041	10.843
1.5	FBK0505394	0.15	4	51	1.5	10	0.025	4	15	11.108	11.490	12.340	13.329
2.0	FBK0505395	0.20	4	51	2	-	-	4	15	4.292	4.434	4.751	5.121
2.0	FBK0505396	0.20	4	51	2	4	0.05	4	15	5.001	5.169	5.541	5.974
2.0	FBK0505397	0.20	4	51	2	6	0.05	4	15	7.069	7.308	7.841	8.461

∞ Remark ∞ means no collusion in projection length area

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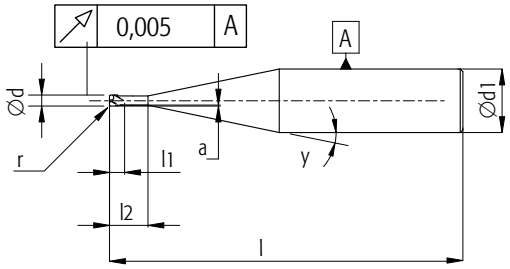
4 Flute

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

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
2.0	FBK0505398	0.20	4	51	2	8	0.05	4	15	9.136	9.447	10.140	10.947
2.0	FBK0505399	0.20	4	51	2	10	0.05	4	15	11.203	11.587	12.440	13.433
2.5	FBK0505400	0.20	4	51	2.5	-	-	4	15	4.808	4.969	5.326	5.742
2.5	FBK0505401	0.20	4	51	2.5	4	0.05	4	15	5.001	5.169	5.541	5.974
2.5	FBK0505402	0.20	4	51	2.5	6	0.05	4	15	7.069	7.308	7.841	8.461
2.5	FBK0505403	0.20	4	51	2.5	8	0.05	4	15	9.136	9.447	10.140	10.947
2.5	FBK0505404	0.20	4	51	2.5	10	0.05	4	15	11.203	11.587	12.440	13.433
3.0	FBK0505405	0.30	4	51	3	-	-	4	15	5.322	5.497	5.886	6.340
3.0	FBK0505406	0.30	4	51	3	4	0.05	4	15	4.998	5.162	5.526	5.950
3.0	FBK0505407	0.30	4	51	3	6	0.05	4	15	7.065	7.301	7.826	8.436
3.0	FBK0505408	0.30	4	51	3	8	0.05	4	15	9.133	9.440	10.125	∞
3.0	FBK0505409	0.30	4	51	3	10	0.05	4	15	11.200	11.580	12.425	∞

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

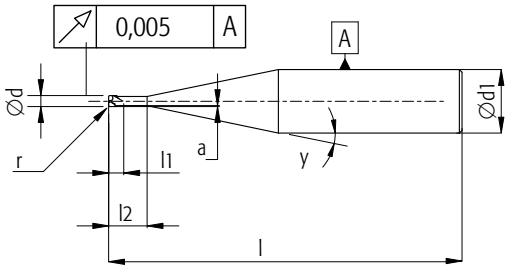
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

∞ Remark ∞ means no collusion in projection length area

4 Flute

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

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.2	FBK0505151	0.03	6	64	0.3	2	0.01	4	11	2.348	2.462	2.729	3.061
0.2	FBK0505152	0.03	6	64	0.3	4	0.01	4	13	4.438	4.618	5.027	5.517
0.4	FBK0505156	0.05	6	64	0.6	2	0.01	4	11	2.347	2.460	2.725	3.054
0.4	FBK0505157	0.05	6	64	0.6	4	0.01	4	13	4.437	4.616	5.023	5.511
0.4	FBK0505158	0.05	6	64	0.6	6	0.01	4	15	6.511	6.736	7.237	7.820
0.4	FBK0505159	0.05	6	64	0.6	8	0.01	4	15	8.578	8.876	9.537	10.307
0.4	FBK0505160	0.05	6	64	0.6	10	0.01	4	15	10.646	11.015	11.837	12.793
0.5	FBK0505161	0.05	6	64	0.8	2	0.015	4	11	2.374	2.489	2.756	3.089
0.5	FBK0505162	0.05	6	64	0.8	4	0.015	4	12	4.462	4.659	5.112	5.665
0.5	FBK0505163	0.05	6	64	0.8	6	0.015	4	15	6.530	6.756	7.259	7.844
0.5	FBK0505164	0.05	6	64	0.8	8	0.015	4	15	8.598	8.896	9.558	10.330
0.5	FBK0505165	0.05	6	64	0.8	10	0.015	4	15	10.665	11.035	11.858	12.816
1	FBK0505419	0.10	6	64	1.5	-	-	4	10	3.050	3.212	3.597	4.090
1	FBK0505167	0.10	6	64	1.5	4	0.025	4	11	4.620	4.843	5.363	6.011
1	FBK0505168	0.10	6	64	1.5	6	0.025	4	14	6.700	6.948	7.506	8.164
1	FBK0505169	0.10	6	64	1.5	8	0.025	4	15	8.771	9.073	9.745	10.528
1	FBK0505170	0.10	6	64	1.5	10	0.025	4	15	10.838	11.212	12.045	13.014
1.5	FBK0505420	0.15	6	64	2.3	-	-	4	9	4.429	4.694	5.337	6.193
1.5	FBK0505172	0.15	6	64	2.3	4	0.025	4	10	4.810	5.066	5.673	6.452
1.5	FBK0505173	0.15	6	64	2.3	6	0.025	4	12	6.921	7.224	7.920	8.768
1.5	FBK0505421	0.15	6	64	2.3	8	0.025	4	15	9.041	9.351	10.041	10.843

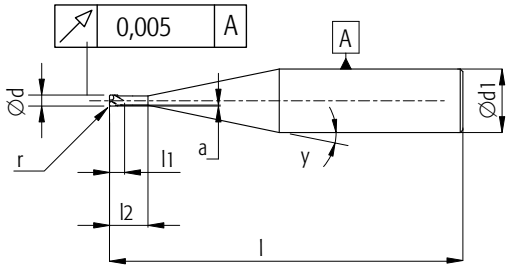
∞ Remark ∞ means no collusion in projection length area

4 Flute

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

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

P1-P6
K1
M1-M3
S1-S4
H1-H4



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1.5	FBK0505175	0.15	6	64	2.3	10	0.025	4	15	11.108	11.490	12.340	13.329
2	FBK0505422	0.20	6	64	3	-	-	4	8	5.157	5.509	6.387	7.615
2	FBK0505423	0.20	6	64	3	4.5	0.05	4	9	5.501	5.830	6.626	7.686
2	FBK0505178	0.20	6	64	3	6	0.05	4	11	7.046	7.384	8.171	9.152
2	FBK0505179	0.20	6	64	3	8	0.05	4	14	9.127	9.463	10.218	11.107
2	FBK0505180	0.20	6	64	3	10	0.05	4	15	11.203	11.587	12.440	13.433
2.5	FBK0505424	0.20	6	64	3	-	-	4	8	5.157	5.509	6.387	7.615
2.5	FBK0505425	0.20	6	64	3	4.5	0.05	4	9	5.501	5.830	6.626	7.686
2.5	FBK0505426	0.20	6	64	3	6	0.05	4	11	7.046	7.384	8.171	9.152
2.5	FBK0505427	0.20	6	64	3	8	0.05	4	14	9.127	9.463	10.218	11.107
2.5	FBK0505428	0.20	6	64	3	10	0.05	4	15	11.203	11.587	12.440	13.433
3	FBK0505429	0.30	6	64	3	-	-	4	6	5.166	5.651	6.982	9.200
3	FBK0505430	0.30	6	64	3	4.5	0.05	4	7	5.589	6.027	7.166	8.872
3	FBK0505431	0.30	6	64	3	6	0.05	4	8	7.129	7.614	8.823	10.514
3	FBK0505432	0.30	6	64	3	8	0.05	4	10	9.159	9.646	10.801	12.282
3	FBK0505433	0.30	6	64	3	10	0.05	4	13	11.198	11.644	12.655	13.866

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

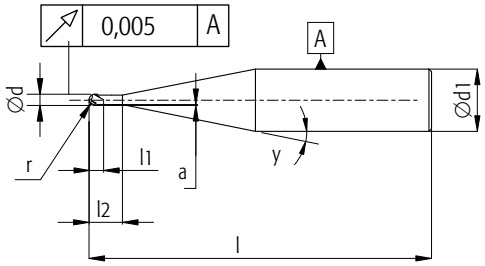
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro ball nose

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.1	FBK0505207	0.05	4	51	0.2	-	-	2	15	0.684	0.706	0.755	0.812
0.1	FBK0505208	0.05	4	60	0.2	-	-	2	10	0.602	0.633	0.705	0.797
0.2	FBK0505209	0.1	4	51	0.3	-	-	2	15	0.786	0.810	0.863	0.925
0.3	FBK0505210	0.15	4	51	0.4	-	-	2	15	1.197	1.234	1.315	1.410
0.3	FBK0505211	0.15	4	51	0.4	1.5	0.01	2	15	1.856	1.916	2.048	2.202
0.3	FBK0505212	0.15	4	51	0.4	3	0.01	2	15	3.407	3.520	3.773	4.067
0.4	FBK0505213	0.2	4	51	0.5	-	-	2	15	1.299	1.337	1.423	1.522
0.4	FBK0505214	0.2	4	51	0.5	2	0.01	2	15	2.371	2.447	2.615	2.811
0.4	FBK0505215	0.2	4	51	0.5	4	0.01	2	15	4.439	4.586	4.915	5.298
0.5	FBK0505216	0.25	4	51	0.7	-	-	2	15	1.504	1.548	1.645	1.758
0.5	FBK0505217	0.25	4	51	0.7	3	0.015	2	15	3.423	3.533	3.779	4.066
0.5	FBK0505218	0.25	4	51	0.7	6	0.015	2	15	6.524	6.742	7.229	7.795
0.5	FBK0505219	0.25	4	51	0.7	8	0.015	2	15	8.591	8.882	9.529	10.281
0.5	FBK0505220	0.25	4	51	0.7	10	0.015	2	15	10.658	11.021	11.828	12.768
0.6	FBK0505221	0.3	4	51	0.8	-	-	2	15	2.259	2.327	2.479	2.656
0.6	FBK0505222	0.3	4	51	0.8	2	0.025	2	15	2.562	2.641	2.816	3.020
0.6	FBK0505223	0.3	4	51	0.8	4	0.025	2	15	4.629	4.780	5.116	5.507
0.6	FBK0505224	0.3	4	51	0.8	6	0.025	2	15	6.697	6.919	7.416	7.993
0.6	FBK0505225	0.3	4	51	0.8	8	0.025	2	15	8.764	9.059	9.715	10.479
0.6	FBK0505226	0.3	4	51	0.8	10	0.025	2	15	10.831	11.198	12.015	12.965
0.8	FBK0505227	0.4	4	51	1	-	-	2	15	2.462	2.534	2.694	2.880
0.8	FBK0505228	0.4	4	51	1	2.5	0.025	2	15	3.075	3.169	3.376	3.618
0.8	FBK0505229	0.4	4	51	1	5	0.025	2	15	5.660	5.843	6.251	6.725
0.8	FBK0505230	0.4	4	51	1	8	0.025	2	15	8.761	9.052	9.700	10.455
0.8	FBK0505231	0.4	4	51	1	10	0.025	2	15	10.828	11.191	12.000	12.941

∞ Remark ∞ means no collusion in projection length area

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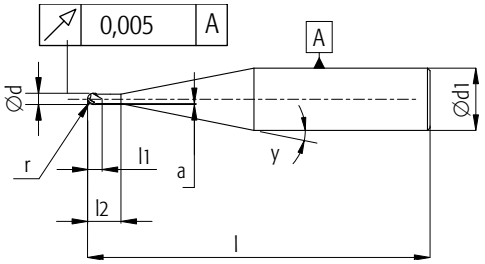
2 Flute

Centre cutting high performance 2 flute micro ball nose

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

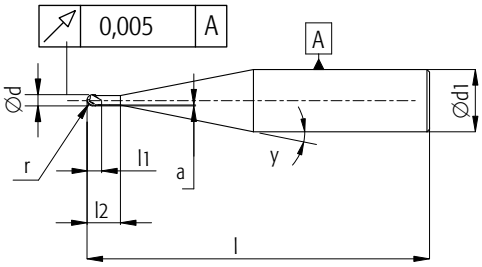
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1	FBK0505232	0.5	4	51	1.2	-	-	2	15	2.665	2.741	2.909	3.104
1	FBK0505233	0.5	4	51	1.2	4	0.025	2	15	4.623	4.766	5.086	5.458
1	FBK0505234	0.5	4	51	1.2	6	0.025	2	15	6.690	6.906	7.386	7.944
1	FBK0505235	0.5	4	51	1.2	8	0.025	2	15	8.757	9.045	9.685	10.431
1	FBK0505236	0.5	4	51	1.2	10	0.025	2	15	10.825	11.184	11.985	12.917
1	FBK0505237	0.5	4	51	1.2	12	0.025	2	15	12.892	13.324	14.285	15.403
1	FBK0505238	0.5	4	51	1.2	15	0.025	2	15	15.993	16.533	17.734	19.133
1	FBK0505239	0.5	4	60	1.2	20	0.025	2	15	21.161	21.881	23.484	25.348
1	FBK0505240	0.5	4	60	1.2	25	0.025	2	15	26.330	27.230	29.233	∞
1.2	FBK0505241	0.6	4	51	1.4	-	-	2	15	3.658	3.764	4.002	4.278
1.2	FBK0505242	0.6	4	51	1.4	4	0.025	2	15	4.891	5.041	5.374	5.761
1.2	FBK0505243	0.6	4	51	1.4	6	0.025	2	15	6.959	7.180	7.673	8.247
1.2	FBK0505244	0.6	4	51	1.4	8	0.025	2	15	9.026	9.320	9.973	10.734
1.2	FBK0505245	0.6	4	51	1.4	12	0.025	2	15	13.161	13.598	14.573	15.706
1.2	FBK0505246	0.6	4	51	1.4	16	0.025	2	15	17.295	17.877	19.172	20.679
1.5	FBK0505247	0.75	4	51	1.8	-	-	2	15	4.066	4.182	4.439	4.738
1.5	FBK0505248	0.75	4	51	1.8	4	0.02	2	15	4.867	5.010	5.330	5.701
1.5	FBK0505249	0.75	4	51	1.8	6	0.025	2	15	6.954	7.170	7.651	8.211
1.5	FBK0505250	0.75	4	51	1.8	8	0.025	2	15	9.021	9.309	9.951	10.697
1.5	FBK0505251	0.75	4	51	1.8	10	0.025	2	15	11.088	11.448	12.250	13.183
1.5	FBK0505252	0.75	4	51	1.8	12	0.025	2	15	13.156	13.588	14.550	15.670
1.5	FBK0505253	0.75	4	51	1.8	15	0.025	2	15	16.257	16.797	18.000	19.399
1.5	FBK0505254	0.75	4	60	1.8	20	0.025	2	15	21.425	22.145	23.749	∞
1.5	FBK0505255	0.75	4	60	1.8	25	0.025	2	15	26.593	27.494	29.498	∞
2	FBK0505256	1	4	51	2.5	-	-	2	15	4.781	4.913	5.206	5.548
2	FBK0505257	1	4	51	2.5	4	0.05	2	15	4.974	5.113	5.421	5.780

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro ball nose

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
2	FBK0505258	1	4	51	2.5	6	0.05	2	15	7.042	7.252	7.721	8.266
2	FBK0505259	1	4	51	2.5	8	0.05	2	15	9.109	9.392	10.020	10.752
2	FBK0505260	1	4	51	2.5	10	0.05	2	15	11.176	11.531	12.320	13.239
2	FBK0505261	1	4	51	2.5	12	0.05	2	15	13.244	13.670	14.620	15.725
2	FBK0505262	1	4	51	2.5	16	0.05	2	15	17.378	17.949	19.219	∞
2	FBK0505263	1	4	60	2.5	20	0.05	2	15	21.513	22.228	23.819	∞
2	FBK0505264	1	4	60	2.5	25	0.05	2	15	26.681	27.576	29.568	∞
2	FBK0505265	1	4	64	2.5	30	0.05	2	15	31.850	32.925	∞	∞
2.5	FBK0505266	1.25	4	51	3.5	-	-	2	15	5.807	5.965	6.319	6.730
2.5	FBK0505267	1.25	4	51	3.5	6	0.05	2	15	7.033	7.235	7.683	8.205
2.5	FBK0505268	1.25	4	51	3.5	8	0.05	2	15	9.101	9.374	9.983	10.692
2.5	FBK0505269	1.25	4	51	3.5	10	0.05	2	15	11.168	11.513	12.283	13.178
2.5	FBK0505270	1.25	4	51	3.5	12	0.05	2	15	13.235	13.653	14.582	15.664
2.5	FBK0505271	1.25	4	51	3.5	16	0.05	2	15	17.370	17.932	19.182	∞
2.5	FBK0505272	1.25	4	60	3.5	20	0.05	2	15	21.505	22.210	∞	∞
2.5	FBK0505273	1.25	4	60	3.5	25	0.05	2	15	26.673	27.559	∞	∞
2.5	FBK0505274	1.25	4	64	3.5	30	0.05	2	15	31.841	32.907	∞	∞
3	FBK0505275	1.5	4	51	3.5	-	-	2	15	5.798	5.948	6.281	6.669
3	FBK0505276	1.5	4	51	3.5	6	0.05	2	15	7.025	7.217	7.646	8.144
3	FBK0505277	1.5	4	51	3.5	8	0.05	2	15	9.092	9.357	9.946	10.631
3	FBK0505278	1.5	4	51	3.5	10	0.05	2	15	11.159	11.496	12.245	∞
3	FBK0505279	1.5	4	51	3.5	12	0.05	2	15	13.227	13.635	14.545	∞
3	FBK0505280	1.5	4	51	3.5	16	0.05	2	15	17.361	17.914	∞	∞
3	FBK0505281	1.5	4	60	3.5	20	0.05	2	15	21.496	22.193	∞	∞
3	FBK0505282	1.5	4	60	3.5	25	0.05	2	15	26.664	27.541	∞	∞
3	FBK0505283	1.5	4	64	3.5	30	0.05	2	15	31.833	∞	∞	∞

∞ Remark ∞ means no collusion in projection length area

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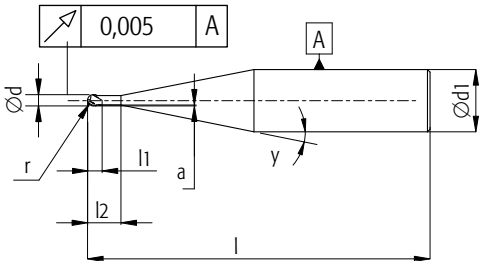
2 Flute

Centre cutting high performance 2 flute micro ball nose

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

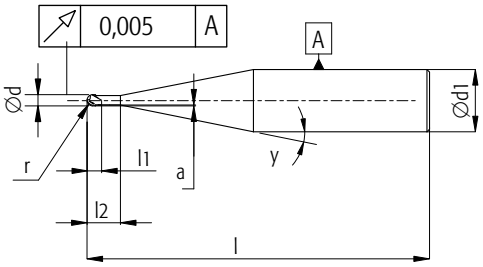
Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
z	FBK0503789	0.1	6	64	0.3	-	-	2	10	0.705	0.738	0.817	0.918
	FBK0505284	0.15	6	64	0.5	-	-	2	10	1.228	1.288	1.428	1.608
0.3	FBK0503791	0.15	6	64	0.5	1.5	0.01	2	11	1.819	1.901	2.093	2.332
0.3	FBK0503792	0.15	6	64	0.5	3	0.01	2	12	3.390	3.535	3.868	4.274
0.4	FBK0505285	0.2	6	64	0.6	-	-	2	10	1.331	1.393	1.540	1.730
0.4	FBK0503794	0.2	6	64	0.6	2	0.01	2	11	2.340	2.446	2.692	2.999
0.4	FBK0503795	0.2	6	64	0.6	4	0.01	2	13	4.431	4.604	4.997	5.467
0.5	FBK0505286	0.25	6	64	0.8	-	-	2	10	1.539	1.610	1.777	1.993
0.5	FBK0503797	0.25	6	64	0.8	3	0.015	2	12	3.411	3.552	3.877	4.273
0.5	FBK0503798	0.25	6	64	0.8	6	0.015	2	15	6.524	6.742	7.229	7.795
0.5	FBK0503799	0.25	6	64	0.8	8	0.015	2	15	8.591	8.882	9.529	10.281
0.5	FBK0503660	0.25	6	64	0.8	10	0.015	2	15	10.658	11.021	11.828	12.768
0.6	FBK0505287	0.3	6	64	0.9	-	-	2	10	2.259	2.367	2.622	2.950
0.6	FBK0503802	0.3	6	64	0.9	2	0.025	2	11	2.517	2.626	2.881	3.199
0.6	FBK0503663	0.3	6	64	0.9	4	0.025	2	12	4.610	4.803	5.245	5.785
0.6	FBK0503804	0.3	6	64	0.9	6	0.025	2	15	6.697	6.919	7.416	7.993
0.6	FBK0503805	0.3	6	64	0.9	8	0.025	2	15	8.764	9.059	9.715	10.479
0.6	FBK0503806	0.3	6	64	0.9	10	0.025	2	15	10.831	11.198	12.015	12.965
0.8	FBK0505288	0.4	6	64	1.2	-	-	2	10	2.570	2.689	2.972	3.335
0.8	FBK0503808	0.4	6	64	1.2	2.5	0.025	2	11	3.036	3.166	3.469	3.847
0.8	FBK0503809	0.4	6	64	1.2	5	0.025	2	13	5.648	5.863	6.350	6.933
0.8	FBK0503810	0.4	6	64	1.2	8	0.025	2	15	8.761	9.052	9.700	10.455
0.8	FBK0503811	0.4	6	64	1.2	10	0.025	2	15	10.828	11.191	12.000	12.941
1	FBK0505289	0.5	6	64	1.5	-	-	2	9	2.866	3.013	3.369	3.842
1	FBK0503813	0.5	6	64	1.5	4	0.025	2	11	4.602	4.804	5.275	5.864
1	FBK0503814	0.5	6	64	1.5	6	0.025	2	14	6.685	6.918	7.441	8.057

∞ Remark ∞ means no collusion in projection length area

2 Flute

Centre cutting high performance 2 flute micro ball nose

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
1	FBK0505181	0.5	6	64	1.5	8	0.025	2	15	8.757	9.045	9.685	10.431
1	FBK0503815	0.5	6	64	1.5	10	0.025	2	15	10.825	11.184	11.985	12.917
1	FBK0503815	0.5	6	64	1.5	12	0.025	2	15	12.892	13.324	14.285	15.403
1	FBK0503816	0.5	6	64	1.5	15	0.025	2	15	15.993	16.533	17.734	19.133
1	FBK0503817	0.5	6	64	1.5	20	0.025	2	15	21.161	21.881	23.484	25.348
1	FBK0503818	0.5	6	64	1.5	25	0.025	2	15	26.330	27.230	29.233	31.564
1.2	FBK0503819	0.6	6	64	1.8	-	-	2	9	3.874	4.077	4.568	5.223
1.2	FBK0503820	0.6	6	64	1.8	4	0.025	2	11	4.799	5.006	5.488	6.090
1.2	FBK0503821	0.6	6	64	1.8	6	0.025	2	13	6.917	7.175	7.761	8.463
1.2	FBK0503822	0.6	6	64	1.8	8	0.025	2	15	9.026	9.320	9.973	10.734
1.2	FBK0503823	0.6	6	64	1.8	12	0.025	2	15	13.161	13.598	14.573	15.706
1.2	FBK0503824	0.6	6	64	1.8	16	0.025	2	15	17.295	17.877	19.172	20.679
1.5	FBK0505291	0.75	6	64	2.30	-	-	2	9	4.394	4.620	5.167	5.896
1.5	FBK0505183	0.75	6	64	2.30	4.00	0.020	2	10	4.749	4.968	5.490	6.158
1.5	FBK0503826	0.75	6	64	2.30	6.00	0.025	2	12	6.895	7.170	7.802	8.572
1.5	FBK0505184	0.75	6	64	2.30	8.00	0.025	2	15	9.021	9.309	9.951	10.697
1.5	FBK0503827	0.75	6	64	2.30	10.00	0.025	2	15	11.088	11.448	12.250	13.183
1.5	FBK0505186	0.75	6	64	2.30	12.00	0.025	2	15	13.156	13.588	14.550	15.670
1.5	FBK0503828	0.75	6	64	2.30	15.00	0.025	2	15	16.257	16.797	18.000	19.399
1.5	FBK0503829	0.75	6	64	2.30	20.00	0.025	2	15	21.425	22.145	23.749	25.615
1.5	FBK0503830	0.75	6	64	2.30	25.00	0.025	2	15	26.593	27.494	29.498	31.831
2.0	FBK0503831	1.00	6	64	3.00	-	-	2	8	5.105	5.396	6.122	7.139
2.0	FBK0505292	1.00	6	64	3.00	4.50	0.050	2	9	5.121	5.376	5.995	6.819
2.0	FBK0503832	1.00	6	64	3.00	6.00	0.050	2	11	7.008	7.305	7.995	8.857
2.0	FBK0505188	1.00	6	64	3.00	8.00	0.050	2	14	9.098	9.403	10.087	10.894

∞ Remark ∞ means no collusion in projection length area

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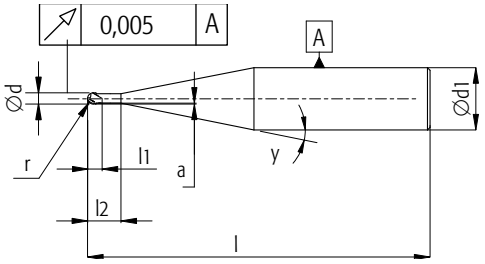
2 Flute

Centre cutting high performance 2 flute micro ball nose end mill

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



P1-P6
K1
M1-M3
S1-S4
H1-H4

Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
2	FBK0503833	1	6	64	3	10	0.05	2	15	11.176	11.531	12.320	13.239
2	FBK0505189	1	6	64	3	12	0.05	2	15	13.244	13.670	14.620	15.725
2	FBK0503834	1	6	64	3	16	0.05	2	15	17.378	17.949	19.219	20.697
2	FBK0503835	1	6	64	3	20	0.05	2	15	21.513	22.228	23.819	25.670
2	FBK0503836	1	6	64	3	25	0.05	2	15	26.681	27.576	29.568	31.886
2	FBK0503837	1	6	64	3	30	0.05	2	15	31.850	32.925	35.317	38.101
2.5	FBK0503838	1.25	6	64	3	-	-	2	7	5.078	5.395	6.219	7.454
2.5	FBK0503839	1.25	6	64	3	6	0.05	2	10	7.006	7.322	8.072	9.035
2.5	FBK0505190	1.25	6	64	3	8	0.05	2	12	9.082	9.433	10.237	11.219
2.5	FBK0503840	1.25	6	64	3	10	0.05	2	15	11.168	11.513	12.283	13.178
2.5	FBK0505191	1.25	6	64	3	12	0.05	2	15	13.235	13.653	14.582	15.664
2.5	FBK0503841	1.25	6	64	3	16	0.05	2	15	17.370	17.932	19.182	20.637
2.5	FBK0503842	1.25	6	64	3	20	0.05	2	15	21.505	22.210	23.781	25.609
2.5	FBK0503843	1.25	6	64	3	25	0.05	2	15	26.673	27.559	29.531	31.825
2.5	FBK0505192	1.25	6	64	3	30	0.05	2	15	31.841	32.907	35.280	∞
3	FBK0503844	1.5	6	64	3	-	-	2	6	5.057	5.412	6.385	8.006
3	FBK0503845	1.5	6	64	3	6	0.05	2	8	7.050	7.444	8.426	9.801
3	FBK0505193	1.5	6	64	3	8	0.05	2	10	9.097	9.514	10.504	11.775
3	FBK0503661	1.5	6	64	3	10	0.05	2	13	11.151	11.546	12.441	13.513
3	FBK0505194	1.5	6	64	3	12	0.05	2	15	13.227	13.635	14.545	15.603
3	FBK0503847	1.5	6	64	3	16	0.05	2	15	17.361	17.914	19.144	20.576
3	FBK0503848	1.5	6	64	3	20	0.05	2	15	21.496	22.193	23.744	25.548
3	FBK0503849	1.5	6	64	3	25	0.05	2	15	26.664	27.541	29.493	∞
3	FBK0503850	1.5	6	64	3	30	0.05	2	15	31.833	32.890	35.242	∞

∞ Remark ∞ means no collusion in projection length area

Cutting conditions

- 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

Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
P3	< 750	< 35 HRc	150 - 220	emulsion
P4	< 1000	< 35-48 HRc	120 - 180	emulsion
P4	< 1400	< 35 HRc	100 - 150	emulsion
H1		42-50 HRc	150 - 190	min.lub.
H2		50-55 HRc	100 - 140	min.lub.
H3		55-60 HRc	70 - 90	min.lub.
H4		60-70 HRc	70 - 90	min.lub.
M1	< 600		80 - 130	emulsion
M2	600-800	< 25 HRc	60 - 100	emulsion
M3	< 800	< 30 HRc	60 - 100	emulsion
K1	125-500	< 32 HRc	100 - 160	emulsion
S1	500-1200	25-48 HRc	40 - 60	emulsion
S2	1000-1500	25-48 HRc	45 - 70	emulsion
S3	600-1700	<48 HRc	30 - 50	emulsion
S4	900-1600	33-48 HRc	60 - 90	emulsion

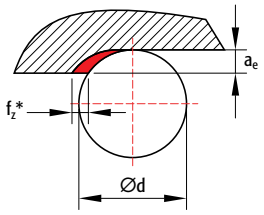
Advantages

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

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



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling. feed per tooth fz* for lower ae values should be converted according formula.
- For shoulder milling cutting speed Vc may be increased up to 30%.

a_e	f_z^*=
0.10 x d	fz x 3
0.25 x d	fz x 2
0.50 x d	fz x 1

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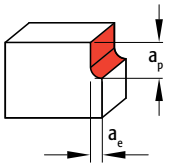
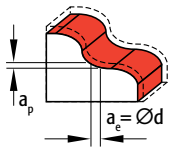
Cutting conditions





Shoulder milling

	P	M	S
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.1	<0.06	<0.004	0.001 - 0.003
0.2	<0.12	<0.008	0.002 - 0.004
0.3	<0.18	<0.012	0.003 - 0.006
0.4	<0.24	<0.016	0.004 - 0.008
0.5	<0.30	<0.020	0.005 - 0.009
0.6	<0.36	<0.024	0.006 - 0.010
0.8	<0.48	<0.032	0.007 - 0.012
1	<0.60	<0.040	0.008 - 0.015
1.2	<0.72	<0.048	0.010 - 0.016
1.5	<0.90	<0.060	0.012 - 0.018
2	<1.20	<0.080	0.016 - 0.022
2.5	<1.50	<0.100	0.018 - 0.025
3	<1.80	<0.120	0.020 - 0.028

Shoulder milling

H1 / H2 / H3 / H4			
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.1	< 0.05	< 0.004	0.001 - 0.003
0.2	< 0.09	< 0.008	0.002 - 0.004
0.3	< 0.14	< 0.012	0.003 - 0.006
0.4	< 0.18	< 0.016	0.004 - 0.008
0.5	< 0.23	< 0.020	0.005 - 0.009
0.6	< 0.27	< 0.024	0.006 - 0.010
0.8	< 0.36	< 0.032	0.007 - 0.012
1	< 0.45	< 0.040	0.008 - 0.015
1.2	< 0.54	< 0.048	0.010 - 0.016
1.5	< 0.68	< 0.060	0.012 - 0.018
2	< 0.90	< 0.080	0.016 - 0.022
2.5	< 1.13	< 0.100	0.018 - 0.025
3	< 1.35	< 0.120	0.020 - 0.028

Shoulder milling

	P	M	S
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.1	<0,03	0,100	0,001 - 0,002
0.2	<0,06	0,200	0,002 - 0,003
0.3	<0,09	0,300	0,003 - 0,005
0.4	<0,12	0,400	0,004 - 0,006
0.5	<0,15	0,500	0,005 - 0,008
0.6	<0,18	0,600	0,006 - 0,010
0.8	<0,24	0,800	0,008 - 0,012
1	<0,30	1,000	0,009 - 0,014
1.2	<0,36	1,200	0,010 - 0,016
1.5	<0,45	1,500	0,012 - 0,018
2	<0,60	2,000	0,016 - 0,022
2.5	<0,75	2,500	0,018 - 0,025
3	<0,90	3,000	0,020 - 0,028

Shoulder milling

H1 / H2 / H3 / H4			
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.1	<0,02	0,100	0,001 - 0,002
0.2	<0,04	0,200	0,002 - 0,003
0.3	<0,06	0,300	0,003 - 0,005
0.4	<0,08	0,400	0,004 - 0,006
0.5	<0,10	0,500	0,005 - 0,008
0.6	<0,12	0,600	0,006 - 0,010
0.8	<0,16	0,800	0,008 - 0,012
1	<0,20	1,000	0,009 - 0,014
1.2	<0,24	1,200	0,010 - 0,016
1.5	<0,30	1,500	0,012 - 0,018
2	<0,40	2,000	0,016 - 0,022
2.5	<0,50	2,500	0,018 - 0,025
3	<0,60	3,000	0,020 - 0,028

Coolant

Keep the tool cool!

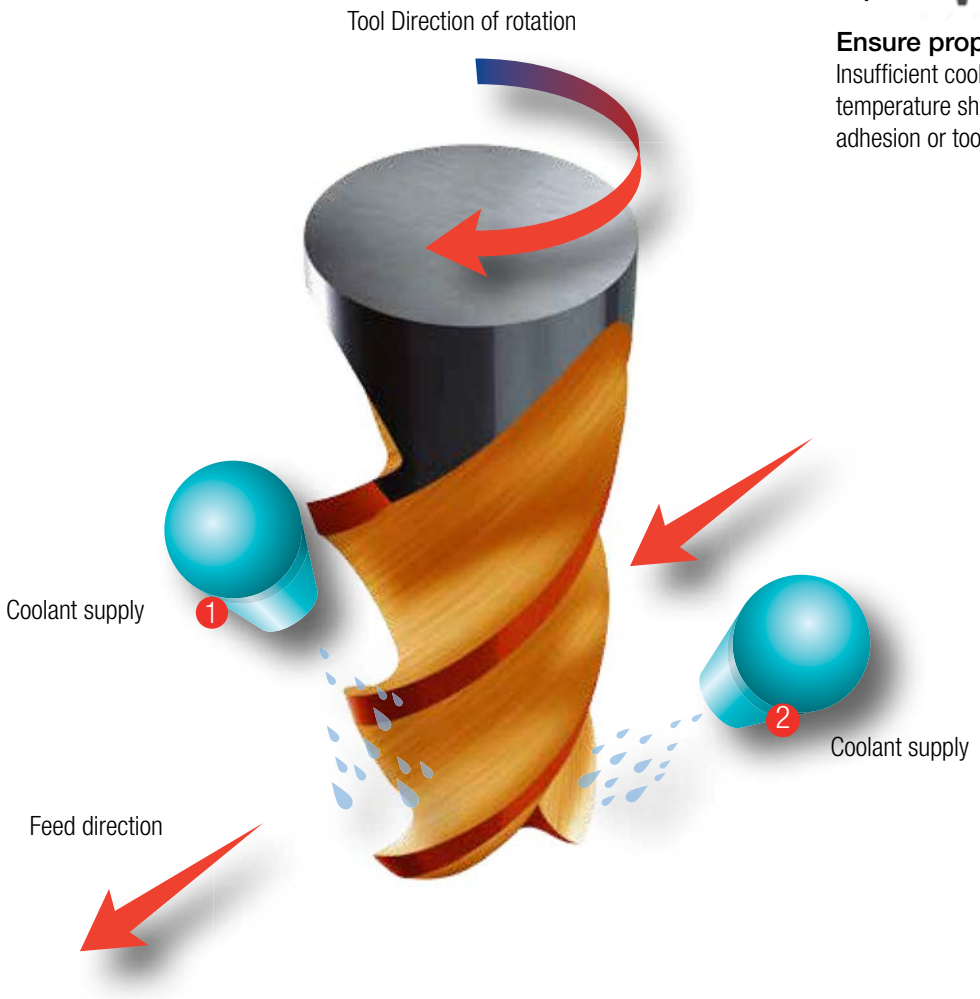
It's recommend to use coolant (emulsion, minimum lubrication, or air) if possible. Coolant contributes to improve toollife, surface finish and chip evacuation.

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

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

Tips:

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



* Please follow instructions to keep the tool cool.

End mills for stainless steel, super alloys & exotic materials

Milling exotic materials

Most common problems faced when milling exotic materials

- Abrasiveness of the material.
- Resonance of the machine and/or workpiece.
- Vibrations of the workpiece and/or tool.
- Burrs
- Burr folding

Program

- Center cutting high performance 4 flute end mills for roughing/semi finishing of exotic materials
- Center cutting high performance 5 flute end mills for roughing/semi finishing of exotic materials
- Center cutting high performance multi flute end mills for finishing of exotic materials
- Center cutting high performance 2 flute ball nose for semi finishing/ finishing of exotic materials

Features of the geometry

- Higher productivity with smooth edges
- Optimized center
- New generation coating

FBK0505846

Workpiece material: 3.7165 (Ti6-Al4V)

	Competitor	Forbes
Ø	16 mm	16 mm
Z	4 Flutes	4 Flutes
vc	38 m/min	85 m/min
n	600 rpm	1691 rpm
Fz	0.033 mm/t	0.080 mm/t
vf	80 mm/min	540 mm/min
ap	16 mm	8 mm
ae	16 mm	16 mm
Coolant	emulsion	emulsion

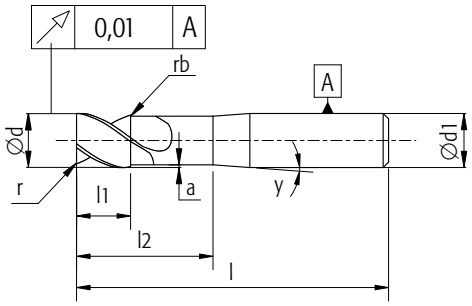
Q	20.48 cm^3/min	69.12 cm^3/min

Higher Productivity

4 Flute

Centre cutting high performance 4 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ 0.5°
Short									
3	FBK0505836	0.2	6	39	5	7	0.1	4	15
4	FBK0505837	0.2	6	51	6	9	0.1	4	15
5	FBK0505838	0.2	6	51	7	11	0.2	4	15
6	FBK0505070	0.3	6	64	8	13	0.2	4	-
6	FBK0505071	0.5	6	64	8	13	0.2	4	-
6	FBK0505072	1	6	64	8	13	0.2	4	-
8	FBK0505839	0.3	8	64	11	18	0.3	4	-
8	FBK0505840	0.5	8	64	11	18	0.3	4	-
8	FBK0505073	1	8	64	11	18	0.3	4	-
10	FBK0505841	0.3	10	70	13	22	0.3	4	-
10	FBK0505842	0.5	10	70	13	22	0.3	4	-
10	FBK0505075	1	10	70	13	22	0.3	4	-
12	FBK0505843	0.3	12	78	15	25	0.3	4	-
12	FBK0505076	0.5	12	78	15	25	0.3	4	-
12	FBK0505844	1	12	78	15	25	0.3	4	-
14	FBK0505845	1	14	89	17	30	0.3	4	-
16	FBK0505846	0.5	16	89	19	35	0.3	4	-
16	FBK0505847	1	16	89	19	35	0.3	4	-
20	FBK0505848	0.5	20	102	23	42	0.4	4	-
20	FBK0505849	1	20	102	23	42	0.4	4	-
25	FBK0505850	0.5	25	120	28	45	0.4	4	-
25	FBK0505851	1	25	120	28	45	0.4	4	-

Shank diameters staring from Ø 6 mm also available in weldon

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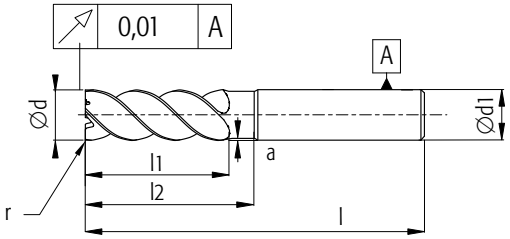
4 Flute

Centre cutting high performance 4 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN

P1-P6
K1-K2
M1-M3
S1-S4
H1



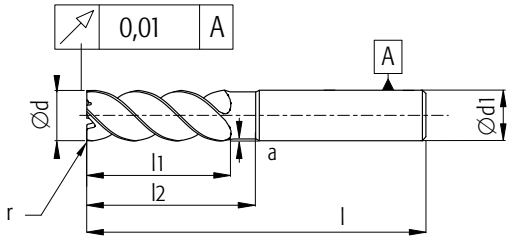
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ 0.5°
Standard									
3	FBK0505852	0.2	6	39	7	-	-	4	15
4	FBK0505853	0.2	6	51	9	-	-	4	15
5	FBK0505854	0.2	6	51	11	-	-	4	15
6	FBK0505104	0.3	6	64	13	-	-	4	-
6	FBK0505105	0.5	6	64	13	-	-	4	-
6	FBK0505106	1	6	64	13	-	-	4	-
8	FBK0505855	0.3	8	64	18	-	-	4	-
8	FBK0505856	0.5	8	64	18	-	-	4	-
8	FBK0505108	1	8	64	18	-	-	4	-
10	FBK0505857	0.3	10	70	22	-	-	4	-
10	FBK0505858	0.5	10	70	22	-	-	4	-
10	FBK0505110	1	10	70	22	-	-	4	-
12	FBK0505859	0.3	12	78	25	-	-	4	-
12	FBK0505111	0.5	12	78	25	-	-	4	-
12	FBK0505860	1	12	78	25	-	-	4	-
14	FBK0505861	1	14	89	30	-	-	4	-
16	FBK0505862	0.5	16	89	35	-	-	4	-
16	FBK0505863	1	16	89	35	-	-	4	-
20	FBK0505864	0.5	20	102	42	-	-	4	-
20	FBK0505865	1	20	102	42	-	-	4	-
25	FBK0505866	0.5	25	120	45	-	-	4	-
25	FBK0505867	1	25	120	45	-	-	4	-

Shank diameters staring from Ø 6 mm also available in weldon

4 Flute

Centre cutting high performance 4 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ 0.5°
With neck relief									
3	FBK0505868	0.2	6	39	7	9	0.1	4	15
4	FBK0505869	0.2	6	51	9	12	0.1	4	15
5	FBK0505870	0.2	6	51	11	15	0.2	4	15
6	FBK0505871	0.3	6	64	13	18	0.2	4	-
6	FBK0505872	0.5	6	64	13	18	0.2	4	-
6	FBK0505873	1	6	64	13	18	0.2	4	-
8	FBK0505874	0.3	8	64	18	24	0.3	4	-
8	FBK0505875	0.5	8	64	18	24	0.3	4	-
8	FBK0505876	1	8	64	18	24	0.3	4	-
10	FBK0505877	0.3	10	70	22	30	0.3	4	-
10	FBK0505878	0.5	10	70	22	30	0.3	4	-
10	FBK0505879	1	10	70	22	30	0.3	4	-
12	FBK0505880	0.3	12	83	25	36	0.3	4	-
12	FBK0505881	0.5	12	83	25	36	0.3	4	-
12	FBK0505882	1	12	83	25	36	0.3	4	-
12	FBK0505883	0.3	12	102	25	36	0.3	4	-
12	FBK0505884	0.5	12	102	25	36	0.3	4	-
12	FBK0505885	1	12	102	25	36	0.3	4	-
14	FBK0505886	1	14	102	30	42	0.3	4	-
16	FBK0505887	0.5	16	102	35	48	0.3	4	-
16	FBK0505888	1	16	102	35	48	0.3	4	-
20	FBK0505889	0.5	20	125	42	60	0.4	4	-
20	FBK0505890	1	20	125	42	60	0.4	4	-
25	FBK0505891	0.5	25	131	45	75	0.4	4	-
25	FBK0505892	1	25	131	45	75	0.4	4	-

Shank diameters staring from Ø 6 mm also available in weldon

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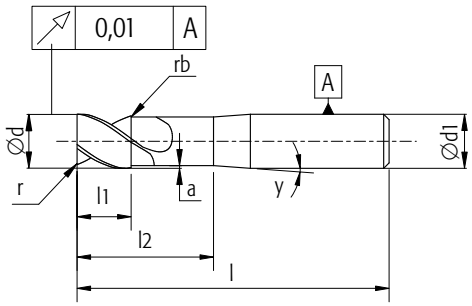
5 Flute

Centre cutting high performance 5 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

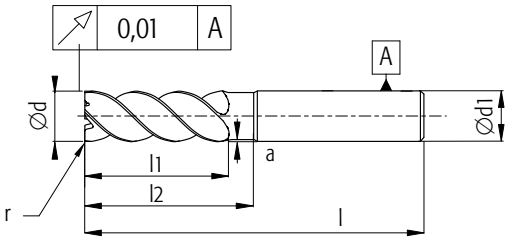
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Short									
3	FBK0505893	0.2	6	39	5	7	0.1	4	15
4	FBK0505894	0.2	6	51	6	9	0.1	4	15
5	FBK0505895	0.2	6	51	7	11	0.2	4	15
6	FBK0505896	0.3	6	64	8	13	0.2	4	-
6	FBK0505897	0.5	6	64	8	13	0.2	4	-
6	FBK0505898	1	6	64	8	13	0.2	4	-
8	FBK0505899	0.3	8	64	11	18	0.3	4	-
8	FBK0505900	0.5	8	64	11	18	0.3	4	-
8	FBK0505901	1	8	64	11	18	0.3	4	-
10	FBK0505902	0.3	10	70	13	22	0.3	4	-
10	FBK0505903	0.5	10	70	13	22	0.3	4	-
10	FBK0505904	1	10	70	13	22	0.3	4	-
12	FBK0505905	0.3	12	78	15	25	0.3	4	-
12	FBK0505906	0.5	12	78	15	25	0.3	4	-
12	FBK0505907	1	12	78	15	25	0.3	4	-
14	FBK0505908	1	14	89	17	30	0.3	4	-
16	FBK0505909	0.5	16	89	19	35	0.3	5	-
16	FBK0505910	1	16	89	19	35	0.3	5	-
20	FBK0505911	0.5	20	102	23	42	0.4	5	-
20	FBK0505912	1	20	102	23	42	0.4	5	-
25	FBK0505913	0.5	25	120	28	45	0.4	5	-
25	FBK0505914	1	25	120	28	45	0.4	5	-

Shank diameters staring from Ø 6 mm also available in weldon

5 Flute

Centre cutting high performance 5 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

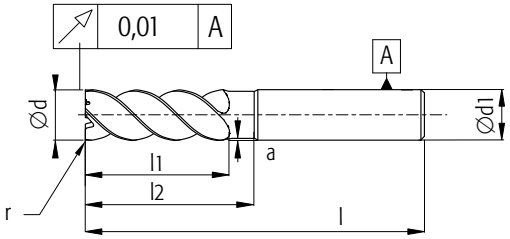
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Standard									
3	FBK0505915	0.2	6	39	7	-	-	5	15
4	FBK0505916	0.2	6	51	9	-	-	5	15
5	FBK0505917	0.2	6	51	11	-	-	5	15
6	FBK0505918	0.3	6	64	13	-	-	5	-
6	FBK0505919	0.5	6	64	13	-	-	5	-
6	FBK0505920	1	6	64	13	-	-	5	-
8	FBK0505921	0.3	8	64	18	-	-	5	-
8	FBK0505922	0.5	8	64	18	-	-	5	-
8	FBK0505923	1	8	64	18	-	-	5	-
10	FBK0505924	0.3	10	70	22	-	-	5	-
10	FBK0505925	0.5	10	70	22	-	-	5	-
10	FBK0505926	1	10	70	22	-	-	5	-
12	FBK0505927	0.3	12	78	25	-	-	5	-
12	FBK0505928	0.5	12	78	25	-	-	5	-
12	FBK0505929	1	12	78	25	-	-	5	-
14	FBK0505930	1	14	89	30	-	-	5	-
16	FBK0505931	0.5	16	89	35	-	-	5	-
16	FBK0505932	1	16	89	35	-	-	5	-
20	FBK0505933	0.5	20	102	42	-	-	5	-
20	FBK0505934	1	20	102	42	-	-	5	-
25	FBK0505935	0.5	25	120	45	-	-	5	-
25	FBK0505936	1	25	120	45	-	-	5	-

Shank diameters staring from Ø 6 mm also available in weldon

5 Flute

Centre cutting high performance 5 flute end mill for exotic materials

HVM HPM | VARI | e8 | 6535 HA | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
With neck relief									
3	FBK0505937	0.2	6	39	8	9	0.1	5	15
4	FBK0505938	0.2	6	51	10	12	0.1	5	15
5	FBK0505939	0.2	6	51	12	15	0.2	5	15
6	FBK0505940	0.3	6	64	14	18	0.2	5	-
6	FBK0505941	0.5	6	64	14	18	0.2	5	-
6	FBK0505942	1	6	64	14	18	0.2	5	-
8	FBK0505943	0.3	8	64	18	24	0.3	5	-
8	FBK0505944	0.5	8	64	18	24	0.3	5	-
8	FBK0505945	1	8	64	18	24	0.3	5	-
10	FBK0505946	0.3	10	70	22	30	0.3	5	-
10	FBK0505947	0.5	10	70	22	30	0.3	5	-
10	FBK0505948	1	10	70	22	30	0.3	5	-
12	FBK0505949	0.3	12	102	26	36	0.3	5	-
12	FBK0505950	0.5	12	102	26	36	0.3	5	-
12	FBK0505951	1	12	102	26	36	0.3	5	-
14	FBK0505952	1	14	102	30	42	0.3	5	-
16	FBK0505953	0.5	16	102	35	48	0.3	5	-
16	FBK0505954	1	16	102	35	48	0.3	5	-
20	FBK0505955	0.5	20	125	42	60	0.4	5	-
20	FBK0505956	1	20	125	42	60	0.4	5	-
25	FBK0505957	0.5	25	131	45	75	0.4	5	-
25	FBK0505958	1	25	131	45	75	0.4	5	-

Shank diameters staring from Ø 6 mm also available in weldon

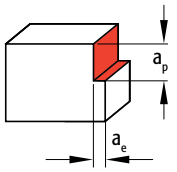
Cutting conditions

- Center cutting high performance 4 flute end mills for roughing/semi finishing of exotic materials
- Center cutting high performance 5 flute end mills for roughing/semi finishing of exotic materials

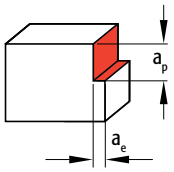
Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	140 - 220	emulsion
P4	< 1000	< 35-48 HRc	100 - 180	emulsion
P4	< 1400	< 35 HRc	70 - 160	emulsion
H1		42-50 HRc	80 - 140	emulsion
M1	< 600		80 - 130	emulsion
M2	600-800	< 25 HRc	60 - 100	emulsion
M3	< 800	< 30 HRc	60 - 100	emulsion
K1	< 800		100 - 160	emulsion
S1	500-1200	25-48 HRc	40 - 60	emulsion
S2	1000-1500	25-48 HRc	45 - 70	emulsion
S3	600-1700	<48 HRc	30 - 50	emulsion
S4	900-1600	33-48 HRc	60 -90	emulsion

Advantages

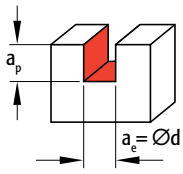
- High performance
- Productivity
- Tool life
- Surface finish



a_p up to 1,00 x d
a_e up to 0,45 x d



a_p up to 2,00 x d
a_e up to 0,45 x d



a_p up to 1,00 x d

Shoulder milling (1xD depth of cut)

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 3.0	< 1.4	0.010 - 0.020
4	< 4.0	< 1.8	0.015 - 0.030
5	< 5.0	< 2.3	0.020 -0.040
6	< 6.0	< 2.7	0.025 - 0.050
8	< 8.0	< 3.6	0.030 - 0.060
10	< 10.0	< 4.5	0.040 - 0.070
12	< 12.0	< 5.4	0.050 - 0.080
14	< 14.0	< 6.3	0.055 - 0.090
16	< 16.0	< 7.2	0.060 - 0.100
20	< 20.0	< 9.0	0.080 - 0.120
25	< 25.0	< 11.3	0.100 - 0.150

Shoulder milling (2xD depth of cut)

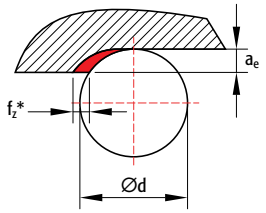
Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 6.0	< 0.75	0.010 - 0.030
4	< 8.0	< 1.00	0.020 - 0.040
5	< 10.0	< 1.25	0.025 - 0.055
6	< 12.0	< 1.50	0.035 - 0.065
8	< 16.0	< 2.00	0.045 - 0.075
10	< 20.0	< 2.50	0.055 - 0.085
12	< 24.0	< 3.00	0.070 - 0.100
14	< 28.0	< 3.50	0.080 - 0.120
16	< 32.0	< 4.00	0.090 - 0.130
20	< 40.0	< 5.00	0.110 - 0.150
25	< 50.0	< 6.25	0.135 - 0.185

Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 3.0	3	0.005 - 0.015
4	< 4.0	4	0.008 - 0.025
5	< 5.0	5	0.010 -0.030
6	< 6.0	6	0.015 - 0.035
8	< 8.0	8	0.025 - 0.045
10	< 10.0	10	0.030 - 0.050
12	< 12.0	12	0.035 - 0.060
14	< 14.0	14	0.040 - 0.070
16	< 16.0	16	0.050 - 0.080
20	< 20.0	20	0.060 - 0.100
25	< 25.0	25	0.080 - 0.130

- At shoulder milling. feed per tooth fz* for lower ae values should be converted according formula.
- For shoulder milling cutting speed Vc may be increased up to 30%.

a_e	$f_z^* =$
0.10 x d	fz x 3
0.25 x d	fz x 2
0.50 x d	fz x 1



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

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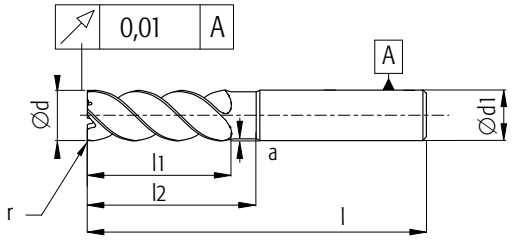
Multi Flute

Centre cutting high performance multi flute end mill for exotic materials

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

P1-P6
K1-K2
M1-M3
S1-S4
H1



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Standard									
6	FBK0505051	0.3	6	64	15	-	-	6	-
8	FBK0503657	0.5	8	64	20	-	-	6	-
10	FBK0505052	0.5	10	78	22	-	-	6	-
12	FBK0505053	0.5	12	78	28	-	-	6	-
16	FBK0505054	0.5	16	89	34	-	-	6	-
20	FBK0505055	0.5	20	102	42	-	-	8	-
Long									
6	FBK0505056	0.3	6	64	20	-	-	6	-
8	FBK0505057	0.5	8	78	30	-	-	6	-
10	FBK0505058	0.5	10	89	35	-	-	6	-
12	FBK0505059	0.5	12	102	40	-	-	6	-
16	FBK0505060	0.5	16	102	50	-	-	6	-
20	FBK0505061	0.5	20	125	60	-	-	8	-
Extra long									
8	FBK0505062	0.5	8	102	40	-	-	6	-
10	FBK0505063	0.5	10	125	60	-	-	6	-
12	FBK0505064	0.5	12	150	65	-	-	6	-
16	FBK0505065	0.5	16	150	75	-	-	6	-
20	FBK0505066	0.5	20	150	80	-	-	8	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting conditions

Centre cutting high performance multi flute end mill for exotic materials

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	140 - 220	emulsion
P4	< 1000	< 35-48 HRc	100 - 180	emulsion
P4	< 1400	< 35 HRc	70 - 160	emulsion
H1		42-50 HRc	80 - 140	emulsion
M1	< 600		80 - 130	emulsion
M2	600-800	< 25 HRc	60 - 100	emulsion
M3	< 800	< 30 HRc	60 - 100	emulsion
K1	< 800		100 - 160	emulsion
S1	500-1200	25-48 HRc	40 - 60	emulsion
S2	1000-1500	25-48 HRc	45 - 70	emulsion
S3	600-1700	<48 HRc	30 - 50	emulsion
S4	900-1600	33-48 HRc	60 -90	emulsion

FBK0505061

Workpiece material:

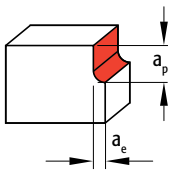
1.4401 stainless 316

	Forbes
ø	8mm
Z	6 Flutes
vc	100 m/min
n	3979 rpm
Fz	0.03 mm/t
vf	950 mm/min
ap	40 mm
ae	0.2 mm
Coolant	emulsion

Q	7.6 cm^3/min

Advantages

- Superior surface finish!
- Excellent straightness tolerances.
- Cutting length up to 6 x D.



Roughing

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
6	< 20.0	< 0.48	0.035 - 0.055
8	< 40.0	< 0.64	0.045 - 0.075
10	< 60.0	< 0.80	0.070 - 0.090
12	< 65.0	< 0.96	0.080 - 0.110
16	< 75.0	< 1.28	0.100 - 0.140
20	< 80.0	< 1.60	0.120 - 0.180

Finishing

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
6	< 20.0	< 0.12	0.020 - 0.040
8	< 40.0	< 0.16	0.030 - 0.050
10	< 60.0	< 0.20	0.040 - 0.060
12	< 65.0	< 0.24	0.050 - 0.080
16	< 75.0	< 0.32	0.070 - 0.100
20	< 80.0	< 0.40	0.085 - 0.120

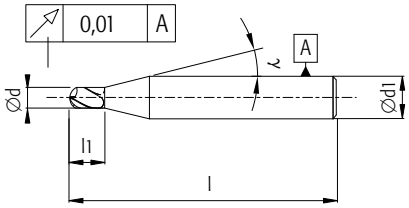
2 Flute

Centre cutting high performance 2 flute ball nose for exotic materials

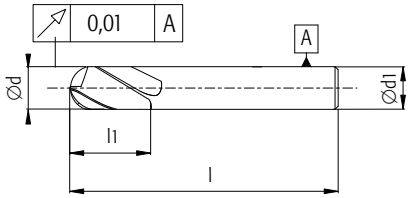
HSM | 30° | f7 | 6535 HA | h5 | TiAlN

P1-P6
K1-K2
M1-M3
S1-S4
H1

Micro



Standard



* For endmills L l 100 mm.

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
0.4	FBK0505037	0.20	4	51	0.6	-	-	2	10
0.5	FBK0505038	0.25	4	51	0.9	-	-	2	10
0.6	FBK0505039	0.30	4	51	1.2	-	-	2	10
0.8	FBK0505040	0.40	4	51	1.5	-	-	2	10
1	FBK0505041	0.50	4	51	2	-	-	2	15
1.5	FBK0505042	0.75	4	51	3	-	-	2	15
2	FBK0505043	1.00	4	51	4	-	-	2	15
3	FBK0505044	1.50	4	51	6	-	-	2	15
4	FBK0505045	2.00	6	57	8	-	-	2	15
5	FBK0505046	2.50	6	57	10	-	-	2	15
6	FBK0505047	3.00	6	57	12	-	-	2	-
8	FBK0505048	4.00	8	63	16	-	-	2	-
10	FBK0505049	5.00	10	72	20	-	-	2	-
12	FBK0505050	6.00	12	83	24	-	-	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting conditions

Centre cutting high performance 2 flute ball nose for exotic materials

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	140 - 220	emulsion
P4	< 1000	< 35-48 HRc	100 - 180	emulsion
P4	< 1400	< 35 HRc	70 - 160	emulsion
H1		42-50 HRc	80 - 140	emulsion
M1	< 600		80 - 130	emulsion
M2	600-800	< 25 HRc	60 - 100	emulsion
M3	< 800	< 30 HRc	60 - 100	emulsion
K1	< 800		100 - 160	emulsion
S1	500-1200	25-48 HRc	40 - 60	emulsion
S2	1000-1500	25-48 HRc	45 - 70	emulsion
S3	600-1700	<48 HRc	30 - 50	emulsion
S4	900-1600	33-48 HRc	60 -90	emulsion

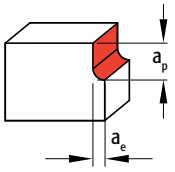
FBK0505048

Workpiece material:

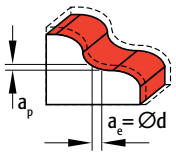
1.4462 Duplex

	Forbes
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



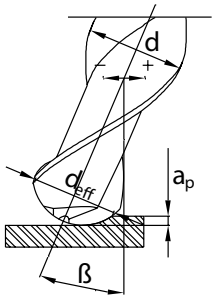
Roughing



Finishing

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.4	< 0.60	< 0.12	0.004 - 0.008
0.5	<0.75	< 0.15	0.005 - 0.009
0.6	<0.90	< 0.18	0.006 - 0.010
0.8	<1.20	< 0.24	0.007 - 0.012
1	< 1.50	< 0.30	0.008 - 0.015
1.5	< 2.25	< 0.45	0.012 - 0.018
2	< 3.00	< 0.60	0.016 - 0.022
3	< 4.50	< 0.90	0.018 - 0.025
4	< 6.00	< 1.20	0.020 - 0.028
5	< 7.50	< 1.50	0.025 - 0.035
6	< 9.00	< 1.80	0.028 - 0.042
8	< 12.00	< 2.40	0.030 - 0.050
10	< 15.00	< 3.00	0.040 - 0.070
12	< 18.00	< 3.60	0.050 - 0.080

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.4	< 0.60	< 0.04	0.007 - 0.015
0.5	< 0.75	< 0.05	0.010 - 0.020
0.6	< 0.90	< 0.06	0.012 - 0.021
0.8	< 1.20	< 0.08	0.014 - 0.023
1	< 1.50	< 0.10	0.015 - 0.025
1.5	< 2.25	< 0.15	0.020 - 0.030
2	< 3.00	< 0.20	0.025 - 0.035
3	< 4.50	< 0.30	0.028 - 0.040
4	< 6.00	< 0.40	0.030 - 0.045
5	< 7.50	< 0.50	0.035 - 0.050
6	< 9.00	< 0.60	0.040 - 0.055
8	< 12.00	< 0.80	0.050 - 0.065
10	< 15.00	<1.00	0.055 - 0.080
12	< 18.00	< 1.20	0.065 - 0.090



For the cutting speed Vc calculation the effective cutting diameter d_{eff} has to be taken into account. See formula.

$$ß \neq 0; \quad d_{eff} = d \times \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$$

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High volume milling - Trochoidal milling

Forbes has designed a program of HVM (High Volume Machining) or roughing on a wide spectrum of applications and materials: Steels up to 50HRc, alloy steels, tools steels, stainless steels, carbon steel, cast iron as well as materials that contain Chrome (Cr) or Nickel (Ni).

- Trochoidal milling
  - ▶ Stainless
  - ▶ Titanium
  - ▶ Steels

- Efficient production
- Longer tool life
- Lower cycle time

Trochoidal Milling is an efficient way to cut a slot other than using a standard slot milling method. In trochoidal milling, an end mill is used to machine the slot width using a circular movement. This is called the trochoid method

Advantages

- 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

Program

- Center cutting high performance trochoidal mills for stainless and titanium
- Center cutting high performance trochoidal mills for steel

Tensile strength: N/mm² I Hardness: HRC

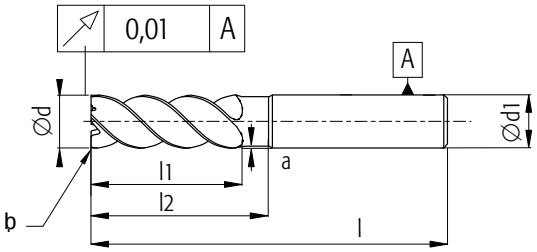
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Optimum Flutes

Centre cutting high performance trochoidal mill for stainless steel, titanium

4-7 | VARI | e8 | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

Ød (mm)	EDP No	b (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0505959	0.1	6	57	10	15	0.1	4	-
4	FBK0505960	0.1	6	57	13	15	0.1	4	-
5	FBK0505961	0.1	6	57	16	20	0.1	4	-
6	FBK0505962	0.1	6	57	19	25	0.1	5	-
8	FBK0505963	0.15	8	63	25	30	0.1	5	-
10	FBK0505964	0.2	10	72	32	35	0.1	5	-
12	FBK0505965	0.2	12	83	38	45	0.1	6	-
16	FBK0505966	0.3	16	108	42	55	0.1	6	-
20	FBK0505967	0.4	20	126	50	70	0.1	7	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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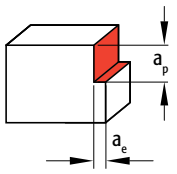
Cutting conditions

Centre cutting high performance trochoidal mill for stainless steel, titanium

Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
P3	< 750	< 35 HRc	220 - 280	emulsion
P4	< 1000	< 35-48 HRc	145 - 225	emulsion
P4	< 1400	< 35 HRc	100 - 180	emulsion
H1		42-50 HRc	100 - 150	emulsion
M1	< 600		115 - 165	emulsion
M2	600-800	< 25 HRc	85 - 125	emulsion
M3	< 800	< 30 HRc	85 - 125	emulsion
K1	125-500	< 32 HRc	100 - 160	emulsion
S1	500-1200	25-48 HRc	55 - 75	emulsion
S2	1000-1500	25-48 HRc	60 - 90	emulsion
S3	600-1700	<48 HRc	45 - 65	emulsion
S4	900-1600	33-48 HRc	80 - 120	emulsion



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3.0	< 9.00	< 0.450	0.015 - 0.035
4.0	< 12.00	< 0.600	0.025 - 0.050
5.0	< 15.00	< 0.750	0.030 - 0.060
6.0	< 18.00	< 0.900	0.040 - 0.070
8.0	< 24.00	< 1.200	0.050 - 0.085
10.0	< 30.00	< 1.500	0.060 - 0.100
12.0	< 36.00	< 1.800	0.085 - 0.120
16.0	< 40.00	< 2.400	0.100 - 0.145
20.0	< 50.00	< 3.000	0.125 - 0.175

Advantages

- High MRR (Material Removal Rate)
- Constant cutting force
  - ▶ Better for machine
  - ▶ Better for end mill
  - ▶ Increased lifetime
- Optimized cutting conditions to application area

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

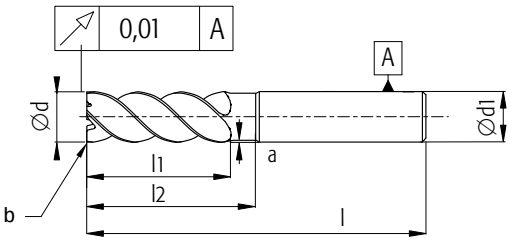
TOTEM

Solid Carbide End Mills

Optimum Flutes

Centre cutting high performance trochoidal mill for steel

4-7 | VARI | e8 | 6535 HB | h5 | TiAlN



P1-P6
K1-K2
M1-M3
S1-S4
H1

Ød (mm)	EDP No	b (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0505968	0.1	6	57	10	15	0.1	4	-
4	FBK0505969	0.1	6	57	13	15	0.1	4	-
5	FBK0505970	0.1	6	57	16	20	0.1	4	-
6	FBK0505971	0.1	6	57	19	25	0.1	5	-
8	FBK0505972	0.15	8	63	25	30	0.1	5	-
10	FBK0505973	0.2	10	72	32	35	0.1	5	-
12	FBK0505974	0.2	12	83	38	45	0.1	6	-
16	FBK0505975	0.3	16	108	42	55	0.1	6	-
20	FBK0505976	0.4	20	126	50	70	0.1	7	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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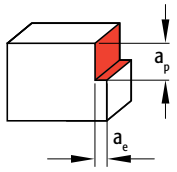
Cutting conditions

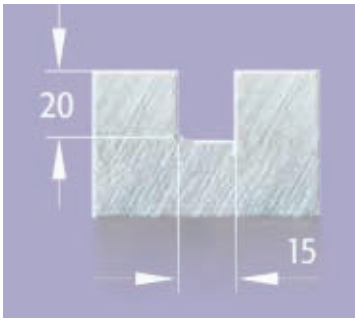
Centre cutting high performance trochoidal mill for steel

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	< 750	< 35 HRc	240 - 300	emulsion
P4	< 1000	< 35-48 HRc	160 - 240	emulsion
P4	< 1400	< 35 HRc	130 - 200	emulsion
H1		42-50 HRc	100 - 150	emulsion
M1	< 600		100 - 150	emulsion
M2	600-800	< 25 HRc	90 - 120	emulsion
M3	< 800	< 30 HRc	90 - 120	emulsion
K1	125-500	<32 HRc	125 - 225	emulsion
S1	500-1200	25-48 HRc	45 - 65	emulsion
S2	1000-1500	25-48 HRc	50 - 80	emulsion
S3	600-1700	<48 HRc	35 - 55	emulsion
S4	900-1600	33-48 HRc	70 - 105	emulsion



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
3	< 9.00	< 0.600	0.015 - 0.035
4	< 12.00	< 0.800	0.025 - 0.050
5	< 15.00	< 1.000	0.030 - 0.060
6	< 18.00	< 1.200	0.040 - 0.070
8	< 24.00	< 1.600	0.050 - 0.085
10	< 30.00	< 2.000	0.060 - 0.100
12	< 36.00	< 2.400	0.085 - 0.120
16	< 40.00	<3 .200	0.100 - 0.145
20	< 50.00	< 4.000	0.125 - 0.175



FBK0505973

Workpiece material: St.37

	Competitor	Forbes
ø	10mm	10mm
Z	4 Flutes	5 Flutes
vc	180 mtr/min	250 mtr/min
n	5730 rpm	7957 rpm
Fz	0.04 mm/t	0.12 mm/t
vf	912 mm/min	4774 mm/min
ap	10 mm	20 mm
ae	10 mm / 5 mm	1 mm (programmed)
Coolant	emulsion	emulsion

Cut time	37 s	24 s

Advantages

- High MRR (Material Removal Rate)
- Lower process time

Composites and Synthetics

Solutions for synthetics and composite materials

Years of experience and numerous tests in aerospace applications, provided the details required to develop an integral endmill high-end program for glass- and carbon fibre reinforced materials.

High accurate manufacturing by laser

Diamond tipped vs PCD

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

FBK0506012

Workpiece material: Nylon with Glass Fibre

Hardness:

	Competitor	Forbes
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

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

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

Program

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

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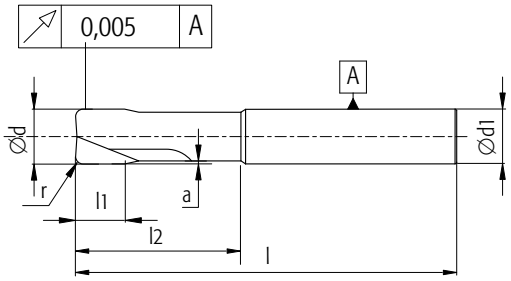
2 Flute

Centre cutting high performance diamond tipped end mill with corner radius

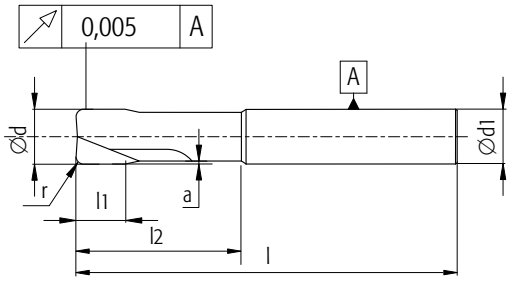
N1-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Standard									
3	FBK0505977	0.3	6	78	2.5	9	0.25	2	25
3	FBK0505978	0.3	6	78	2.5	15	0.25	2	25
3	FBK0505979	0.5	6	78	2.5	9	0.25	2	25
3	FBK0505980	0.5	6	78	2.5	15	0.25	2	25
4	FBK0505981	0.3	6	78	2.5	12	0.25	2	25
4	FBK0505982	0.3	6	78	2.5	20	0.25	2	25
4	FBK0505983	0.5	6	78	2.5	12	0.25	2	25
4	FBK0505984	0.5	6	78	2.5	20	0.25	2	25
5	FBK0505985	0.3	6	78	3	15	0.3	2	25
5	FBK0505986	0.3	6	78	3	25	0.3	2	25
5	FBK0505987	0.5	6	78	3	15	0.3	2	25
5	FBK0505988	0.5	6	78	3	25	0.3	2	25
6	FBK0505989	0.3	6	102	6	18	0.3	2	-
6	FBK0505990	0.3	6	102	6	30	0.3	2	-
6	FBK0505991	0.5	6	102	6	18	0.3	2	-
6	FBK0505992	0.5	6	102	6	30	0.3	2	-
6	FBK0505993	1	6	102	6	18	0.3	2	-
6	FBK0505994	1	6	102	6	30	0.3	2	-
8	FBK0505995	0.3	8	102	7	24	0.4	2	-
8	FBK0505996	0.5	8	102	7	24	0.4	2	-
8	FBK0505997	1	8	102	7	24	0.4	2	-
10	FBK0505998	0.5	10	102	8	30	0.5	2	-
10	FBK0505999	1	10	102	8	30	0.5	2	-
12	FBK0506000	0.5	12	107	9	36	0.5	2	-
12	FBK0506001	1	12	107	9	36	0.5	2	-

2 Flute

Centre cutting high performance diamond tipped end mill with corner radius



N1-N7

Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Long									
3	FBK0506002	0.3	6	78	3	9	0.1	2	15
3	FBK0506003	0.5	6	78	3	9	0.1	2	15
4	FBK0506004	0.3	6	78	4	12	0.1	2	15
4	FBK0506005	0.5	6	78	4	12	0.1	2	15
5	FBK0506006	0.5	6	78	5	15	0.1	2	15
5	FBK0506007	1	6	78	5	15	0.1	2	15
6	FBK0506008	0.5	6	78	6	18	0.1	2	-
6	FBK0506009	1	6	78	6	18	0.1	2	-
8	FBK0506010	0.5	8	78	8	24	0.1	2	-
8	FBK0506011	1	8	78	8	24	0.1	2	-
10	FBK0506012	1	10	78	10	30	0.1	2	-
12	FBK0506013	1	12	78	12	30	0.1	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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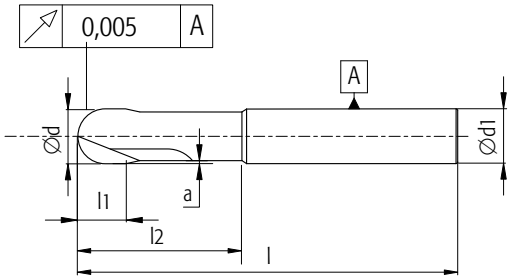
2 Flute

Centre cutting high performance diamond tipped ball nose end mill

N1-N7



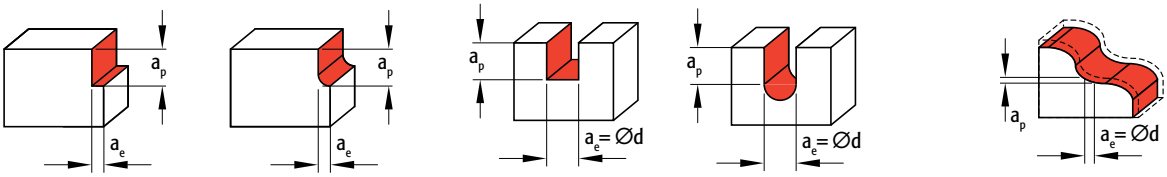
Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Standard									
3	FBK0506014	1.5	6	78	2.5	9	0.25	2	25
3	FBK0506015	1.5	6	78	2.5	15	0.25	2	25
4	FBK0506016	2	6	78	2.5	12	0.25	2	25
4	FBK0506017	2	6	78	2.5	20	0.25	2	25
5	FBK0506018	2.5	6	78	3	15	0.3	2	25
5	FBK0506019	2.5	6	78	3	25	0.3	2	25
6	FBK0506020	3	6	102	6	18	0.3	2	-
6	FBK0506021	3	6	102	6	30	0.3	2	-
8	FBK0506022	4	8	102	7	24	0.4	2	-
8	FBK0506023	4	8	102	7	40	0.4	2	-
10	FBK0506024	5	10	102	8	30	0.5	2	-
10	FBK0506025	5	10	102	8	50	0.5	2	-
12	FBK0506026	6	12	107	9	36	0.5	2	-
12	FBK0506027	6	12	107	9	60	0.5	2	-
Long									
3	FBK0506028	1.5	6	78	3	9	0.1	2	15
4	FBK0506029	2	6	78	4	12	0.1	2	15
5	FBK0506030	2.5	6	78	5	15	0.1	2	15
6	FBK0506031	3	6	78	6	18	0.1	2	-
8	FBK0506032	4	8	78	8	24	0.1	2	-
10	FBK0506033	5	10	78	10	30	0.1	2	-
12	FBK0506034	6	12	78	12	30	0.1	2	-

Available in special dimensions on request.

Cutting conditions

- Center cutting diamond tipped high performance endmill with corner radius
- Center cutting diamond tipped high performance ball nose

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
N1	< 500	< 150	350 - 650	emulsion / air
N2	< 400	< 120	200 - 500	emulsion / air
N3	< 350	< 100	350 - 500	emulsion / air
N4			400 - 1000	emulsion / air
N5			400 - 1000	emulsion / air
N6			< 700	emulsion / air
N7			< 700	emulsion / air



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 1.95	< 1.20	0.020 - 0.030
4	< 2.60	< 1.60	0.030 - 0.045
5	< 3.25	< 2.00	0.040 - 0.060
6	< 3.90	< 2.40	0.050 - 0.070
8	< 5.20	< 3.20	0.060 - 0.080
10	< 6.50	< 4.00	0.070 - 0.100
12	< 7.80	< 4.80	0.090 - 0.120

Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 0.60	< 3.0	0.010 - 0.020
4	< 0.80	< 4.0	0.020 - 0.040
5	< 1.00	< 5.0	0.030 - 0.045
6	< 1.20	< 6.0	0.040 - 0.060
8	< 1.60	< 8.0	0.050 - 0.070
10	< 2.00	< 10.0	0.060 - 0.080
12	< 2.40	< 12.0	0.080 - 0.100

Profile milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
3	< 0.60	< 0.30	0.020 - 0.030
4	< 0.80	< 0.40	0.030 - 0.045
5	< 1.00	< 0.50	0.040 - 0.060
6	< 1.20	< 0.60	0.050 - 0.070
8	< 1.60	< 0.80	0.060 - 0.080
10	< 2.00	< 1.00	0.070 - 0.100
12	< 2.40	< 12.0	0.080 - 0.120

FBK0506008
Workpiece material: T800 M21
Hardness: Aerospace material

	Competitor	Forbes
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 cm³/min	72 cm³/min
Toollife	94 min	214 min

FBK0506033
Workpiece material: Hextool
Hardness: Aerospace material

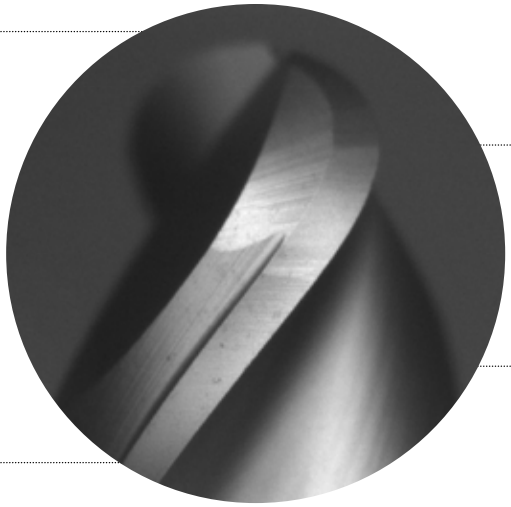
	Competitor	Forbes
ø	10mm	10mm
Z	2 Flute	2 Flute
vc	377 m/min	314 m/min
n	10000 rpm	10000 rpm
Fz	0.10 mm/t	0.15 mm/t
vf	2600 mm/min	3000 mm/min
ap	0.35 mm	0.35 mm
ae	0.35 mm	0.35 mm
Coolant	dry	dry

Q	0.32 cm³/min	0.37 cm³/min
Toollife	5 h 33 min	14 h 10 min

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

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

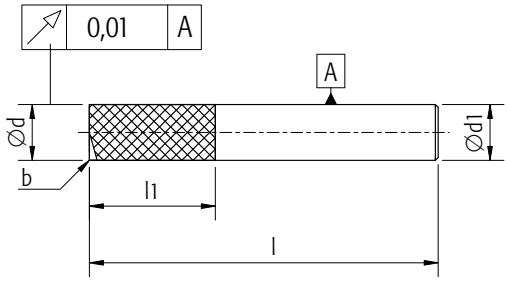
Higher productivity

2 Flute

Centre cutting high performance 2 flute rougher for graphite

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

N5-N7



Ød (mm)	EDP No	b (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Standard									
4	FBK0504668	0.25	4	60	12	-	-	2	
6	FBK0504669	0.3	6	78	18	-	-	2	
8	FBK0504670	0.35	8	78	24	-	-	2	
10	FBK0504671	0.4	10	78	30	-	-	2	
12	FBK0504672	0.5	12	89	36	-	-	2	
12	FBK0504673	0.5	12	150	36	50	0.3	2	
16	FBK0504674	0.5	16	150	36	70	0.4	2	

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

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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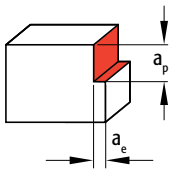
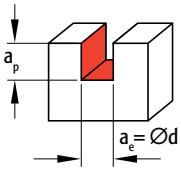
Cutting conditions

Centre cutting high performance 2 flute rougher for graphite

Material group	TSR (N/mm²)	Hardness HRc	Cutting speed Vc m/min	Coolant
N5			< 600	air
N6			< 600	air
N7			350 - 500	air



a_p up to 2.50 x d
a_e up to 0.50 x d



a_p up to 1.00 x d

Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
4	< 10.0	< 2.0	< 5000
6	< 15.0	< 3.0	< 6000
8	< 20.0	< 4.0	< 8000
10	< 25.0	< 5.0	< 10000
12	< 30.0	< 6.0	< 12000
16	< 35.0	< 8.0	< 15000

Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
4	< 4.0	4	< 3750
6	< 6.0	6	< 4500
8	< 8.0	8	< 6000
10	< 10.0	10	< 7500
12	< 12.0	12	< 9000
16	< 16.0	16	< 11250

FBK0504671
Workpiece material: EDM200 Graphite

	Forbes
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:

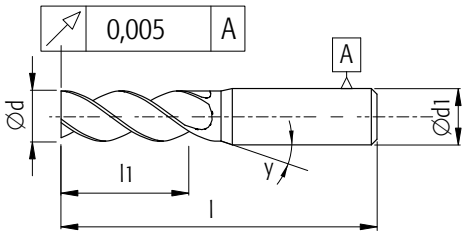
Advantages
- High material removal rate.
- Special roughing pitch.
- Designed for high feeds on graphite applications.

3 Flute

Centre cutting high performance 3 flute end mill for graphite

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

N5-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	γ (°)
Standard								
2	FBK0503940	-	3	50	10	-	-	15
3	FBK0503941	-	3	50	10	-	-	-
4	FBK0503942	-	4	60	15	-	-	-
5	FBK0503943	-	5	60	20	-	-	-
6	FBK0503944	-	6	78	30	-	-	-
8	FBK0503945	-	8	78	30	-	-	-
10	FBK0503946	-	10	78	30	-	-	-
12	FBK0503947	-	12	89	30	-	-	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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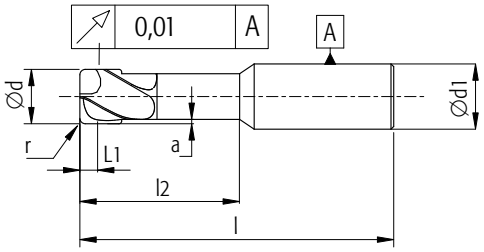
Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite

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

N5-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Short									
2	FBK0504675	0.1	3	50	3	10	0.1	2	15
3	FBK0504676	0.1	6	51	4	10	0.1	2	15
4	FBK0504677	0.2	6	51	4	10	0.1	4	15
5	FBK0504678	0.2	6	51	5	10	0.15	4	15
6	FBK0504679	0.3	6	51	6	10	0.2	4	-
8	FBK0504680	0.3	8	64	8	15	0.3	4	-
10	FBK0504681	0.3	10	78	10	20	0.3	4	-
12	FBK0504682	0.3	12	78	10	20	0.3	4	-
Standard									
2	FBK0504683	0.1	2	50	10	-	-	3	-
2	FBK0504684	0.1	3	50	10	-	-	3	15
2	FBK0504685	0.1	3	50	10	15	0.1	3	10
2	FBK0506035	0.1	3	50	10	20	0.1	3	15
2	FBK0504686	0.1	3	65	10	30	0.1	3	15
2	FBK0504687	0.1	3	80	10	30	0.1	3	15
3	FBK0504688	0.1	3	50	10	-	-	3	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

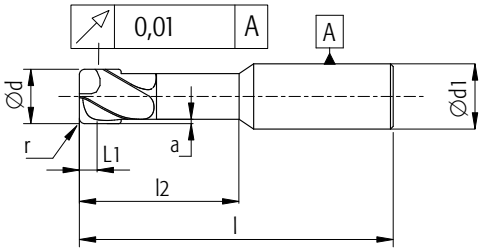
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, PI, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Optimum Flutes

Centre cutting high performance end mill with corner radius for graphite

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

N5-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0506036	0.1	3	65	10	20	0.1	3	-
3	FBK0504689	0.1	3	65	10	30	0.1	3	-
3	FBK0504690	0.1	3	80	10	30	0.1	3	-
4	FBK0504691	0.2	4	60	15	-	-	3	-
5	FBK0504692	0.2	5	60	20	-	-	3	-
6	FBK0504693	0.3	6	78	30	-	-	3	-
8	FBK0504694	0.3	8	78	30	-	-	3	-
10	FBK0504695	0.3	10	78	30	-	-	3	-
12	FBK0504696	0.3	12	89	30	-	-	3	-
Long									
4	FBK0504697	0.3	4	102	10	-	-	2	-
5	FBK0504698	0.5	5	102	13	-	-	2	-
6	FBK0504699	0.5	6	102	42	-	-	2	-
6	FBK0504700	0.5	6	150	26	-	-	2	-
8	FBK0504701	0.5	8	150	41	-	-	2	-
10	FBK0504702	0.5	10	150	42	-	-	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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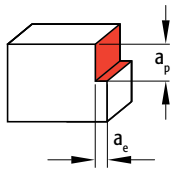
Cutting conditions

- Center cutting high performance 3 flute end mill for graphite
- Center cutting high performance end mill with corner radius for graphite

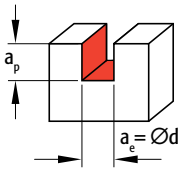
Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
N5			< 600	air
N6			< 600	air
N7			350 - 500	air

Advantages

- More accuracy
- Smooth surface on the workpiece
- Better toollife



a_p up to 2.50 x d
a_e up to 0.50 x d



a_p up to 1.00 x d

Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
2	< 4.0	< 0.4	0.012 - 0.036
3	< 6.0	< 0.6	0.018 - 0.048
4	< 8.0	< 0.8	0.030 - 0.060
5	< 10.0	< 1.0	0.042 - 0.072
6	< 12.0	< 1.2	0.054 - 0.096
8	< 16.0	< 1.6	0.066 - 0.120
10	< 20.0	< 2.0	0.090 - 0.144
12	< 24.0	< 2.4	0.108 - 0.168

Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
2	< 2.0	2	0.010 - 0.030
3	< 3.0	3	0.015 - 0.040
4	< 4.0	4	0.025 - 0.050
5	< 5.0	5	0.035 - 0.060
6	< 6.0	6	0.045 - 0.080
8	< 8.0	8	0.055 - 0.100
10	< 10.0	10	0.075 - 0.120
12	< 12.0	12	0.090 - 0.140

FBK0503944
Workpiece material: Graphite

	Competitor	Forbes
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
Toollife	2 h 37 min	7 h 14 min

Higher tool life

FBK0504691
Workpiece material: EDM-3 Graphite

	Forbes
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

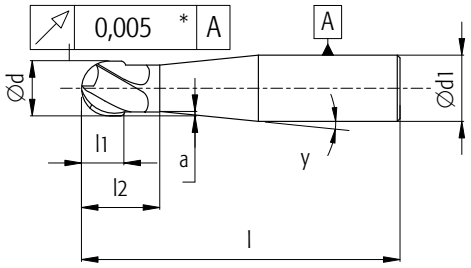
Higher MRR

Optimum Flutes

Centre cutting high performance ball nose for graphite

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

N5-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
Short									
2	FBK0504272	1	3	50	3	10	0.1	2	15
3	FBK0504273	1.5	6	51	4	10	0.1	2	15
4	FBK0504274	2	6	51	4	10	0.1	4	15
5	FBK0504275	2.5	6	51	5	10	0.15	4	15
6	FBK0504276	3	6	51	6	10	0.2	4	-
8	FBK0504277	4	8	64	8	15	0.3	4	-
10	FBK0504278	5	10	78	10	20	0.3	4	-
12	FBK0504279	6	12	78	10	20	0.3	4	-
Standard									
2	FBK0504280	1	2	50	10	-	-	3	-
2	FBK0504281	1	3	50	10	-	-	3	15
2	FBK0506037	1	3	50	10	15	0.1	3	15
2	FBK0506038	1	3	50	10	20	0.1	3	15
2	FBK0506039	1	3	65	10	30	0.1	3	15
3	FBK0504282	1.5	3	50	10	-	-	3	-
3	FBK0506037	1.5	3	50	10	15	0.1	3	-
3	FBK0506038	1.5	3	50	10	20	0.1	3	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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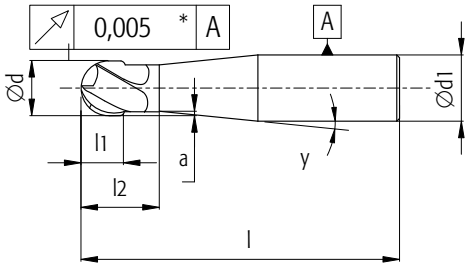
Optimum Flutes

Centre cutting high performance ball nose for graphite

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

N5-N7



Ød (mm)	EDP No	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)
3	FBK0506039	1.5	3	50	10	30	0.1	3	-
4	FBK0504283	2	4	60	15	-	-	3	-
5	FBK0504284	2.5	5	60	20	-	-	3	-
6	FBK0504285	3	6	78	30	-	-	3	-
8	FBK0504286	4	8	78	30	-	-	3	-
10	FBK0504287	5	10	78	30	-	-	3	-
12	FBK0504288	6	12	89	30	-	-	3	-
Long									
2	FBK0504289	1	3	102	6	-	-	2	15
3	FBK0504290	1.5	3	102	16	-	-	2	-
4	FBK0504291	2	4	102	16	-	-	2	-
6	FBK0504292	3	6	102	42	-	-	2	-
6	FBK0504293	3	6	150	42	-	-	2	-
8	FBK0504294	4	8	102	42	-	-	2	-
8	FBK0504295	4	8	150	42	-	-	2	-
10	FBK0504296	5	10	150	45	-	-	2	-
12	FBK0504297	6	12	150	65	-	-	2	-

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

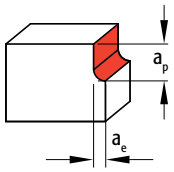
Cutting conditions

Centre cutting high performance ball nose for graphite

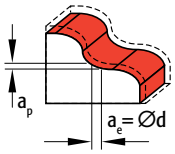
Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
N5			< 600	air
N6			< 600	air
N7			350 - 500	air

Advantages

- More accuracy
- Smooth surface on the workpiece
- Better toollife



Roughing



Finishing

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
2	< 4.0	< 0.4	0.012 - 0.036
3	< 6.0	< 0.6	0.018 - 0.048
4	< 8.0	< 0.8	0.030 - 0.060
5	< 10.0	< 1.0	0.042 - 0.072
6	< 12.0	< 1.2	0.054 - 0.096
8	< 16.0	< 1.6	0.066 - 0.120
10	< 20.0	< 2.0	0.090 - 0.144
12	< 24.0	< 2.4	0.108 - 0.168

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
< 0.4	0.2	0.012 - 0.036	0.007 - 0.015
< 0.6	0.3	0.018 - 0.048	0.010 - 0.020
< 0.8	0.4	0.030 - 0.060	0.012 - 0.021
< 1.0	0.5	0.042 - 0.072	0.014 - 0.023
< 1.2	0.6	0.054 - 0.096	0.015 - 0.025
< 1.6	0.8	0.066 - 0.120	0.020 - 0.030
< 2.0	1	0.090 - 0.144	0.025 - 0.035
< 2.4	1.2	0.108 - 0.168	0.028 - 0.040

FBK0504283
Workpiece material: ISO 63

	Forbes
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 cm³/min

Higher productivity

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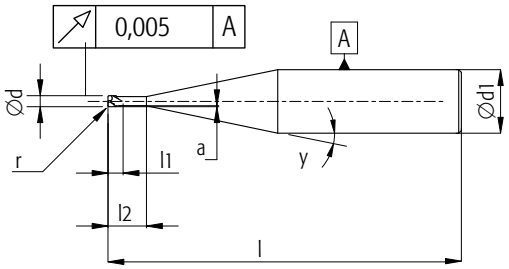
2 Flute

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

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

N5-N7



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.3	FBK0504298	0.05	6	64	1	-	-	2	7	1.743	1.896	2.304	2.944
0.3	FBK0504299	0.05	6	64	1.5	2.5	0.01	2	7	2.908	3.148	3.771	4.710
0.3	FBK0504300	0.05	6	64	1.5	5	0.01	2	8	5.562	5.967	6.988	8.436
0.4	FBK0504301	0.05	6	64	1.5	-	-	2	6	1.744	1.900	2.319	2.985
0.4	FBK0504302	0.05	6	64	1.5	2.5	0.01	2	7	2.912	3.156	3.797	4.773
0.4	FBK0504303	0.05	6	64	1.5	5	0.01	2	8	5.568	5.982	7.029	8.529
0.5	FBK0504304	0.05	6	64	1.5	-	-	2	6	2.286	2.492	3.043	3.918
0.5	FBK0504305	0.05	6	64	1.5	3.5	0.01	2	7	3.984	4.310	5.158	6.429
0.5	FBK0504306	0.05	6	64	1.5	7	0.01	2	8	7.671	8.192	9.480	11.256
0.5	FBK0504307	0.05	6	64	1.5	10	0.01	2	10	10.772	11.375	12.813	14.671
0.6	FBK0504308	0.05	6	64	1.5	-	-	2	6	2.890	3.157	3.878	5.036
0.6	FBK0504309	0.05	6	64	2	3.5	0.025	2	7	4.185	4.534	5.442	6.815
0.6	FBK0504310	0.05	6	64	2	7	0.025	2	8	7.864	8.405	9.750	11.614
0.6	FBK0504311	0.05	6	64	2	10	0.025	2	10	10.959	11.582	13.070	15.001
0.8	FBK0504312	0.05	6	64	2	-	-	2	6	3.435	3.760	4.642	6.078
0.8	FBK0504313	0.05	6	64	2	5	0.025	2	7	5.787	6.253	7.456	9.240

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

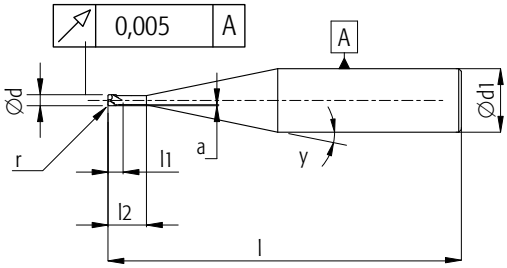
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute

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

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

N5-N7



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.8	FBK0504314	0.05	6	64	2	7.5	0.025	2	8	8.402	8.987	10.447	12.478
0.8	FBK0504315	0.05	6	64	2	10	0.025	2	9	10.978	11.629	13.195	15.253
0.8	FBK0504316	0.05	6	64	2	15	0.025	2	13	16.043	16.674	18.099	19.794
1	FBK0504317	0.05	6	64	2.5	-	-	2	6	3.982	4.368	5.423	7.163
1	FBK0504318	0.05	6	64	3	5	0.025	2	7	5.805	6.294	7.572	9.512
1	FBK0504319	0.05	6	64	3	7.5	0.025	2	8	8.422	9.036	10.581	12.772
1	FBK0504320	0.05	6	64	3	10	0.025	2	9	10.999	11.680	13.333	15.537
1	FBK0504321	0.05	6	64	3	15	0.025	2	13	16.057	16.716	18.212	20.005
1	FBK0504322	0.05	6	64	3	20	0.025	2	18	21.124	21.741	23.091	24.621
1.2	FBK0504323	0.05	6	64	3	5	0.025	2	7	5.950	6.475	7.869	10.037
1.2	FBK0504324	0.05	6	64	3	10	0.025	2	9	11.183	11.907	13.683	16.087
1.5	FBK0504325	0.05	6	64	3	5	0.025	2	6	5.978	6.548	8.094	10.609
1.5	FBK0504326	0.05	6	64	3	7.5	0.025	2	7	8.618	9.326	11.166	13.921
1.5	FBK0504327	0.05	6	64	3	10	0.025	2	8	11.215	11.996	13.941	16.647
1.5	FBK0504328	0.05	6	64	3	15	0.025	2	12	16.319	17.069	18.798	20.921
1.5	FBK0504329	0.05	6	64	3	20	0.025	2	15	21.448	22.194	23.854	25.785

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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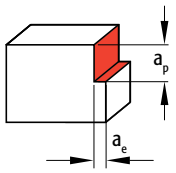
Cutting conditions

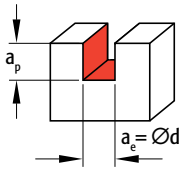
Center cutting high performance micro end mill with corner radius for graphite

Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
N5			< 600	air
N6			< 600	air
N7			350 - 500	air

Advantages

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





Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.3	< 0.6	< 0.03	0.007 - 0.014
0.4	< 0.8	< 0.04	0.010 - 0.018
0.5	< 1.0	< 0.05	0.012 - 0.024
0.6	< 1.2	< 0.06	0.014 - 0.026
0.8	< 1.6	< 0.08	0.018 - 0.030
1	< 2.0	< 0.10	0.022 - 0.036
1.2	< 2.4	< 0.12	0.024 - 0.042
1.5	< 3.0	< 0.15	0.030 - 0.048

Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.3	< 0.15	0.3	0.006 - 0.012
0.4	< 0.20	0.4	0.008 - 0.015
0.5	< 0.25	0.5	0.010 - 0.020
0.6	< 0.30	0.6	0.012 - 0.022
0.8	< 0.40	0.8	0.015 - 0.025
1	< 0.50	1	0.018 - 0.030
1.2	< 0.60	1.2	0.020 - 0.035
1.5	< 0.75	1.5	0.025 - 0.040

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%

Tensile strength: N/mm² I Hardness: HRC

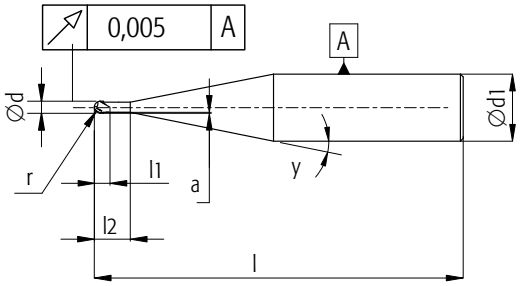
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting high performance micro ball nose for graphite

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

N5-N7



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.3	FBK0504330	0.15	6	64	1	-	-	2	6	1.736	1.886	2.292	2.946
0.3	FBK0504331	0.15	6	64	1.5	2.5	0.01	2	7	2.901	3.131	3.731	4.635
0.3	FBK0504332	0.15	6	64	1.5	5	0.01	2	8	5.555	5.953	6.953	8.373
0.4	FBK0504333	0.2	6	64	1.5	-	-	2	6	1.731	1.880	2.283	2.942
0.4	FBK0504334	0.2	6	64	1.5	2.5	0.01	2	7	2.900	3.131	3.735	4.656
0.4	FBK0504335	0.2	6	64	1.5	5	0.01	2	8	5.557	5.959	6.976	8.432
0.5	FBK0504336	0.25	6	64	1.5	-	-	2	6	2.272	2.472	3.020	3.928
0.5	FBK0504337	0.25	6	64	1.5	3.5	0.01	2	7	3.968	4.277	5.078	6.28
0.5	FBK0504338	0.25	6	64	1.5	7	0.01	2	8	7.658	8.164	9.417	11.143
0.5	FBK0504339	0.25	6	64	1.5	10	0.01	2	10	10.761	11.353	12.762	14.584
0.6	FBK0504340	0.3	6	64	1.5	-	-	2	6	2.871	3.131	3.849	5.055
0.6	FBK0504341	0.3	6	64	2	3.5	0.025	2	7	4.166	4.492	5.341	6.624
0.6	FBK0504342	0.3	6	64	2	7	0.025	2	8	7.848	8.371	9.670	11.47
0.6	FBK0504343	0.3	6	64	2	10	0.025	2	10	10.946	11.554	13.006	14.89
0.8	FBK0504344	0.4	6	64	2	-	-	2	6	3.413	3.731	4.625	6.177
0.8	FBK0504345	0.4	6	64	2	5	0.025	2	7	5.761	6.196	7.320	8.987

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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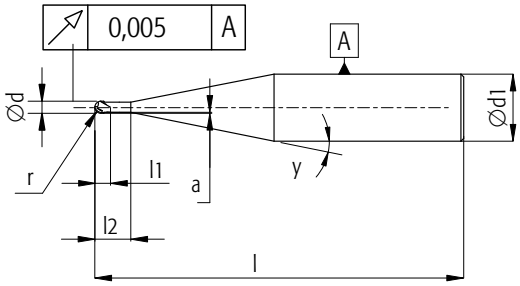
2 Flute

Centre cutting high performance micro ball nose for graphite

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

N5-N7



Ød	EDP No	r	Ød1	L	L1	L2	a	z	γ	Effective length compared with Inclined Angle			
(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	0.5°	1.0°	2.0°	3.0°
0.8	FBK0504346	0.40	6	64	2	7.5	0.025	2	8	8.379	8.938	10.332	12.273
0.8	FBK0504347	0.40	6	64	2	10	0.025	2	9	10.958	11.587	13.100	15.089
0.8	FBK0504348	0.40	6	64	2	15	0.025	2	13	16.029	16.646	18.039	19.695
1.0	FBK0504349	0.50	6	64	2.5	-	-	2	5	3.958	4.341	5.437	7.410
1.0	FBK0504350	0.50	6	64	3	5	0.025	2	7	5.770	6.218	7.388	9.164
1.0	FBK0504351	0.50	6	64	3	7.5	0.025	2	8	8.392	8.970	10.427	12.491
1.0	FBK0504352	0.50	6	64	3	10	0.025	2	9	10.973	11.624	13.205	15.313
1.0	FBK0504353	0.50	6	64	3	15	0.025	2	13	16.040	16.679	18.131	19.872
1.0	FBK0504354	0.50	6	64	3	20	0.025	2	18	21.111	21.715	23.035	24.532
1.2	FBK0504355	0.60	6	64	3	5	0.025	2	7	5.905	6.378	7.630	9.579
1.2	FBK0504356	0.60	6	64	3	10	0.025	2	9	11.149	11.836	13.518	15.796
1.5	FBK0504357	0.75	6	64	3	5	0.025	2	6	5.917	6.413	7.761	9.953
1.5	FBK0504358	0.75	6	64	3	7.5	0.025	2	7	8.564	9.210	10.889	13.401
1.5	FBK0504359	0.75	6	64	3	10	0.025	2	8	11.169	11.898	13.713	16.238
1.5	FBK0504360	0.75	6	64	3	15	0.025	2	12	16.288	17.004	18.656	20.684
1.5	FBK0504361	0.75	6	64	3	20	0.025	2	15	21.425	22.145	23.749	25.615

Tensile strength: N/mm² | Hardness: HRC

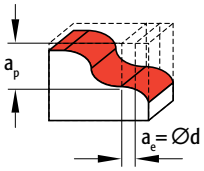
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting conditions

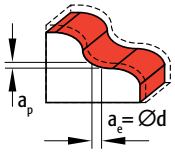
Center cutting high performance micro end mill for graphite

Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm²)	HRc	Vc m/min	
N5			< 600	air
N6			< 600	air
N7			350 - 500	air



Shoulder milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.3	< 0.3	<0.03	0.007 - 0.014
0.4	< 0.4	<0.04	0.010 - 0.018
0.5	< 0.5	<0.05	0.012 - 0.024
0.6	< 0.6	<0.06	0.014 - 0.026
0.8	< 0.8	<0.08	0.018 - 0.030
1	< 1.0	<0.10	0.022 - 0.036
1.2	< 1.2	<0.12	0.024 - 0.042
1.5	< 1.5	<0.15	0.030 - 0.048



Slot milling

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/tooth)
0.3	< 0.03	0.03	0.007 - 0.014
0.4	< 0.04	0.04	0.010 - 0.018
0.5	< 0.05	0.05	0.012 - 0.024
0.6	< 0.06	0.06	0.014 - 0.026
0.8	< 0.08	0.08	0.018 - 0.030
1	< 0.10	0.1	0.022 - 0.036
1.2	< 0.12	0.12	0.024 - 0.042
1.5	< 0.15	0.15	0.030 - 0.048

FBK0504349
Workpiece material: Poco Graphite
Hardness: 1700

	Competiton	Forbes
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

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%

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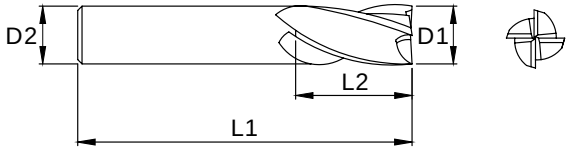
4 Flute

Centre cutting Proton Plus end mill for 45-60 HRC steel

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2	Corner Radius Cr
3	FBK0503424	12	38	3	-
3	FBK0503425	12	38	3	0.5
3	FBK0503426	12	38	3	1.0
4	FBK0503427	14	51	4	-
4	FBK0503428	14	51	4	0.5
4	FBK0503429	14	51	4	1.0
5	FBK0503430	15	60	5	-
5	FBK0503431	15	60	5	0.5
5	FBK0503432	15	60	5	1.0
6	FBK0503433	15	60	6	-
6	FBK0503434	15	60	6	0.5
6	FBK0503435	15	60	6	1.0
8	FBK0503436	19	60	8	-
8	FBK0503437	19	60	8	0.5
8	FBK0503438	19	60	8	1.0
10	FBK0503439	22	75	10	-

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

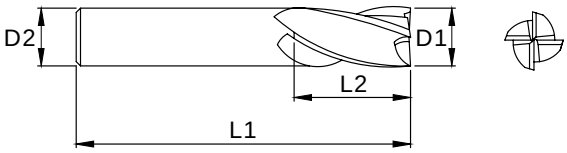
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute

Centre cutting Proton Plus end mill for 45-60 HRC Steel

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2	Corner Radius Cr
10	FBK0503440	22	75	10	0.5
10	FBK0503441	22	75	10	1.0
12	FBK0503442	22	76	12	-
12	FBK0503443	22	76	12	0.5
12	FBK0503444	22	76	12	1.0
16	FBK0503445	32	100	16	-
16	FBK0503446	32	100	16	0.5
16	FBK0503447	32	100	16	1.0

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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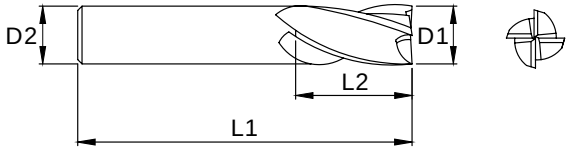
4 Flute

Centre cutting Proton Plus end mill 45-60 HRC for steel.

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2	Corner Radius Cr
3	FBK0503448	12	60	3	-
3	FBK0503449	12	60	3	0.5
3	FBK0503450	12	60	3	1.0
4	FBK0503451	14	76	4	-
4	FBK0503452	14	76	4	0.5
4	FBK0503453	14	76	4	1.0
5	FBK0503454	15	76	5	-
5	FBK0503455	15	76	5	0.5
5	FBK0503456	15	76	5	1.0
6	FBK0503457	20	80	6	-
6	FBK0503458	20	80	6	0.5
6	FBK0503459	20	80	6	1.0
8	FBK0503460	25	80	8	-
8	FBK0503461	25	80	8	0.5

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

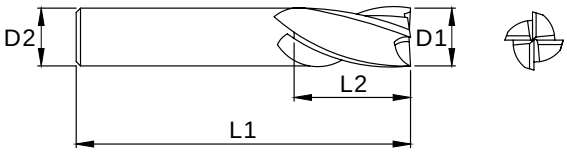
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute Centre Cutting Proton Plus for 45-60 HRC Steel

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2	Corner Radius Cr
8	FBK0503462	25	80	8	1.0
10	FBK0503463	25	100	10	-
10	FBK0503464	25	100	10	0.5
10	FBK0503465	25	100	10	1.0
12	FBK0503466	30	102	12	-
12	FBK0503467	30	102	12	0.5
12	FBK0503468	30	102	12	1.0
16	FBK0503469	40	150	16	-
16	FBK0503470	40	150	16	0.5
16	FBK0503471	40	150	16	1.0

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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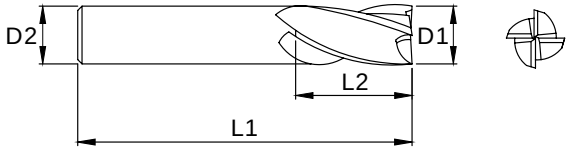
4 Flute — Centre cutting Proton Plus end mill for 45-60 HRc

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2	Corner Radius Cr
6	FBK0503472	25	100	6	-
6	FBK0503473	25	100	6	0.50
6	FBK0503474	25	100	6	1.00
8	FBK0503475	25	100	8	-
8	FBK0503476	25	100	8	0.50
8	FBK0503477	25	100	8	1.00
10	FBK0503478	30	150	10	-
10	FBK0503479	30	150	10	0.50
10	FBK0503480	30	150	10	1.00
12	FBK0503481	30	150	12	-
12	FBK0503482	30	150	12	0.50
12	FBK0503483	30	150	12	1.00

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

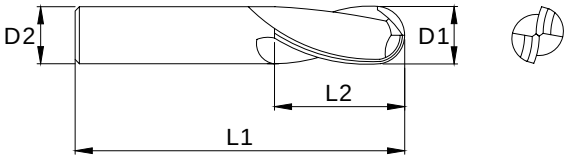
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, PI, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute

Centre cutting Proton Plus ball nose end mill for 45-60 HRc Steel

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0501561	2	60	4
1.5	FBK0501562	3	60	4
2	FBK0501563	4	60	4
2.5	FBK0501564	4	60	4
3	FBK0501565	5	60	6
4	FBK0501566	6	60	6
5	FBK0501571	4	80	6
6	FBK0501553	10	60	6
8	FBK0501554	16	60	8
10	FBK0501555	19	75	10
12	FBK0501556	22	80	12

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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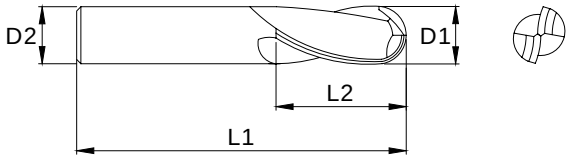
2 Flute

Centre cutting Proton Plus ball nose end mill for 45-60 HRc

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0501567	2	80	4
2	FBK0501568	3	80	4
3	FBK0501569	4	80	6
4	FBK0501570	4	80	6
6	FBK0501557	10	80	6
6	FBK0503367	12	102	6
8	FBK0503390	16	80	8
8	FBK0501558	16	100	8
10	FBK0501559	19	100	10
12	FBK0501560	22	100	12

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

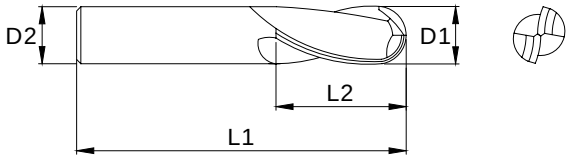
N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute

Centre cutting Proton Plus ball nose end mill for 45-60 HRc

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

H1-H3



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6	FBK0503367	12	102	6
8	FBK0501558	16	100	8
10	FBK0503912	32	152	10
12	FBK0503913	32	152	12

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cuttting speed & feed rate chart

Centre cutting Proton Plus end mill for 45-60 HRc
Centre cutting Proton Plus ball nose end mill for 45-60 HRc Steel

Material group	Hardness HRC	Cutting speed Vc m/min	Coolant
H1	48-50 HRc	120-150	min.lub.
H2	50-55 HRc	150-180	min.lub.
H3	55-70 HRc	180-200	min.lub.

Advantages

- Higher tool life
- Consistency
- Better surface finish

Tips:

- All suggested Parameters are starting values and they may be increased based on the rigidity of the setup
- If ap and ae are lesser than the recommended values the feed rates can be increased

FBK0501557		
Workpiece material: H13, 52HRc		
	Competitor	Forbes
Ø	6mm	6mm
Z	2 Flutes	2 Flutes
Vc	226 m/min	226 m/min
n	12000 rpm	12000 rpm
Fz	0.08 mm/t	0.08 mm/t
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

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
1	0.04	0.07	0.015-0.025
1.5	0.06	0.10	0.022-0.032
2	0.08	0.20	0.030-0.040
2.5	0.10	0.25	0.040-0.050
3	0.12	0.30	0.050-0.060
4	0.16	0.40	0.071-0.081
5	0.20	0.50	0.078-0.088
6	0.24	0.60	0.104-0.111
8	0.32	0.80	0.131-0.141
10	0.40	1.00	0.158-0.168
12	0.48	1.20	0.213-0.223
16	0.56	1.50	0.245-0.255
20	0.64	2.00	0.280-0.290

Tensile strength: N/mm² I Hardness: HRC

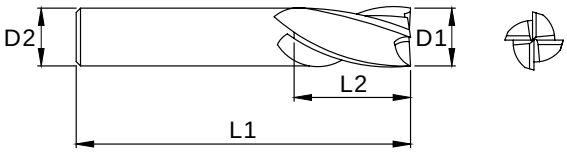
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting HSM end mill for 30-45 HRc steel

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

P2-P4



Unit : mm

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

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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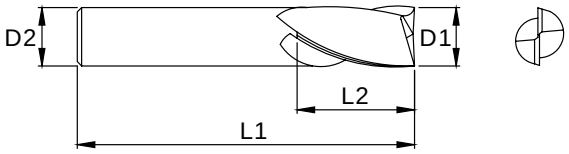
2 Flute

Centre cutting HSM end mill for 30-45 HRc Steel

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

P2-P4



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0501196	12	38	3
4	FBK0501986	14	51	4
5	FBK0501318	20	51	5
6	FBK0501987	20	64	6
8	FBK0501441	20	64	8
10	FBK0500834	25	70	10
12	FBK0500932	25	76	12
14	FBK0501015	30	89	14
16	FBK0501046	30	89	16
20	FBK0501122	38	102	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

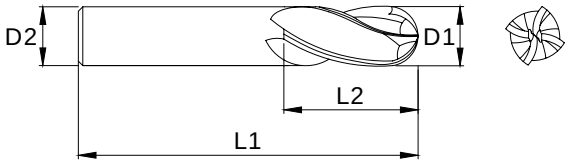
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting HSM ball nose end mill for 30-45 HRc Steel

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

P2-P4



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0501198	12	38	3
4	FBK0501980	14	51	4
5	FBK0501322	20	51	5
6	FBK0501361	20	64	6
8	FBK0501448	20	64	8
10	FBK0500838	25	70	10
12	FBK0500937	25	76	12
16	FBK0501047	30	89	16
20	FBK0501981	38	102	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² I Hardness: HRC

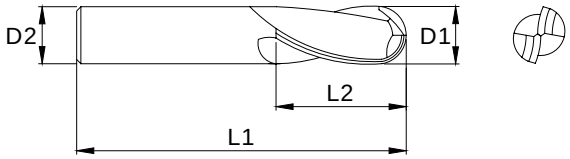
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting HSM ball nose end mill for 30-45 HRc

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

P2-P4



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0501195	12	38	3
4	FBK0501241	14	51	4
5	FBK0501320	20	51	5
6	FBK0501992	20	64	6
8	FBK0501437	20	64	8
10	FBK0501993	25	70	10
12	FBK0501994	25	76	12
16	FBK0501045	30	89	16
20	FBK0501995	38	102	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cuttting speed & feed rate chart

Centre cutting HSM end mill for 30-45 HRc Steel
Centre cutting HSM ball nose end mill for 30-45 HRc Steel

Material group	TSR (N/mm^2)	Hardness HRc	Cutting speed Vc m/min	Coolant
P3	<750	< 30 HRc	90-120	emulsion
P4	<1000	<35-48 HRc	75-90	emulsion
P4	<1400	<35 HRc	60-75	emulsion

Advantages

- Higher tool life
- Consistency
- Better surface finish

Tips:

- All suggested Parameters are starting values and they may be increased based on the rigidity of the setup
- If ap and ae are lesser than the recommended values the feed rates can be increased

FBK0501196		
Workpiece material: P20/P30 35HRc		
	Competitor	Forbes
Ø	3mm	3mm
Z	2 Flutes	2 Flutes
Vc	100 m/min	100 m/min
n	10606 rpm	10606 rpm
Fz	0.06 mm/t	0.06 mm/t
Vf	1273mm/min	1273mm/min
ap	0.15mm	0.3mm
ae	0.15mm	0.15mm
Coolant	Air	Air
Q	28.6cm^3/min	57.28cm^3/min
Tool Life	3.5 Hrs	4.2 Hrs

Ød (mm)	ap max. (mm)	ae max. (mm)	fz (mm/ tooth)
1	0.04	0.50	0.015-0.025
1.5	0.06	0.75	0.022-0.032
2	0.08	1.00	0.030-0.040
2.5	0.10	1.25	0.040-0.050
3	0.30	1.50	0.050-0.060
4	0.40	2.00	0.071-0.081
5	0.50	2.50	0.078-0.088
6	0.60	3.00	0.104-0.111
8	0.80	4.00	0.131-0.141
10	1.00	5.00	0.158-0.168
12	1.20	6.00	0.213-0.223
16	1.60	8.00	0.245-0.255
20	2.00	10.00	0.280-0.290

Tensile strength: N/mm^2 I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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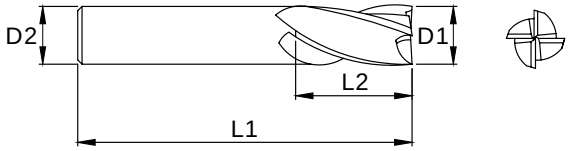
4 Flute

Centre cutting high performance end mill

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

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0503876	6	38	3
4	FBK0503954	14	51	4
5	FBK0503956	20	51	5
6	FBK0503484	20	64	6
8	FBK0503485	20	64	8
10	FBK0503422	25	70	10
12	FBK0503487	25	76	12
14	FBK0503488	30	89	14
16	FBK0503489	30	89	16
20	FBK0503490	35	102	20

*Custom Solution possible Refer page 2.171

Available in Corner Radius

Tensile strength: N/mm² | Hardness: HRC

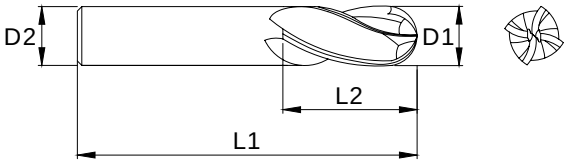
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute

Centre cutting high performance ball nose end mill

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



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0503958	6	38	6
4	FBK0503888	15	64	6
6	FBK0503889	16	64	6
8	FBK0503890	20	64	8
10	FBK0503891	20	70	10
12	FBK0503892	25	76	12
16	FBK0503893	30	89	16
18	FBK0503894	35	102	18

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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Cutting speed chart

Series F177/F179 INCH

Workpiece Material Group		Example	Coolant			Slotting		1 x Diameter Axial Depth Small Radial Depth Profiling > Largest Radial Depth						
			Max	Air	MMS	25% Axial	50% Axial	1% of Dia	5% of Dia	10% of Dia	15% of Dia	20% of Dia	30% of Dia	50% of Dia
			Type			SFM								
Steels	P	Free Machining	•	•	•	500	500	2400	2250	2050	1850	1660	1260	500
		Low Carbon	•	•	•	500	500	2400	2250	2050	1850	1660	1260	500
		Medium Carbon	•	•	•	300	300	1100	1030	950	875	790	620	300
		Alloys Steels	•	•	•	250	250	500	480	450	430	400	350	250
		High Strength Alloys	•	•	•	250	250	500	480	450	430	400	350	250
		Structural Steels	•	•	•	500	500	2400	2250	2050	1850	1660	1260	500
		Die/Tool Steels	•	•	•	200	200	400	390	380	370	360	300	200
Stainless Steels	M	Free Machining	•	X	o	300	300	500	485	460	450	430	380	300
		Moderate Stainless	•	X	o	250	250	500	390	380	370	360	320	250
		Difficult Stainless	•	X	o	200	200	350	330	320	300	295	260	200
		PH Stainless	•	X	o	125	125	250	245	240	235	230	195	125
		Cobalt Chrome Alloys	•	X	o	150	150	250	245	230	225	215	190	150
		Duplex (22%)	•	X	o	125	125	250	245	230	225	215	185	125
		Super Duplex (25%)	•	X	o	100	100	200	195	180	180	170	140	100
Special Alloys	S	High Temp Alloys	•	X	X	150	150	250	240	220	215	200	180	150
		Titanium Alloys	•	X	X	175	175	425	400	380	350	325	275	175
Cast Iron	K	Gray Cast Iron	•	o	o	400	400	1500	1420	1315	1210	1100	860	400
		SG Iron	•	o	o	350	350	1200	1130	1050	980	900	710	350
		Ductile Cast Iron	•	o	o	300	300	500	485	460	450	430	380	300
		Malleable Iron	•	o	o	300	300	400	385	375	360	345	330	300

•	Preferred	o	Possible	X	Not Possible

If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

Feed rate chart

Series F177/F179 INCH

Workpiece Material Group		Example	Tool Diameter								
			1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth									
Steels	P	Free Machining, Low Carbon, Medium Carbon, Alloys Steels, High Strength Alloys, Structural Steels, Die/Tool Steels	0.0002	0.0004	0.0007	.0010 - .0016	.0013 - .0021	.0016 - .0026	.0020 - .0031	.0026 - .0033	.0031 - .0035	.0035 - .0051
Stainless Steels	M	Free Machining, Moderate Stainless, Difficult Stainless, PH Stainless, Cobalt Chrome Alloys, Duplex (22%), Super Duplex (25%)	0.0002	0.0004	0.0007	.0010 - .0016	.0012 - .0021	.0012 - .0026	.0020 - .0031	.0020 - .0033	.0022 - .0035	.0024 - .0039
Special Alloys	S	High Temp Alloys, Titanium Alloys	0.0001	0.0002	0.0008	.0005 - .0008	.0007 - .0011	-0.0013	.0010 - .0016	.0010 - .0016	.0011 - .0018	.0012 - .0020
Cast Iron	K	Gray Cast Iron, SG Iron, Ductile Cast Iron, Malleable Iron	0.0002	0.0004	0.0007	.0007 - .0016	.0010 - .0022	.0015 - .0028	.0018 - .0033	.0024 - .0035	.0028 - .0039	.0024 - .0050

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = IPM (Inches per Minute)

Example: Slotting

1) Select material from chart
2) Select tool size
3) Select feed per chart
4) Multiply Feed per tooth x Number of teeth x RPM
5) Answer: IPM (Inches Per Minute)

Spindle Max.

Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

Cutting speed chart

Series F177/F179 METRIC

Workpiece Material Group		Example	Coolant			Slotting		1 x Diameter Axial Depth Small Radial Depth Profiling > Largest Radial Depth						
			Max	Air	MIST	25% Axial	50% Axial	1% of Dia	5% of Dia	10% of Dia	15% of Dia	20% of Dia	30% of Dia	50% of Dia
														
			Type			Vc (m/min)								
Steels	P	Free Machining	•	•	•	150	150	730	685	620	565	500	380	150
		Low Carbon	•	•	•	150	150	730	685	620	565	500	380	150
		Medium Carbon	•	•	•	90	90	335	310	290	260	240	180	90
		Alloys Steels	•	•	•	75	75	150	140	130	130	120	105	75
		High Strength Alloys	•	•	•	75	75	150	140	130	130	120	105	75
		Structural Steels	•	•	•	150	150	730	685	620	565	500	380	150
		Die/Tool Steels	•	•	•	60	60	120	115	115	110	110	90	60
Stainless Steels	M	Free Machining	•	X	o	90	90	150	145	140	130	130	115	90
		Moderate Stainless	•	X	o	75	75	150	115	115	105	105	95	75
		Difficult Stainless	•	X	o	60	60	105	100	95	90	90	75	60
		PH Stainless	•	X	o	40	40	75	75	75	70	70	60	40
		Cobalt Chrome Alloys	•	X	o	45	45	75	75	75	70	70	60	45
		Duplex (22%)	•	X	o	40	40	75	75	75	70	70	60	40
		Super Duplex (25%)	•	X	o	30	30	60	60	55	55	50	45	30
Special Alloys	S	High Temp Alloys	•	X	X	45	45	75	75	75	70	60	55	45
		Titanium Alloys	•	X	X	55	55	125	120	115	105	100	80	55
Cast Iron	K	Gray Cast Iron	•	o	o	120	120	450	430	400	360	335	250	120
		SG Iron	•	o	o	105	105	365	345	320	295	275	215	105
		Ductile Cast Iron	•	o	o	90	90	150	145	140	130	130	115	90
		Malleable Iron	•	o	o	90	90	120	115	110	105	105	100	90

•	Preferred	X	Possible	o	Not Possible

If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

Feed rate chart

Series F177/F179 METRIC

Workpiece Material Group		Example	Tool Diameter (mm)									
			1	3	4	6	8	10	12	16	18	25
			mm/Tooth									
Steels	P	Free Machining, Low Carbon, Medium Carbon, Alloys Steels, High Strength Alloys, Structural Steels, Die/Tool Steels	0.005	0.01	0.017	.025 - .040	.033 - .053	0.04	0.066	.066 - .083	.078 - .088	.088 - .129
Stainless Steels	M	Free Machining, Moderate Stainless, Difficult Stainless, PH Stainless, Cobalt Chrome Alloys, Duplex (22%), Super Duplex (25%)	0.005	0.01	0.017	.025 - .040	.033 - .053	0.04	0.066	.066 - .083	.078 - .088	.088 - .129
Special Alloys	S	High Temp Alloys, Titanium Alloys	0.002	0.005	0.02	.012 - .020	.017 - .027	.017 - .033	.025 - .040	.025 - .043	.027 - .045	.030 - .050
Cast Iron	K	Gray Cast Iron, SG Iron, Ductile Cast Iron, Malleable Iron	0.005	0.01	0.017	.017 - .040	.025 - .055	.038 - .071	.045 - .083	.060 - .088	.071 - .099	.060 - .127

Example: Profile Milling
1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = mm/min (millimetres per minute)

Example: Slotting
1) Select material from chart
2) Select tool size
3) Select feed per chart
4) Multiply Feed per tooth x Number of teeth x RPM
5) Answer: mm/min (Millimetres Per Minute)

Spindle Max.
Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

During Profile Milling less than 50% of the cutter diameter's Radial depth,the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

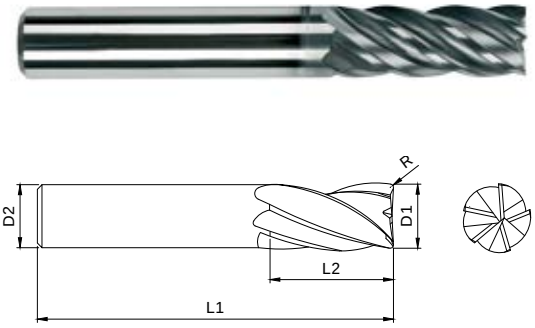
Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

5 Flute

Centre cutting high performance end mill

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

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6	FBK0503491	20	64	6
8	FBK0503492	20	64	8
10	FBK0503493	25	70	10
12	FBK0503494	25	76	12
14	FBK0503495	30	89	14
16	FBK0503496	30	89	16
20	FBK0503497	35	102	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting speed chart

Series F178 INCH

Workpiece Material Group		Example	Coolant: Max	Coolant: Air	Coolant: MMS	1 x Diameter Axial Depth; Small Radial Depth Profiling > Largest Radial Depth: 1% of Dia	5% of Dia	10% of Dia	15% of Dia	20% of Dia	30% of Dia	50% of Dia
			Type			SFM						
Steels	P	Free Machining	•	•	•	2400	2250	2050	1850	1660	1260	500
		Low Carbon	•	•	•	2400	2250	2050	1850	1660	1260	500
		Medium Carbon	•	•	•	1100	1030	950	875	790	620	300
		Alloys Steels	•	•	•	500	480	450	430	400	350	250
		High Strength Alloys	•	•	•	500	480	450	430	400	350	250
		Structural Steels	•	•	•	2400	2250	2050	1850	1660	1260	500
		Die/Tool Steels	•	•	•	400	390	380	370	360	300	200
Stainless Steels	M	Free Machining	•	X	o	500	485	460	450	430	380	300
		Moderate Stainless	•	X	o	500	390	380	370	360	320	250
		Difficult Stainless	•	X	o	350	330	320	300	295	260	200
		PH Stainless	•	X	o	250	245	240	235	230	195	125
		Cobalt Chrome Alloys	•	X	o	250	245	230	225	215	190	150
		Duplex (22%)	•	X	o	250	245	230	225	215	185	125
		Super Duplex (25%)	•	X	o	200	195	180	180	170	140	100
Special Alloys	S	High Temp Alloys	•	X	X	250	240	220	215	200	180	150
		Titanium Alloys	•	X	X	425	400	380	350	325	275	175
Cast Iron	K	Gray Cast Iron	•	o	o	1500	1420	1315	1210	1100	860	400
		SG Iron	•	o	o	1200	1130	1050	980	900	710	350
		Ductile Cast Iron	•	o	o	500	485	460	450	430	380	300
		Malleable Iron	•	o	o	400	385	375	360	345	330	300

•	Preferred	X	Possible	o	Not Possible

If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

FEED RATE CHART

Series F178 INCH

Workpiece Material Group		Example	Tool Diameter (inches): 1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth									
Steels	P	Free Machining, Low Carbon, Medium Carbon, Alloys Steels, High Strength Alloys, Structural Steels, Die/Tool Steels	0.0002	0.0004	0.0007	.0010 - .0016	.0013 - .0021	.0016 - .0026	.0020 - .0031	.0026 - .0033	.0031 - .0035	.0035 - .0051
Stainless Steels	M	Free Machining, Moderate Stainless, Difficult Stainless, PH Stainless, Cobalt Chrome Alloys, Duplex (22%), Super Duplex (25%)	0.0002	0.0004	0.0007	.0010 - .0016	.0012 - .0021	.0012 - .0026	.0020 - .0031	.0020 - .0033	.0022 - .0035	.0024 - .0039
Special Alloys	S	High Temp Alloys, Titanium Alloys	0.0001	0.0002	0.0008	.0005 - .0008	.0007 - .0011	-0.0013	.0010 - .0016	.0010 - .0016	.0011 - .0018	.0012 - .0020
Cast Iron	K	Gray Cast Iron, SG Iron, Ductile Cast Iron, Malleable Iron	0.0002	0.0004	0.0007	.0007 - .0016	.0010 - .0022	.0015 - .0028	.0018 - .0033	.0024 - .0035	.0028 - .0039	.0024 - .0050

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = IPM (Inches per Minute)

Spindle Max.
Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

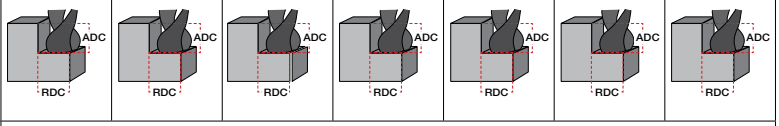
During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

sales@forbes.co.in

Cutting speed chart

Series F178 METRIC

Workpiece Material Group		Example	Coolant			1 x Diameter Axial Depth Small Radial Depth Profiling > Largest Radial Depth						
			Max	Air	MMS	1% of Dia	5% of Dia	10% of Dia	15% of Dia	20% of Dia	30% of Dia	50% of Dia
												
			Type			Vc (m/min)						
Steels	P	Free Machining	•	•	•	730	685	620	565	500	380	150
		Low Carbon	•	•	•	730	685	620	565	500	380	150
		Medium Carbon	•	•	•	335	310	290	260	240	180	90
		Alloys Steels	•	•	•	150	140	130	130	120	105	75
		High Strength Alloys	•	•	•	150	140	130	130	120	105	75
		Structural Steels	•	•	•	730	685	620	565	500	380	150
		Die/Tool Steels	•	•	•	120	115	115	110	110	90	60
Stainless Steels	M	Free Machining	•	X	o	150	145	140	135	130	115	90
		Moderate Stainless	•	X	o	150	115	115	110	105	95	75
		Difficult Stainless	•	X	o	105	100	95	90	90	75	60
		PH Stainless	•	X	o	75	75	75	70	70	60	40
		Cobalt Chrome Alloys	•	X	o	75	75	75	70	70	60	45
		Duplex (22%)	•	X	o	75	75	75	70	70	60	40
		Super Duplex (25%)	•	X	o	60	60	55	55	50	45	30
Special Alloys	S	High Temp Alloys	•	X	X	75	75	75	70	60	55	45
		Titanium Alloys	•	X	X	125	120	115	105	100	80	55
Cast Iron	K	Gray Cast Iron	•	o	o	450	430	400	360	335	250	120
		SG Iron	•	o	o	365	345	320	295	275	215	105
		Ductile Cast Iron	•	o	o	150	145	140	130	130	115	90
		Malleable Iron	•	o	o	120	115	110	105	105	100	90

•	Preferred	X	Possible	o	Not Possible

If axial depth is less than the ball diameter, the speed is figured using the effective cutting diameter.

Feed rate chart

Series F178 METRIC

Workpiece Material Group		Example	Tool Diameter (mm)									
			1	3	4	6	8	10	12	16	18	25
			mm/Tooth									
Steels	P	Free Machining, Low Carbon, Medium Carbon, Alloys Steels, High Strength Alloys, Structural Steels, Die/Tool Steels	0.005	0.01	0.017	.025 - .040	.033 - .053	0.04	0.066	.066 - .083	.078 - .088	.088 - .129
Stainless Steels	M	Free Machining, Moderate Stainless, Difficult Stainless, PH Stainless, Cobalt Chrome Alloys, Duplex (22%), Super Duplex (25%)	0.005	0.01	0.017	.025 - .040	.033 - .053	0.04	0.066	.066 - .083	.078 - .088	.088 - .129
Special Alloys	S	High Temp Alloys, Titanium Alloys	0.002	0.005	0.02	.012 - .020	.017 - .027	.017 - .033	.025 - .040	.025 - .043	.027 - .045	.030 - .050
Cast Iron	K	Gray Cast Iron, SG Iron, Ductile Cast Iron, Malleable Iron	0.005	0.01	0.017	.017 - .040	.025 - .055	.038 - .071	.045 - .083	.060 - .088	.071 - .099	.060 - .127

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = mm/min (millimetres per minute)

Spindle Max.
Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

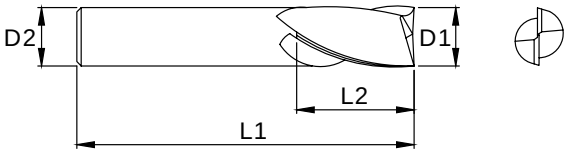
Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

2 Flute

Centre cutting high performance end mill for Non ferrous material

Carbide | REG | 30° | 6535 HA | BF

N1-N4



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4	FBK0501238	14	51	4
5	FBK0501315	20	51	5
6	FBK0501355	20	64	6
8	FBK0503383	20	64	8
10	FBK0500829	20	70	10
12	FBK0503384	20	76	12
14	FBK0503522	30	89	14
16	FBK0501605	30	89	16
20	FBK0501613	30	102	20

*Custom Solution possible Refer page 2.171

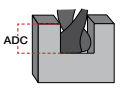
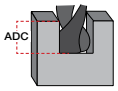
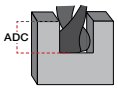
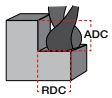
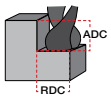
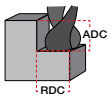
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting speed chart

Series F135 INCH

Workpiece Material Group		Example	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth		
							1 x Diameter Axial Depth		
							Profile Milling		
				25% Axial	50% Axial	100% Axial	25% Dia.	50% Dia.	100% Dia.
			Max						
			Type	SFM					
Non-Ferrous	N	Aluminium < 10% Si	•	1000-2000			2000	1625	1000
		Aluminium > 10% Si	•	800-1500			1500	1230	800
		Brass	•	500-900			900	750	500
		Plastic	•	800-1200			1200	1050	800

Feed rate chart

Series F135 INCH

Workpiece Material Group		Example	Milling Type	Tool Diameter (inch)								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				Inch/Tooth								
Non-Ferrous	N	Aluminium / Aluminium Alloys < 10% Si Aluminium / Aluminium Alloys > 10% Si Brass Plastics	Slotting	0.0012	0.0018	0.0025	0.0032	0.0037	0.0005	0.0065	0.0075	0.01
			Profile Milling	0.003 - 0.004	0.004 - 0.006	0.004 - 0.008	0.006 0.009	0.007 - 0.012	0.010 - 0.045	0.015 - 0.04	0.015 - 0.04	0.015 - 0.04

Above 20,000 RPM, Tool Balancing Is Required

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = IPM (inch/min)

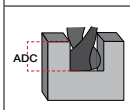
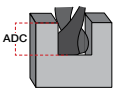
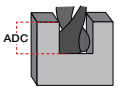
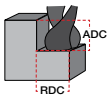
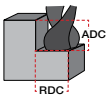
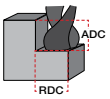
Spindle Max.

Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

Cutting speed chart

Series F135 METRIC

Workpiece Material Group		Example	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth 1 x Diameter Axial Depth Profile Milling		
				25% Axial	50% Axial	100% Axial	25% Dia.	50% Dia.	100% Dia.
			Max						
			Type	Vc (m/min)					
Non-Ferrous	N	Aluminium < 10% Si	•	305 - 610			610	495	305
		Aluminium > 10% Si	•	245 - 460			460	375	245
		Brass	•	150 - 275			900	230	155
		Plastic	•	245 - 365			365	320	245

Feed rate chart

Series F135 METRIC

Workpiece Material Group		Example	Milling Type	Tool Diameter (mm)								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				mm/Tooth								
Non-Ferrous	N	Aluminium / Aluminium Alloys < 10% Si Aluminium / Aluminium Alloys > 10% Si Brass Plastics	Slotting	0.03	0.046	0.064	0.081	0.094	0.127	0.165	0.191	0.254
			Profile Milling	.076 - 0.102	.102 - 0.152	.102 - 0.203	.152 - 0.229	.178 - 0.305	0.254 - 1.143	.381 - 1.1016	.381 - 1.1016	.381 - 1.1016

Above 20,000 RPM, Tool Balancing Is Required

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = mm/min

Spindle Max.

Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

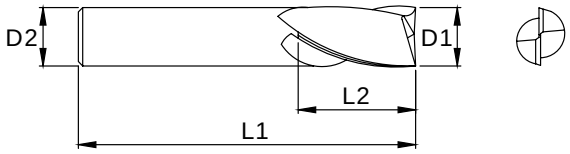
$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

2 Flute

Centre cutting high performance end mill for non ferrous material

Carbide | REG | 45° | 6535 HA | BF

N1-N4



Unit : mm

Diameter ØD1	FG Code	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4	FBK0501239	14	51	4
5	FBK0501316	20	51	5
6	FBK0501356	20	64	6
8	FBK0501618	20	64	8
10	FBK0500830	25	70	10
12	FBK0500930	26	76	12
16	FBK0501606	30	89	16

*Custom Solution possible Refer page 2.171

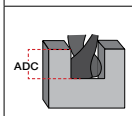
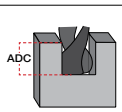
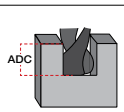
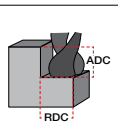
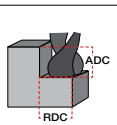
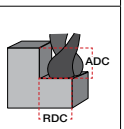
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting speed chart

Series F136 INCH

Workpiece Material Group		Example	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth 1 x Diameter Axial Depth Profile Milling		
				25% Axial	50% Axial	100% Axial	25% Dia.	50% Dia.	100% Dia.
			Max						
			Type	SFM					
Non-Ferrous	N	Aluminium < 10% Si	•	1400-2000			2000	1775	1400
		Aluminium > 10% Si	•	1000-1500			1500	1310	1000
		Brass	•	500-900			900	750	500
		Plastic	•	800-1200			1200	1050	800

Feed rate chart

Series F136 INCH

Workpiece Material Group		Example	Milling Type	Tool Diameter (inch)								
				1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
				Inch/Tooth								
Non-Ferrous	N	Aluminium / Aluminium Alloys < 10% Si Aluminium / Aluminium Alloys > 10% Si Brass Plastics	Slotting	0.0012	0.0018	0.0025	0.0032	0.0037	0.0005	0.0065	0.0075	0.01
			Profile Milling	0.0024	0.0036	0.005	0.0064	0.0074	0.01	0.012	0.014	0.02

Above 20,000 RPM, Tool Balancing Is Required

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = IPM (inch/min)

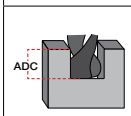
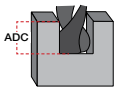
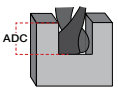
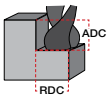
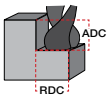
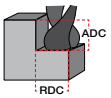
Spindle Max.

Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

Cutting speed chart

Series F136 METRIC

Workpiece Material Group		Example	Coolant	Slotting			Small Radial Depth ==> Large Radial Depth 1 x Diameter Axial Depth Profile Milling		
				25% Axial	50% Axial	100% Axial	25% Dia.	50% Dia.	100% Dia.
			Max						
			Type	Vc					
Non-Ferrous	N	Aluminium < 10% Si	•	425-610			610	540	425
		Aluminium > 10% Si	•	305-460			460	400	305
		Brass	•	150-275			275	230	150
		Plastic	•	245-365			365	320	245

Feed rate chart

Series F136 METRIC

Workpiece Material Group		Example	Milling Type	Tool Diameter (mm)								
				3	5	6	8	10	14	16	18	25
				mm/Tooth								
Non-Ferrous	N	Aluminium / Aluminium Alloys < 10% Si Aluminium / Aluminium Alloys > 10% Si Brass Plastics	Slotting	0.03	0.046	0.064	0.081	0.094	0.127	0.165	0.191	0.254
			Profile Milling	0.061	0.091	0.127	0.163	0.188	0.254	0.305	0.356	0.508

Above 20,000 RPM, Tool Balancing Is Required

During Profile Milling less than 50% of the cutter diameter's Radial depth, the actual chipload at the cutting edge is less than the programmed chip load. Below are Chip Load factors depending on Radial Depth Percentage. Multiply your inches per tooth by the factor before figuring your IPM.

Radial Depth in Percentage of Cutter Diameter	Increase Chip Load Factor
50%	1
30%	1.1
20%	1.2
15%	1.4
10%	1.8
5%	2.3
1%	5

Example: Profile Milling

1) Select material from chart
2) Select tool size
3) Select feed per tooth
4) Figure percentage of cutter diameter radial cut depth
5) Select chip load factor for radial depth
6) Select chip load factor x Feed per tooth
7) Answer: New feed per tooth
8) New feed per tooth x Number of teeth x RPM = mm/min

Spindle Max.

Should the calculated Spindle Speed be more than your actual Spindle Max., Use the Formula given below:

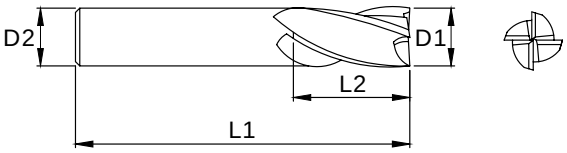
$$\frac{\text{Calculated Feed x Spindle Max.}}{\text{Calculated Speed}}$$

4 Flute

Sinusoidal regular length chip breaker end mill

Carbide | REG | 20° | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
8	FBK0504087	8	51	8
8	FBK0504029	16	64	8
10	FBK0504088	10	51	10
10	FBK0504089	20	70	10
12	FBK0504090	12	64	12
12	FBK0504091	25	76	12
16	FBK0504092	16	76	16
16	FBK0503359	35	89	16
20	FBK0504093	20	76	20
20	FBK0504094	38	102	20

8 mm available in 3 flute

*Custom Solution possible Refer page 2.171

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Cutting speed chart

Series F192 INCH

Workpiece Material Group		Example	SFM
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	450 - 500
		Steel - Mild (.4 - .5 Carbon) 4140	250 - 300
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	125 - 250
Cast Iron	K	Iron Cast (Soft)	450 - 600
		Iron - Cast (Medium Hard)	300 - 400
		Iron (Hard Chilled)	250 - 300
		Iron (Malleable)	225 - 300
Stainless Steels	M	Stainless Free Machining	200 - 300
		Austenitic Stainless 304/316	180 - 225
		Ferritic	200 - 275
		Martensitic	150 - 200
		PH Stainless 17-4 PH	125 - 200
Special Alloys	S	Titanium 6AL-4V	175 - 375
		Cobalt-Based Alloys Stellite	80 - 125
		Nickel-Based Alloys Inconel 625/718	80 - 125
		Iron-Based Alloys Incoloy 800-802	80 - 125
Hardened Steels	H	Hardened Steels 35-45 Rc	200 - 250
		Hardened Steels 45-55 Rc	150 - 200

Feed rate chart

Series F192 INCH

Workpiece Material Group		Example	Tool Diameter (inch)								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0015 - .0025	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Special Alloys	S	Titanium 6AL-4V	.0003 -.0004	.0004 - .0006	.0006 - .0008	.0008 - .0012	.0008 - .0012	.0012 - .0016	.0016 - .0018	.0018 - .0020	.0020 - .0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035

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

*For TiAlN Coated Tool Increase RPM by 20% and Feed by 10%

Cutting speed chart

Series F192 Metric

Workpiece Material Group		Example	SMM
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	135 - 150
		Steel - Mild (.4 - .5 Carbon) 4140	75 - 90
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	40 - 75
Cast Iron	K	Iron Cast (Soft)	135 - 185
		Iron - Cast (Medium Hard)	90 - 120
		Iron (Hard Chilled)	75 - 90
		Iron (Malleable)	70 - 90
Stainless Steels	M	Stainless Free Machining	60 - 90
		Austenitic Stainless 304/316	55 - 70
		Ferritic	60 - 85
		Martensitic	45 - 60
		PH Stainless 17-4 PH	40 - 60
Special Alloys	S	Titanium 6AL-4V	55 - 115
		Cobalt-Based Alloys Stellite	25 - 40
		Nickel-Based Alloys Inconel 625/718	25 - 40
		Iron-Based Alloys Incoloy Incoloy 800-802	25 - 40
Hardened Steels	H	Hardened Steels 35-45 Rc	60 - 75
		Hardened Steels 45-55 Rc	45 - 60

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

Feed rate chart

Series F192 METRIC

Workpiece Material Group		Example	Tool Diameter (mm)								
			3	5	6	8	10	14	16	18	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013 - .020	.025 - .30	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	0.081 - .127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013 - .020	.025 - .030	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	.081 - .127
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.013 - .020	.025 - .030	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	.081 - .127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Special Alloys	S	Titanium 6AL-4V	.008 - .010	.010 - .015	.015 - .020	.020 - .030	.020 - .030	.030 - .041	.041 - .046	.046 - .051	.051 - .076
		Stellite Inconel 625/718 Incoloy 800-802	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc	.008 - .013	.013 - .038	.013 - .038	.025 - .051	.025 - .051	.025 - .076	.051 - .076	.064 - .089	.064 - .089

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

*For TiAlN Coated Tool Increase RPM by 20% and Feed by 10%

TOTEM®

High Performance Cutting Tools

GENERAL PURPOSE & ECONOMY SERIES END MILLS

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GENERAL PURPOSE END MILLS

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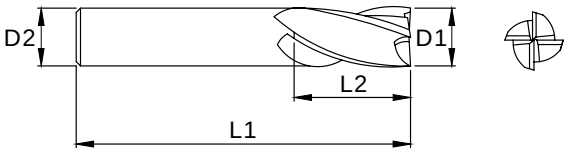
CONTENTS

ECONOMY RANGE END MILLS

END MILLS

4 Flute — Centre cutting regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500003	3	38	3
1.5	FBK0500006	6	38	3
2	FBK0500009	9	38	3
2.5	FBK0500012	12	38	3
3	FBK0500015	12	38	3
3.5	FBK0500017	12	51	4
4	FBK0500020	14	51	4
4.5	FBK0500023	20	51	5
5	FBK0500026	20	51	5
5.5	FBK0500029	20	64	6
6	FBK0500032	20	64	6
6.5	FBK0500035	20	64	8
7	FBK0500037	20	64	8
8	FBK0500040	20	64	8
9	FBK0500043	20	64	9
10	FBK0500046	25	70	10
11	FBK0500048	25	70	11

*Custom Solution possible Refer page 2.171

Also available in uncoated & TiN

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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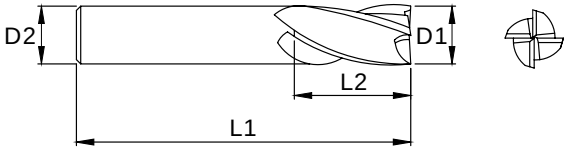
4 Flute

Centre cutting regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
12	FBK0500051	25	76	12
13	FBK0500053	30	89	13
14	FBK0500056	30	89	14
15	FBK0500059	30	89	15
16	FBK0500062	30	89	16
18	FBK0500065	35	102	18
20	FBK0500068	38	102	20
22	FBK0500070	38	102	20
25	FBK0500072	38	102	25

*Custom Solution possible Refer page 2.171

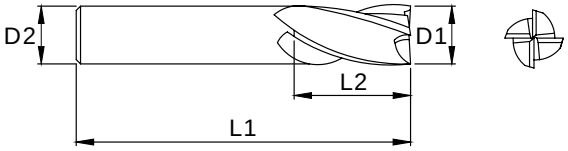
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting stub length end mill

Carbide | STUB | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0502014	2	38	3
1.5	FBK0500533	3	38	3
2	FBK0500535	4	38	3
2.5	FBK0500537	5	38	3
3	FBK0500539	6	38	3
4	FBK0500541	8	51	4
5	FBK0500543	11	51	5
6	FBK0500545	13	51	6
8	FBK0500547	13	51	8
10	FBK0500549	14	51	10
12	FBK0500551	16	64	12
14	FBK0500553	18	70	14
16	FBK0500555	20	76	16
20	FBK0500557	25	76	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

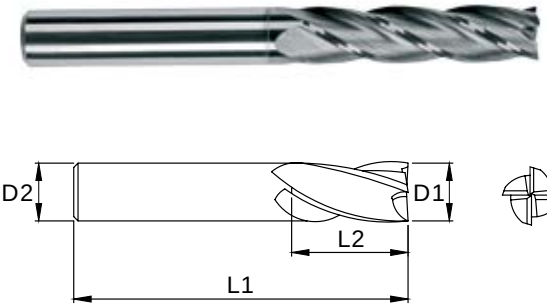
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting long length end mill

Carbide | LONG | 30° | 6535 HA | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500336	25	64	3
4	FBK0500339	25	64	4
5	FBK0500342	25	64	5
6	FBK0500345	30	76	6
7	FBK0500347	30	83	8
8	FBK0500350	35	83	8
9	FBK0500352	35	89	10
10	FBK0500355	40	89	10
11	FBK0500357	40	102	12
12	FBK0500360	50	102	12
14	FBK0500362	65	117	14
16	FBK0500365	65	117	16
20	FBK0500368	80	133	20
25	FBK0500370	80	152	25

*Custom Solution possible Refer page 2.171

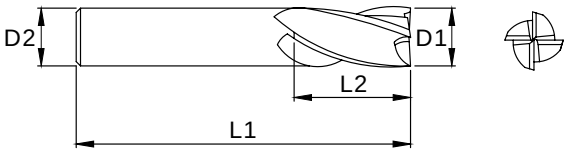
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting extra long end mill

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



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0502681	40	100	3
4	FBK0502682	40	100	4
5	FBK0502683	40	100	5
6	FBK0502684	50	100	6
8	FBK0502685	50	100	8
10	FBK0502686	75	152	10
12	FBK0502687	75	152	12
16	FBK0502688	75	152	16
20	FBK0502689	75	152	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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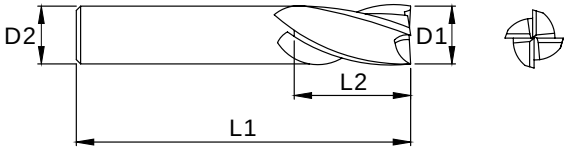
4 Flute — Centre cutting long reach end mill

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



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500455	6	60	3
4	FBK0500457	9	76	4
5	FBK0500459	15	76	5
6	FBK0500461	15	76	6
8	FBK0500463	20	101	8
10	FBK0500465	25	101	10
12	FBK0500467	25	152	12
16	FBK0500469	30	152	16
18	FBK0500471	40	152	18
20	FBK0500473	50	152	20

*Custom Solution possible Refer page 2.171

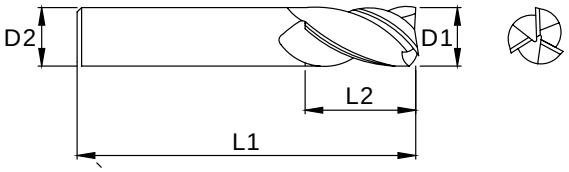
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

3 Flute — Centre cutting regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500140	3	38	3
1.5	FBK0500143	6	38	3
2	FBK0500146	9	38	3
2.5	FBK0500149	12	38	3
3	FBK0500152	12	38	3
4	FBK0500157	14	51	4
5	FBK0500162	20	51	5
6	FBK0500165	20	63	6
8	FBK0500171	20	63	8
10	FBK0500176	25	70	10
12	FBK0500181	25	76	12
16	FBK0500189	30	89	16
20	FBK0500195	38	102	20
25	FBK0500198	40	102	25

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

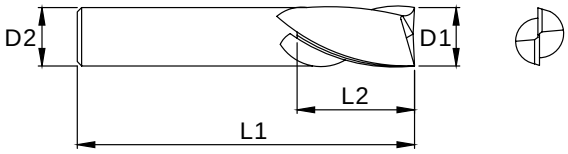
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting stub length end mill

Carbide | STUB | 30° | 6535 HA | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK05002016	2	38	3
1.5	FBK0500559	3	38	3
2	FBK0500561	4	38	3
2.5	FBK0500563	5	38	3
3	FBK0500565	6	38	3
4	FBK0500567	8	51	4
5	FBK0500569	11	51	5
6	FBK0500571	13	51	6
8	FBK0500573	13	51	8
10	FBK0500575	14	51	10
12	FBK0500577	16	63	12
14	FBK0500579	18	70	14
16	FBK0500581	20	76	16
20	FBK0500583	25	76	20

*Custom Solution possible Refer page 2.171

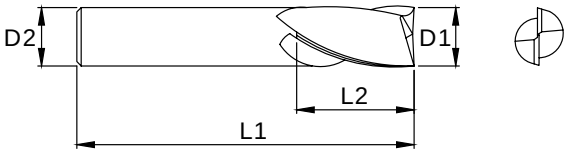
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500075	3	38	3
1.5	FBK0500078	6	38	3
2	FBK0500081	9	38	3
2.5	FBK0500084	12	38	3
3	FBK0500087	12	38	3
4	FBK0500092	14	51	4
5	FBK0500097	20	51	5
6	FBK0500102	20	63	6
8	FBK0500109	20	63	8
10	FBK0500114	25	70	10
12	FBK0500119	25	76	12
16	FBK0500127	30	89	16
18	FBK0500130	35	102	18
20	FBK0500133	38	102	20
22	FBK0500135	40	102	22
25	FBK0500137	40	102	25

*Custom Solution possible Refer page 2.171

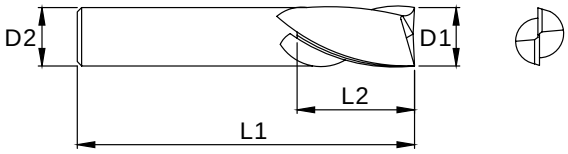
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting long length end mill

Carbide | LONG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500372	25	63	3
4	FBK0500375	25	63	4
5	FBK0500378	25	63	5
6	FBK0500380	30	76	6
7	FBK0500382	30	83	8
8	FBK0500385	35	83	8
9	FBK0500387	35	89	10
10	FBK0500390	40	89	10
12	FBK0500393	50	102	12
16	FBK0500396	65	117	16
20	FBK0500398	80	152	20

*Custom Solution possible Refer page 2.171

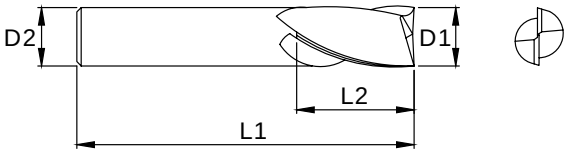
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting long reach end mill

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



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500475	6	60	3
4	FBK0500477	9	76	4
5	FBK0500479	15	76	5
6	FBK0500481	15	76	6
8	FBK0500483	20	101	8
10	FBK0500485	25	101	10
12	FBK0500487	25	152	12
16	FBK0500489	30	152	16
20	FBK0500491	50	152	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

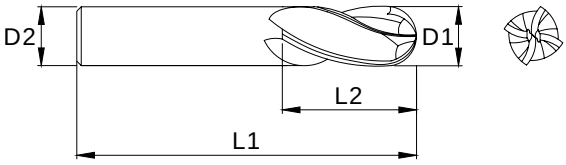
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute

Centre cutting ball nose stub length end mill

Carbide | STUB | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0502018	2	38	3
1.5	FBK0500585	3	38	3
2	FBK0500587	4	38	3
2.5	FBK0500589	5	38	3
3	FBK0500591	6	38	3
4	FBK0500593	8	51	4
5	FBK0500595	11	51	5
6	FBK0500597	13	51	6
8	FBK0500599	13	51	8
10	FBK0500601	14	51	10
12	FBK0500603	16	63	12
14	FBK0500605	18	70	14
16	FBK0500607	20	76	16
20	FBK0500609	25	76	20

*Custom Solution possible Refer page 2.171

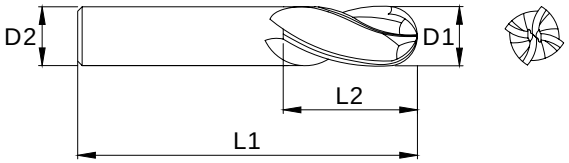
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute — Centre cutting ball nose regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500201	3	38	3
1.5	FBK0500204	6	38	3
2	FBK0500207	9	38	3
2.5	FBK0500210	12	38	3
3	FBK0500213	12	38	3
4	FBK0500219	14	51	4
5	FBK0500225	20	51	5
6	FBK0500231	20	63	6
8	FBK0500240	20	63	8
10	FBK0500245	25	70	10
12	FBK0500250	25	76	12
16	FBK0500260	30	89	16
20	FBK0500266	38	102	20
25	FBK0500270	40	102	25

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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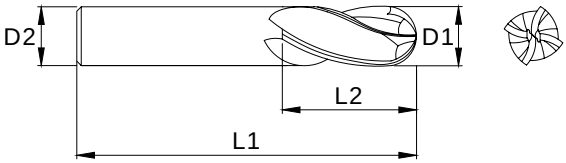
4 Flute

Centre cutting ball nose long reach end mill

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

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500493	6	60	3
4	FBK0500495	9	76	4
5	FBK0500497	15	76	5
6	FBK0500499	15	76	6
8	FBK0500501	20	101	8
10	FBK0500503	25	101	10
12	FBK0500505	25	152	12
16	FBK0500507	30	152	16
18	FBK0500509	40	152	16
20	FBK0500511	50	152	20

*Custom Solution possible Refer page 2.171

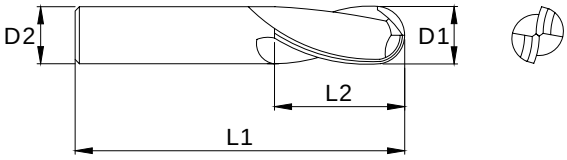
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting ball nose regular length end mill

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500273	3	38	3
1.5	FBK0500276	6	38	3
2	FBK0500279	9	38	3
2.5	FBK0500282	12	38	3
3	FBK0500285	12	38	3
4	FBK0500290	14	51	4
5	FBK0500295	20	51	5
6	FBK0500300	20	63	6
7	FBK0500304	20	63	7
8	FBK0500307	20	63	8
10	FBK0500312	25	70	10
12	FBK0500317	25	76	12
14	FBK0500320	30	89	14
16	FBK0500323	30	89	16
20	FBK0500329	38	102	20
22	FBK0500331	40	102	22
25	FBK0500333	40	102	25

*Custom Solution possible Refer page 2.171

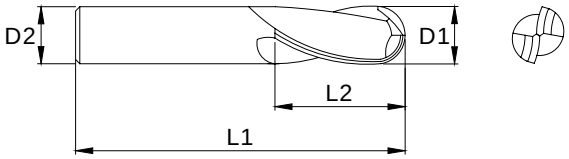
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting ball nose stub length end mill

Carbide | STUB | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0502020	2	38	3
1.5	FBK0500611	3	38	3
2	FBK0500613	4	38	3
2.5	FBK0500615	5	38	3
3	FBK0500617	6	38	3
4	FBK0500619	8	51	4
5	FBK0500621	11	51	5
6	FBK0500623	13	51	6
8	FBK0500625	13	51	8
10	FBK0500627	14	51	10
12	FBK0500629	16	63	12
14	FBK0500631	18	70	14
16	FBK0500633	20	76	16
20	FBK0500635	25	76	20

*Custom Solution possible Refer page 2.171

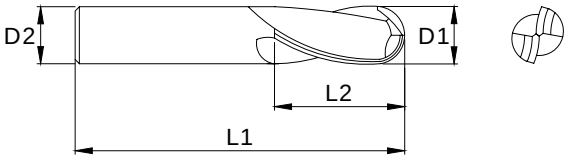
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute — Centre cutting ball nose long reach end mill

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



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500513	6	60	3
4	FBK0500515	9	76	4
5	FBK0500517	15	76	5
6	FBK0500519	15	101	6
8	FBK0500521	20	101	8
10	FBK0500523	25	152	10
12	FBK0500525	25	152	12
16	FBK0500527	30	152	16
18	FBK0500529	40	152	18
20	FBK0500531	50	152	20

*Custom Solution possible Refer page 2.171

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting speed chart

General Purpose Technical Metric

	2 Flute Series			3 Flute Series		4 Flute Series		
Stub	F164	F166				F163	F165	
standard	F121	F150		F116	F145	F111	F140	
long length/reach	F123		F183 / F186			F122		F181 / F184 / F187

Workpiece Material Group		Example	VC
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	105 - 150
		Steel - Mild (.4 - .5 Carbon) 4140	75 - 105
		Tool Steels (1.2 carbon) A2/D2/ H13/P20	60 - 75
		Forgings	40 - 75
Cast Iron	K	Iron Cast (Soft)	140 - 185
		Iron - Cast (Medium Hard)	90 - 120
		Iron (Hard Chilled)	75 - 90
		Iron (Malleable)	70 - 90
Stainless Steels	M	Stainless Free Machining	90 - 120
		Austenitic Stainless 304/316	55 - 70
		Ferritic	60 - 85
		Martensitic	45 - 60
		PH Stainless 17-4 PH	40 - 60

Workpiece Material Group		Example	VC
Special Alloys	S	Titanium 6AL-4V	55 - 115
		Cobalt-Based Alloys Stellite	30 - 60
		Nickel-Based Alloys Inconel 625/718	30 - 60
		Iron-Based Alloys Incoloy 800-802	40 - 60
Hardened Steels	H	Hardened Steels 35-45 Rc	60 - 75
		Hardened Steels 45-55 Rc	45 - 60
		Hardened Steels 55-65 Rc	15 - 30
Non-Ferrous	N	Aluminium / Aluminium Alloys	150 - 215
		Brass / Bronze	120 - 185
		Magnesium / Magnesium Alloys	215 - 305
		Plastics / Bakelite	245 - 365

Feed rate chart

General Purpose Technical Metric

Workpiece Material Group		Example	Tool Diameter (mm)								
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008 - .013	.020 - .025	.030 - .038	.036 -.046	.046 - .051	.051 - .058	.058 - .076	.061 - .081	.061 - .081
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008 - .013	.020 - .025	.030 - .038	.036 -.046	.046 - .051	.051 - .058	.058 - .076	.061 - .081	.061 - .081
Special Alloys	S	Titanium 6AL-4V	.008 - .010	.010 -.015	.015 - .020	.020 -.030	.020 -.030	.030 -.041	.041 -.046	.046 - .051	.051 - .076
		Stellite Inconel 625/718 Incoloy 800-802	.008 -.013	0.13 - .038	0.13 - .038	.025 -.051	.025 -.051	.025 -.076	0.51 -.076	.064 - .089	.064 - .089
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.008 -.013	0.13 - .038	0.13 - .038	.025 -.051	.025 -.051	.025 -.076	0.51 -.076	.064 - .089	.064 - .089
Non-Ferrous	N	Aluminium/Aluminium Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.020 - .038	.038 -.051	.051 -.064	.064 - .076	.076 - .089	.089 - .127	.127 -.216	.191 - .241	.216 - .254

Cutting speed chart

General Purpose Technical Inch

	2 Flute Series			3 Flute Series		4 Flute Series		
Stub	F164	F166		F169		F163	F165	
standard	F121	F150		F116	F145	F111	F140	
long length/reach	F123		F183 / F186			F122		F181 / F184 / F187

Workpiece Material Group		Example	SFM
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	350 - 500
		Steel - Mild (.4 - .5 Carbon) 4140	250 - 350
		Tool Steels (1.2 carbon) A2/D2/ H13/P20	200 - 250
		Forgings	125 - 250
Cast Iron	K	Iron Cast (Soft)	450 - 600
		Iron - Cast (Medium Hard)	300 - 400
		Iron (Hard Chilled)	250 - 300
		Iron (Malleable)	225 - 300
Stainless Steels	M	Stainless Free Machining	300 - 400
		Austenitic Stainless 304/316	180 - 225
		Ferritic	200 - 275
		Martensitic	150 - 200
		PH Stainless 17-4 PH	125 - 200

Workpiece Material Group		Example	SFM
Special Alloys	S	Titanium 6AL-4V	175 - 375
		Cobalt-Based Alloys Stellite	100 - 200
		Nickel-Based Alloys Inconel 625/718	100 - 200
		Iron-Based Alloys Incoloy 800-802	125 - 200
Hardened Steels	H	Hardened Steels 35-45 Rc	200 - 250
		Hardened Steels 45-55 Rc	150 - 200
		Hardened Steels 55-65 Rc	50 - 100
Non-Fer-rous	N	Aluminium / Aluminium Alloys	500 - 700
		Brass / Bronze	400 - 600
		Magnesium / Magnesium Alloys	700 - 1000
		Plastics / Bakelite	800 - 1200

Feed rate chart

General Purpose Technical Inch

Workpiece Material Group		Example	Tool Diameter (inch)								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.0005 - .0008	.0010 - .0012	.0012 - .0015	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Special Alloys	S	Titanium 6AL-4V	.0003 -.0004	.0004 - .0006	.0006 - .0008	.0008 - .0012	.0008 - .0012	.0012 - .0016	.0016 - .0018	.0018 - .0020	.0020 - .0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Non-Ferrous	N	Aluminium/Aluminium Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.0008 - .0015	.0015 - .0020	.0020 - .0025	.0025 - .0030	.0030 - .0035	.0035 - .0050	.0050 - .0080	.0075 - .0095	.0085 - .100

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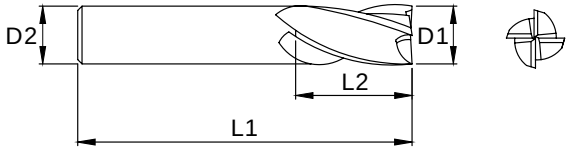
4 Flute

Centre cutting regular length chip breaker end mill

Carbide | REG | 30° | 6535 HA

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



Without Coating

Unit : mm

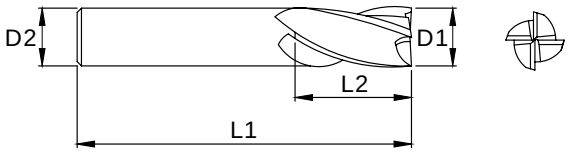
Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4	FBK0500636	14	51	4
5	FBK0500637	20	51	5
6	FBK0500639	20	64	6
8	FBK0500642	20	64	8
9	FBK0500644	20	64	9
10	FBK0500646	25	70	10
12	FBK0500648	25	76	12
14	FBK0500650	30	89	14
16	FBK0500652	30	89	16
18	FBK0500654	35	102	18
20	FBK0500655	38	102	20

With TiAlN Coating

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4	FBK0504095	14	51	4
5	FBK0500638	20	51	5
6	FBK0500640	20	64	6
8	FBK0500643	20	64	8
9	FBK0500645	20	64	9
10	FBK0500647	25	70	10
12	FBK0500649	25	76	12
14	FBK0500651	30	89	14
16	FBK0500653	30	89	16
18	FBK0504096	35	102	18
20	FBK0503975	38	102	20

4 Flute — Centre cutting long length chip breaker end mill

Carbide | LONG | 30° | 6535 HA | BF



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

Without Coating

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6	FBK0500656	30	76	6
8	FBK0500658	35	83	8
10	FBK0500660	40	89	10
12	FBK0500662	50	102	12
16	FBK0500664	65	117	16

With TiAlN Coating

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6	FBK0500657	30	76	6
8	FBK0500659	35	83	8
10	FBK0500661	40	89	10
12	FBK0500663	50	102	12

*Custom Solution possible Refer page 2.171

Available in uncoated and TiN coating

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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Cutting speed chart

Series F114/F132 INCH

Workpiece Material Group		Example	SFM
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	340 - 500
		Steel - Mild (.4 - .5 Carbon) 4140	250 - 300
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	125 - 250
Cast Iron	K	Iron Cast (Soft)	450 - 600
		Iron - Cast (Medium Hard)	300 - 400
		Iron (Hard Chilled)	250 - 300
		Iron (Malleable)	225 - 300
Stainless Steels	M	Stainless Free Machining	200 - 300
		Austenitic Stainless 304/316	180 - 225
		Ferritic	200 - 275
		Martensitic	150 - 200
		PH Stainless 17-4 PH	125 - 200
Special Alloys	S	Titanium 6AL-4V	175 - 375
		Cobalt-Based Alloys Stellite	80 - 125
		Nickel-Based Alloys Inconel 625/718	80 - 125
		Iron-Based Alloys Incoloy 800-802	80 - 125
Hardened Steels	H	Hardened Steels 35-45 Rc	200 - 250
		Hardened Steels 45-55 Rc	150 - 200

#RPM = SMM x 318.057/Tool Dia. #IPM = RPM/number of teeth x (inch/tooth)

Feed rate chart

Series F114/F132 INCH

Workpiece Material Group		Example	Tool Diameter (inch)								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.0005 - .0008	.0010 - .0012	.0012 - .0015	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Special Alloys	S	Titanium 6AL-4V	.0003 -.0004	.0004 - .0006	.0006 - .0008	.0008 - .0012	.0008 - .0012	.0012 - .0016	.0016 - .0018	.0018 - .0020	.0020 - .0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035

*For TiAlN Coated Tool Increase RPM by 20% and Feed by 10%

Cutting speed chart

Series F114/F132 METRIC

Workpiece Material Group		Example	Vc
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	135 - 150
		Steel - Mild (.4 - .5 Carbon) 4140	75 - 90
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	40 - 75
Cast Iron	K	Iron Cast (Soft)	135 - 185
		Iron - Cast (Medium Hard)	90 - 120
		Iron (Hard Chilled)	75 - 90
		Iron (Malleable)	70 - 90
Stainless Steels	M	Stainless Free Machining	60 - 90
		Austenitic Stainless 304/316	55 - 70
		Ferritic	60 - 85
		Martensitic	45 - 60
		PH Stainless 17-4 PH	40 - 60
Special Alloys	S	Titanium 6AL-4V	55 - 115
		Cobalt-Based Alloys Stellite	25 - 40
		Nickel-Based Alloys Inconel 625/718	25 - 40
		Iron-Based Alloys Incoloy Incoloy 625/718	25 - 40
Hardened Steels	H	Hardened Steels 35-45 Rc	60 - 75
		Hardened Steels 45-55 Rc	45 - 60

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

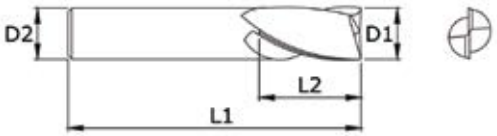
Feed rate chart

Series F114/F132 METRIC

Workpiece Material Group		Example	Tool Diameter (mm)								
			3	5	6	8	10	14	16	18	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013 - .020	.025 - .30	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	0.081 - .127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013 - .020	.020 - .025	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	.081 - .127
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.013 - .020	.020 - .025	.038 - .051	.038 - .064	.053 - .076	.056 - .076	.058 - .102	.056 - .109	.081 - .127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Special Alloys	S	Titanium 6AL-4V	.008 - .010	.010 - .015	.015 - .020	.020 - .030	.020 - .030	.030 - .041	.041 - .046	.046 - .051	.051 - .076
		Stellite Inconel 625/718 Incoloy 800-802	.008 - .013	.020 - .025	.030 - .038	.036 - .046	.046 - .051	.051 - .058	.058 - .076	.060 - .081	.060 - .081
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.008 - .013	.013 - .038	.013 - .038	.025 - .051	.025 - .051	.025 - .076	.051 - .076	.064 - .089	.064 - .089

2 Flute F121 XL

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500705	3	38	3
1.5	FBK0500706	6	38	3
2	FBK0500707	9	38	3
2.5	FBK0500708	12	38	3
3	FBK0500709	12	38	3
4	FBK0500710	14	50	4
5	FBK0500711	20	50	5
6	FBK0500712	20	63	6
8	FBK0500713	20	63	8
10	FBK0500714	25	70	10
12	FBK0500715	25	75	12
16	FBK0500716	30	89	16
20	FBK0500717	38	102	16

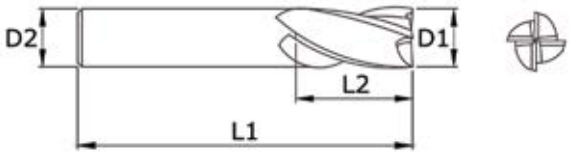
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute F111 XL

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500718	3	38	3
1.5	FBK0500719	6	38	3
2	FBK0500720	9	38	3
2.5	FBK0500721	12	38	3
3	FBK0500722	12	38	3
4	FBK0500723	14	50	4
5	FBK0500724	20	50	5
6	FBK0500725	20	63	6
8	FBK0500726	20	63	8
10	FBK0500727	25	70	10
12	FBK0500728	25	75	12
16	FBK0500729	30	89	16
20	FBK0500730	38	102	20

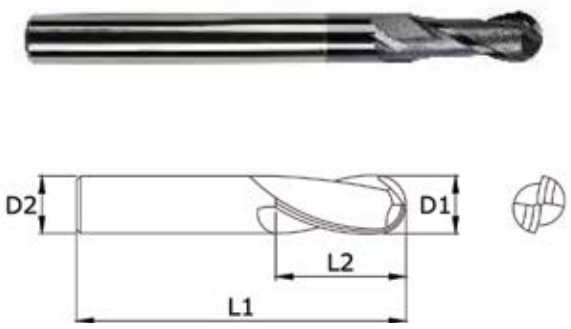
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute F150 XL

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500731	3	38	3
1.5	FBK0500732	6	38	3
2	FBK0500733	9	38	3
2.5	FBK0500734	12	38	3
3	FBK0500735	12	38	3
4	FBK0500736	14	50	4
5	FBK0500737	20	50	5
6	FBK0500738	20	63	6
8	FBK0500739	20	63	8
10	FBK0500740	25	70	10
12	FBK0500741	25	75	12
16	FBK0500742	30	89	16
20	FBK0500743	38	102	20

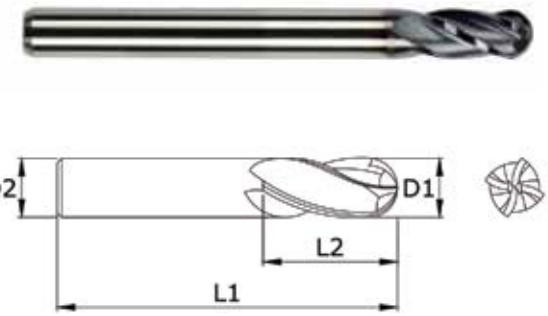
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute F140 XL

Carbide | REG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
1	FBK0500744	3	38	3
1.5	FBK0500745	6	38	3
2	FBK0500746	9	38	3
2.5	FBK0500747	12	38	3
3	FBK0500748	12	38	3
4	FBK0500749	14	50	4
5	FBK0500750	20	50	5
6	FBK0500751	20	63	6
8	FBK0500752	20	63	8
10	FBK0500753	25	70	10
12	FBK0500754	25	75	12
16	FBK0500755	30	89	16
20	FBK0500756	38	102	20

Tensile strength: N/mm² I Hardness: HRC

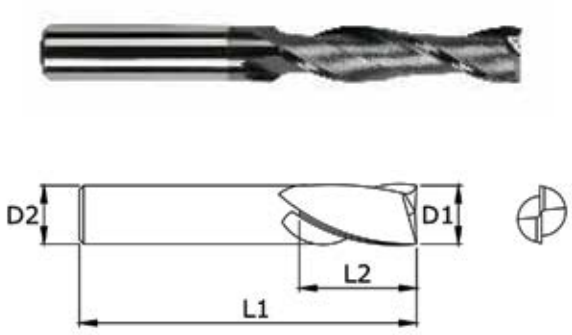
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

2 Flute F123XL

Carbide | LONG | 30° | 6535 HA | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0500757	25	63	3
4	FBK0500758	25	63	4
5	FBK0500759	25	63	5
6	FBK0500760	30	75	6
8	FBK0500761	35	83	8
10	FBK0500762	40	89	10
12	FBK0500763	50	102	12
16	FBK0500764	65	110	16
20	FBK0500765	80	150	20

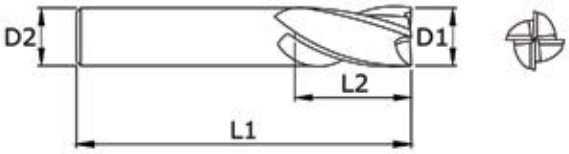
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute F122 XL

Carbide | LONG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter	EDP No	Flute Length	Overall Length	Shank Diameter
Ø D1		L2	L1	Ø D2
3	FBK0500766	25	63	3
4	FBK0500767	25	63	4
5	FBK0500768	25	63	5
6	FBK0500769	30	75	6
8	FBK0500770	35	83	8
10	FBK0500771	40	89	10
12	FBK0500772	50	102	12
16	FBK0500773	65	110	16
20	FBK0500774	80	150	20

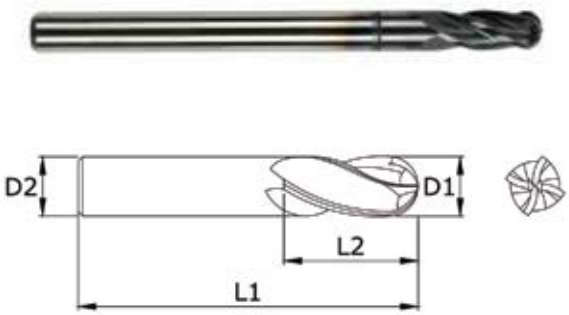
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

4 Flute F125 XL

Carbide | LONG | 30° | 6535 HA | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBK0503374	25	63	3
4	FBK0503375	25	63	4
5	FBK0503376	25	63	5
6	FBK0503377	30	75	6
8	FBK0503378	35	83	8
10	FBK0503379	40	89	10
12	FBK0503380	50	102	12
16	FBK0503381	65	110	16
20	FBK0503382	80	150	20

Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

Cutting speed chart

General Purpose Technical Metric

	2 Flute Series		4 Flute Series	
standard	F121 XL	F150 XL	F111 XL	F140 XL
long length/reach	F123 XL		F122 XL	F125 XL

Workpiece Material Group		Example	Vc
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	105 - 150
		Steel - Mild (.4 - .5 Carbon) 4140	75 - 105
		Tool Steels (1.2 carbon) A2/D2/ H13/P20	60 - 75
		Forgings	40 - 75
Cast Iron	K	Iron Cast (Soft)	140 - 185
		Iron - Cast (Medium Hard)	90 - 120
		Iron (Hard Chilled)	75 - 90
		Iron (Malleable)	70 - 90
Stainless Steels	M	Stainless Free Machining	90 - 120
		Austenitic Stainless 304/316	55 - 70
		Ferritic	60 - 85
		Martensitic	45 - 60
		PH Stainless 17-4 PH	40 - 60

Workpiece Material Group		Example	Vc
Special Alloys	S	Titanium 6AL-4V	55 - 115
		Cobalt-Based Alloys Stellite	30 - 60
		Nickel-Based Alloys Inconel 625/718	30 - 60
		Iron-Based Alloys Incoloy 800-802	40 - 60
Hardened Steels	H	Hardened Steels 35-45 Rc	60 - 75
		Hardened Steels 45-55 Rc	45 - 60
		Hardened Steels 55-65 Rc	15 - 30
Non-Ferrous	N	Aluminium / Aluminium Alloys	150 - 215
		Brass / Bronze	120 - 185
		Magnesium / Magnesium Alloys	215 - 305
		Plastics / Bakelite	245 - 365

Feed rate chart

General Purpose Technical Metric

Workpiece Material Group		Example	Tool Diameter (mm)								
			3	5	6	8	10	12	16	20	25
			mm/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.008 - .013	.020 - .025	.030 - .038	.036 -.046	.046 - .051	.051 - .058	.058 - .076	.061 - .081	.061 - .081
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.013 - .020	.025 - .030	.038 - .051	.038 - .051	.053 - .076	.051 - .089	.058 - .102	.056 - .109	.081 - .127
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.008 - .013	.020 - .025	.030 - .038	.036 -.046	.046 - .051	.051 - .058	.058 - .076	.061 - .081	.061 - .081
Special Alloys	S	Titanium 6AL-4V	.008 - .010	.010 -.015	.015 - .020	.020 -.030	.020 -.030	.030 -.041	.041 -.046	.046 - .051	.051 - .076
		Stellite Inconel 625/718 Incoloy 800-802	.008 -.013	0.13 - .038	0.13 - .038	.025 -.051	.025 -.051	.025 -.076	0.51 -.076	.064 - .089	.064 - .089
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.008 -.013	0.13 - .038	0.13 - .038	.025 -.051	.025 -.051	.025 -.076	0.51 -.076	.064 - .089	.064 - .089
Non-Ferrous	N	Aluminium/Aluminium Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.020 - .038	.038 -.051	.051 -.064	.064 - .076	.076 - .089	.089 - .127	.127 -.216	.191 - .241	.216 - .254

Cutting speed chart

General Purpose Technical Inch

	2 Flute Series			3 Flute Series		4 Flute Series		
Stub	F164	F166		F169		F163	F165	
standard	F121	F150		F116	F145	F111	F140	
long length/reach	F123		F183 / F186			F122		F181 / F184 / F187

Workpiece Material Group		Example	SFM
Steels	P	Steel - Mild (.2 - .3 Carbon) 1018	350 - 500
		Steel - Mild (.4 - .5 Carbon) 4140	250 - 350
		Tool Steels (1.2 carbon) A2/D2/ H13/P20	200 - 250
		Forgings	125 - 250
Cast Iron	K	Iron Cast (Soft)	450 - 600
		Iron - Cast (Medium Hard)	300 - 400
		Iron (Hard Chilled)	250 - 300
		Iron (Malleable)	225 - 300
Stainless Steels	M	Stainless Free Machining	300 - 400
		Austenitic Stainless 304/316	180 - 225
		Ferritic	200 - 275
		Martensitic	150 - 200
		PH Stainless 17-4 PH	125 - 200

Workpiece Material Group		Example	SFM
Special Alloys	S	Titanium 6AL-4V	175 - 375
		Cobalt-Based Alloys Stellite	100 - 200
		Nickel-Based Alloys Inconel 625/718	100 - 200
		Iron-Based Alloys Incoloy 800-802	125 - 200
Hardened Steels	H	Hardened Steels 35-45 Rc	200 - 250
		Hardened Steels 45-55 Rc	150 - 200
		Hardened Steels 55-65 Rc	50 - 100
Non-Fer-rous	N	Aluminium / Aluminium Alloys	500 - 700
		Brass / Bronze	400 - 600
		Magnesium / Magnesium Alloys	700 - 1000
		Plastics / Bakelite	800 - 1200

FEED RATE CHART

General Purpose Technical Inch

Workpiece Material Group		Example	Tool Diameter (inch)								
			1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
			Inch/Tooth								
Steels	P	Steel - Mild (.2-.3 Carbon) 1018 Steel - Mild (.4-.5 Carbon) 4140	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Tool Steels (1.2 carbon) A2/D2/H13/P20 Forgings	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Cast Iron	K	Iron Cast (Soft) Iron - Cast(Medium Hard) Iron (Hard Chilled) Iron (Malleable)	.0005 - .0008	.0010 - .0012	.0015 - .0020	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
Stainless Steel	M	Stainless Steel Free Machining Ferritic	.0005 - .0008	.0010 - .0012	.0012 - .0015	.0015 - .0025	.0021 - .0030	.0020 - .0035	.0023 - .0040	.0022 - .0043	.0032 - .0050
		Austenitic Stainless 304/316 Martensitic PH Stainless 17-4 PH	.0003 - .0005	.0008 - .0010	.0012 - .0015	.0014 - .0018	.0018 - .0020	.0020 - .0023	.0023 - .0030	.0024 - .0032	.0024 - .0032
Special Alloys	S	Titanium 6AL-4V	.0003 -.0004	.0004 - .0006	.0006 - .0008	.0008 - .0012	.0008 - .0012	.0012 - .0016	.0016 - .0018	.0018 - .0020	.0020 - .0030
		Stellite Inconel 625/718 Incoloy 800-802	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Hardened Steels	H	Hardened Steels 35-45 Rc Hardened Steels 45-55 Rc Hardened Steels 55-65 Rc	.0003 - .0005	.0005 - .0015	.0005 - .0015	.0010 -.0020	.0010 -.0020	.0010 -.0030	.0020 -.0030	.0025 - .0035	.0025 - .0035
Non-Ferrous	N	Aluminium/Aluminium Alloys Brass/Bronze Magnesium/Magnesium Alloys Plastics/Bakelite	.0008 - .0015	.0015 - .0020	.0020 - .0025	.0025 - .0030	.0030 - .0035	.0035 - .0050	.0050 - .0080	.0075 - .0095	.0085 - .100

Material details

Material Group	Material Description	Content	Tensile Strength RM (MPa)*	Hardness (HB)	Hardness (HRC)
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
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
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
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)	—	—	—	—
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
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
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
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
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
N1	2025, 5050, 7050, 1000, 2017	AlMg1, Al99.5, AlCuMg1, AlCuBiPb, AlMgSi1, ALMgSiPb
N2	2024, 6061, 7075	GAlSiCu4, GDAlSi10Mg
N3	—	G-ALSi12, G-AlSi17Cu4, G-AlSi21CuNiMg
N4	C81500	CuZn40, Ms60, G-CuSn5ZnPb, CuZn37, CuSi3Mn
N5	—	LEXAN®, HOSTALEN™, Polystyrol, Makralon®
N6	Graphite, CFK, CFRP	CFK, GFK
N7	C63000	—
S1	INCOLOY® 800 Series, A608, A567, Discaloy™, INVAR®, N-155, 16-25-6, 19-9 DL; Cast: ASTM A-297, A-351, A-567, A-608	X1NiCrMoCu32 28 7, X12NiCrSi36 16, X5NiCrAlTi31 20, X40CoCrNi20 20
S2	Haynes® 25 (L605), Haynes 188, J-1570, Stellite®, AiResist 213; Cast: AiResist 13, Haynes 21, MAR-M302, MAR-M509, NASA Co-W-Re, WI-52	Haynes® 188, Stelllite® 6,21,31
S3	Astroloy™, Hastelloy® B/C/ C-276 /X, INCONEL® 600 and 700 Series, IN102,INCOLOY 900 Series, Rene 41, Waspalloy®, Monel®, K-500, MAR-M20, NIMONIC®, UDIMET®	INCONEL® 690, INCONEL 625, Hastelloy®, NIMONIC® 75
S4	Pure: Ti 98.8, Ti 98.9,Ti 99.9; Alloyed: Ti 5Al-2.5Sn, Ti6Al-4V, Ti6Al-2Sn-4Zr-2Mo,Ti-3Al-8V-6Cr-4Mo-4Zr, Ti-10V-2Fe-3Al, Ti-13V-11Cr-3Al	Ti1, TiAl5Sn2, TiAl6V4, TiAl4Mo4Sn2
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	—

Surface treatment

STEAM OXIDE:
A black oxided surface (Fe3O4) produced on the surface of a finished tap by means of a steam furnace. This oxidized surface is porous and helps retain cutting fluid in the working portion of the tap. The materials on which steam oxide has shown improvement in performance are stainless steels, steel forgings, tool and die steels, hot and cold rolled steels, and high nickel alloys.

TITANIUM NITRIDE (TiN):
A thin deposit (approx. 0.0001") applied to the surface of a finished tap utilizing PVD coating technology. TiN coating increases the surface hardness and wear resistance. Use of TiN coating on standard tools will help increase tool life in harder materials (up to 32 HrC), such as stainless steels, steel forgings, tool and die steels and hot and cold rolled steels. TiN coating also works very well with water-base cutting fluids.

TITANIUM CARBON NITRIDE (TiCN):
Similar to TiN, TiCN is applied utilizing PVD coating technology. This coating combines high hardness (approx. 2800 vickers) with the anti-seizure properties of Nitride. A lower coefficient of friction helps reduce welding by 75% over TiN coated tools. These features make TiCN especially beneficial in non-ferrous material and hardened steels.

TITANIUM ALUMINUM NITRIDE (TiAlN):
TiAlN is applied using PVD coating technology. The addition of aluminum reduces friction and increases the coating oxidation temperature. As a result, TiAlN has increased resistance to heat and oxidation wear. This makes TiAlN better suited for High Speed/High Heat applications. TiAlN coating is incorporated into many of our tools.

PROTON + COATING :
Proton + coating devised explicitly for solid carbide tools used in roughing and finishing of hardened steels and difficult-to-machine materials.
Major competitive advantages in tool and die-making can be attained by cutting steels with hardness >60 HRC.

Cr BASED COATING
Cr based coating, has made it possible to systematically optimize and decisively improve the key coating properties for milling applications.

Greater abrasion resistance, extra shear strength, lower adhesion tendency, maximum toughness and a very smooth surface achieve a quantum leap in drilling performance.

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End Mill Troubleshooting

Problem	Rigidity	Increase Inches/Tooth	Reduce Inches/Tooth	Material	Recutting Chips	Increase Rake Angle	Handling	Runout	Reduce Speed	Increase Speed	Depth of Cut	Fixturing	Coolant	Finish	Dull Tool	Chip Evaluation	Inadequate Number of Flutes	Insufficient Coolant	Plunge Cutting	Reduce Feed	Increase Feed	Tool Holder	Balance Holder & Tool
Chipping	X		X	X	X		X	X														X	
Chatter	X	X							X		X	X										X	
Built Up Edge		X				X				X			X	X									
Breakage	X		X								X				X	X						X	
Chip Packing																	X	X	X				
Poor Slotting	X	X	X						X		X	X								X			
Premature Wear				X					X	X			X							X	X	X	
Chip Welding			X			X			X				X	X									
Cratering																							X

FORMULAS:-

INCH
RPM = SFM x 3.82/Tool Diameter
IPM = RPM x number of teeth x (inches/tooth)

METRIC
RPM = Vc x 318.057/Tool Diameter
mm/min. = RPM x number of teeth x (mm/tooth)

CONVERSION INCH TO METRIC
Vc = SFM x 3.084
mm/min. = IPM x 25.4

CONVERSION METRIC TO INCH
SFM = Vc/ . 3048
IPM = (mm/min.)/25.4

SAFETY NOTE:-

Always wear the appropriate personal protective equipment such as safety glasses and protective clothing when using solid carbide or HSS cutting tools. Machines should fully guarded. Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

End Mill Troubleshooting guide

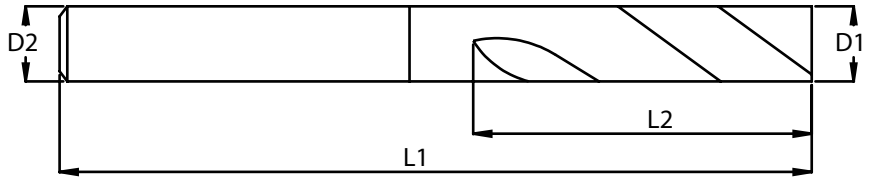
PROBLEM	CAUSE	SOLUTION
Chip packing	Too great a cutting amount	Adjust feed or speed
	Not enough chip room	Use end mill fewer flutes
	Not enough coolant	Apply more coolant. Use air pressure
Rough surface finish	Feed too fast	Slow down to correct feed
	Slow speed	Use higher speed
	Too much wear	Regrind earlier stage
	Chip biting	Cut less amount per pass
	No end tooth concavity	Add margin (touch primary with oilstone)
Burr	Too much wear on primary relief	Regrind sooner
	Incorrect condition	Correct milling condition
	Improper cutting angle	Change to correct cutting angle
No dimensional accuracy	Too tough condition	Change to easier condition
	Lack of accuracy (machine & holder)	Repair machine or holder
	Not enough rigidity (machine & holder)	Change machine or holder or condition
	Not sufficient number of flutes	Use end mill with greater number of flutes
No perpendicular side	Feed too fast	Slow down to correct feed
	Too great a cutting amount	Reduce cutting amount
	Too long a flute length or long overall length	Use proper length tool. Hold shank deeper
	Not sufficient number of flutes	Use end mill with greater number of flutes
Chipping	Feed too fast	Slow down to proper feed
	Feed too fast on first cut	Slow down on first bite
	Not enough rigidity of machine tool & holder	Change rigid machine tool or holder
	Loose holder	Tighten tool holder
	Loose holder (workpiece)	Tighten workpiece fixture
	Lack of rigidity (tool)	Use shortest end mill available. Hold shank deeper. Try down cut
	Teeth too sharp	Change to lower cutting angle, primary relief
Wear	Speed too fast	Slow down, use more coolant
	Hard material	Use higher grade tool material, add surface treatment
	Biting chips	Change feed speed to change chip size or clear chips with coolant or air pressure
	Improper feed speed (too slow)	Increase feed speed. Try down cut
	Improper cutting angle	Change to correct cutting angle
	Too low a primary relief angle	Change to larger relief angle
Breakage	Feed too fast	Slow down feed
	Too large cutting amount	Adjust to smaller cutting amount per teeth
	Too long flute length or long overall length	Hold shank deeper, use shorter end mill
	Too much wear	Regrind at earlier stage
Chattering	Feed and speed too fast	Correct feed and speed
	Not enough rigidity (machine & holder)	Use better machine tool or holder or change condition
	Too much relief angle	Change to smaller relief angle. Add margin (touch primary with oil stone)
	Loose holder (workpiece)	Hold workpiece tighter
	Cutting too deep	Correct to smaller cutting depth
	Too long flute length or long overall length	Hold shank deeper, use shorter end mill or try down cut

CUSTOM TOOL REQUEST FORM

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

☐ Request Approval Drawing

D1 = _____
D2 = _____
L1 = _____
L2 = _____



***Material**

☐ Solid Carbide

☐ Carbide Coolant Thru

***Number of Flutes**

_____

***Flute Form**

☐ Straight

☐ Helical _____ ° Helix

***Flute Form**

☐ Cylindrical

☐ Shank Flat

Flat Style _____

***Flute Form**

☐ Corner Radius _____ +/-.002"

☐ Corner Chamfer _____ x _____ °

☐ Chipbreaker

***Coating**

☐ TiN

☐ TiCN

☐ TiAlN

☐ None

Other _____

Note:
This information enables us to engineer and manufacture a tool for your specific requirments.

Customer Name: _____

Phone: _____

* Work Material Machined:

Hardness: _____

Distributor: _____

Quantities: _____

TRIAL TOOL RESULTS FORM

Customer Name		Ref No.	
Address		Date	
		Sales Engineer Name:	
		Contact No.:	
Contact Person :		Trial PO OA No:	
Tool Diameter :			
Component Details:		**Operation Details:**	
Name		End Milling Depth	
Material		No of Passes	
Material Hardness		Slotting/Profiling/Ramping	
Machine Make /Model/No.		Roughing/Finishing	
Tool No.		Tol/Finish required :	
Machining Details :			
Parameters	**Existing**	**Proposed**	
Holding			
M/c.Type			
Cycle Time			
Coolant			
Coolant Press.			
Tool Data:			
Parameters	**Existing**	**Trial 1**	**Trial 2**
Make			
Ext/Thru cool			
Cutting Speed (Vc) m/min			
RPM			
Feed			
Depth of cut			
Life Obtained (TIME)			
Kind of Failure			
Cost Data:			
Tool Cost (Rs.)			
Cost/Component (Rs.)			
Remarks:-			
Customer Benefit:-1.			
Customer Benefit:-2.			

Sales Engineer
FORBES & COMPANY LIMITED

Authorised Signatory
CUSTOMER

Proton Series takes high-performance milling on hardend steels to the next level. This Product line is designed to provide maximum metal removal rates and superior surface finish

FEATURES

- Proprietary High Performance Coating.
- Special High Performance Geometry designed and proven on 45HRC-62HRC Material
- Common shank for tools <3mm for reduced breakage
- Available in Neck style
- Single End Mill for both Roughing and Finishing
- Diameter Range- 0.3-16mm as standard, custom solutions available

BENEFITS

- Higher Productivity and profitability
- Lower Cycle Times and CPC
- Improved Surface Finish
- Improved reliability and consistency in performance

TOTEM®

High Performance Cutting Tools

SOLID CARBIDE DRILLS

CONTENTS

CARBIDE DRILLS

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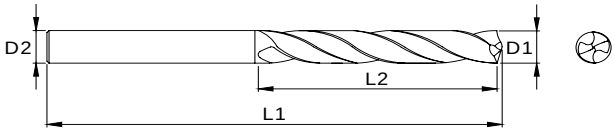
3X Solid carbide 3x high performance drill

Carbide | STUB | 3X | 142° | 30° | TiAlN



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

DRILLS

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0501006	16	57	3
3.1	FBJ0501007	22	63	4
3.2	FBJ0501008	22	63	4
3.3	FBJ0501009	22	63	4
3.4	FBJ0501010	22	63	4
3.5	FBJ0501011	22	63	4
3.6	FBJ0501012	22	63	4
3.7	FBJ0501013	22	63	4
3.8	FBJ0501014	22	63	4
3.9	FBJ0501015	22	63	4
4	FBJ0501016	22	63	4
4.1	FBJ0501017	26	63	5
4.2	FBJ0501018	26	63	5
4.3	FBJ0501019	26	63	5
4.4	FBJ0501020	26	63	5
4.5	FBJ0501021	26	63	5
4.6	FBJ0501022	26	63	5
4.7	FBJ0501023	26	63	5
4.8	FBJ0501024	26	63	5
4.9	FBJ0501025	26	63	5

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
5	FBJ0501026	26	63	5
5.1	FBJ0501027	30	76	6
5.2	FBJ0501028	30	76	6
5.3	FBJ0501029	30	76	6
5.4	FBJ0501030	30	76	6
5.5	FBJ0501031	30	76	6
5.7	FBJ0501032	30	76	6
5.8	FBJ0501033	30	76	6
5.9	FBJ0501034	30	76	6
6	FBJ0501035	30	76	6
6.1	FBJ0501037	35	82	8
6.2	FBJ0501038	35	82	8
6.3	FBJ0501039	35	82	8
6.4	FBJ0501040	35	82	8
6.5	FBJ0501041	35	82	8
6.6	FBJ0501042	35	82	8
6.7	FBJ0501043	35	82	8
6.8	FBJ0501044	35	82	8
6.9	FBJ0501045	35	82	8
7	FBJ0501046	35	82	8

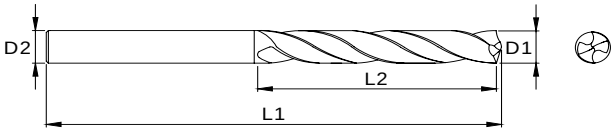
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

3X Solid carbide 3x high performance drill

Carbide | STUB | 3X | 142° | 30° | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
7.1	FBJ0501047	38	82	8
7.2	FBJ0501048	38	82	8
7.3	FBJ0501049	38	82	8
7.4	FBJ0501050	38	82	8
7.5	FBJ0501051	38	82	8
7.6	FBJ0501052	38	82	8
7.8	FBJ0501053	38	82	8
7.9	FBJ0501054	38	82	8
8	FBJ0501055	38	82	8
8.1	FBJ0501056	43	89	10
8.2	FBJ0501057	43	89	10
8.3	FBJ0501058	43	89	10
8.4	FBJ0501059	43	89	10
8.5	FBJ0501060	43	89	10
8.6	FBJ0501061	43	89	10
8.7	FBJ0501062	43	89	10
8.8	FBJ0501063	43	89	10
8.9	FBJ0501064	43	89	10
9	FBJ0501065	43	89	10
9.1	FBJ0501066	43	89	10

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
9.2	FBJ0501067	43	89	10
9.25	FBJ0501068	43	89	10
9.3	FBJ0501069	43	89	10
9.4	FBJ0501072	43	89	10
9.5	FBJ0501070	43	89	10
9.6	FBJ0501071	43	89	10
9.7	FBJ0501073	43	89	10
9.8	FBJ0501074	43	89	10
9.9	FBJ0501075	43	89	10
10	FBJ0501076	43	89	10
10.1	FBJ0501077	51	101	12
10.2	FBJ0501078	51	101	12
10.3	FBJ0501079	51	101	12
10.4	FBJ0501080	51	101	12
10.5	FBJ0501081	51	101	12
10.6	FBJ0501082	51	101	12
10.7	FBJ0501083	51	101	12
10.8	FBJ0501084	51	101	12
10.9	FBJ0501085	51	101	12
11	FBJ0501086	51	101	12

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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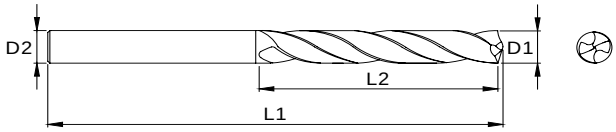
3X Solid carbide 3x high performance drill

Carbide | STUB | 3X | 142° | 30° | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
11.1	FBJ0501087	51	101	12
11.2	FBJ0501088	51	101	12
11.3	FBJ0501089	51	101	12
11.4	FBJ0501090	51	101	12
11.5	FBJ0501091	51	101	12
11.6	FBJ0501092	51	101	12
11.7	FBJ0501093	51	101	12
11.8	FBJ0501094	51	101	12
11.9	FBJ0501095	51	101	12
12	FBJ0501096	51	101	12
12.1	FBJ0501097	54	107	14
12.5	FBJ0501098	54	107	14
12.8	FBJ0501099	54	107	14
12.83	FBJ0501100	54	107	14
12.9	FBJ0501101	54	107	14
13	FBJ0501102	54	107	14
13.5	FBJ0501103	54	107	14
13.7	FBJ0501104	54	107	14
14	FBJ0501105	54	107	14
14.5	FBJ0501106	60	117	16

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
14.7	FBJ0501107	60	117	16
15	FBJ0501108	60	117	16
15.3	FBJ0501109	60	117	16
15.5	FBJ0501110	60	117	16
15.7	FBJ0501111	60	117	16
16	FBJ0501112	60	117	16
16.08	FBJ0501113	63	122	18
16.3	FBJ0501114	63	122	18
16.5	FBJ0501115	63	122	18
17	FBJ0501116	63	122	18
17.5	FBJ0501117	63	122	18
18	FBJ0501118	63	122	18
18.5	FBJ0501119	70	133	20
19.16	FBJ0501120	70	133	20
19.25	FBJ0501121	70	133	20
19.3	FBJ0501122	70	133	20
19.5	FBJ0501123	70	133	20
20	FBJ0501124	70	133	20

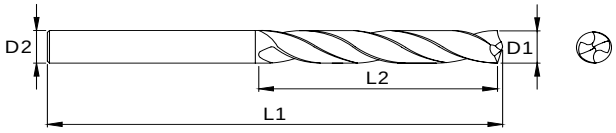
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

5X Solid carbide 5x high performance drill

Carbide | 5X | 142° | 30° | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0501125	24	63	3
3.1	FBJ0501126	32	69	4
3.2	FBJ0501127	32	69	4
3.3	FBJ0501128	32	69	4
3.4	FBJ0501129	32	69	4
3.5	FBJ0501130	32	69	4
3.6	FBJ0501131	32	69	4
3.7	FBJ0501132	32	69	4
3.8	FBJ0501133	32	69	4
3.9	FBJ0501134	32	69	4
4	FBJ0501135	32	69	4
4.1	FBJ0501136	38	80	5
4.2	FBJ0501137	38	80	5
4.3	FBJ0501138	38	80	5
4.4	FBJ0501139	38	80	5
4.5	FBJ0501140	38	80	5
4.6	FBJ0501141	38	80	5
4.7	FBJ0501142	38	80	5

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4.8	FBJ0501143	38	80	5
4.9	FBJ0501144	38	80	5
5	FBJ0501145	38	80	5
5.1	FBJ0501146	40	82	6
5.2	FBJ0501147	40	82	6
5.3	FBJ0501148	40	82	6
5.4	FBJ0501149	40	82	6
5.5	FBJ0501150	40	82	6
5.7	FBJ0501151	40	82	6
5.8	FBJ0501152	40	82	6
5.9	FBJ0501153	40	82	6
6	FBJ0501154	40	82	6
6.1	FBJ0501155	48	91	8
6.2	FBJ0501156	48	91	8
6.3	FBJ0501157	48	91	8
6.4	FBJ0501158	48	91	8
6.5	FBJ0501159	48	91	8
6.6	FBJ0501160	48	91	8

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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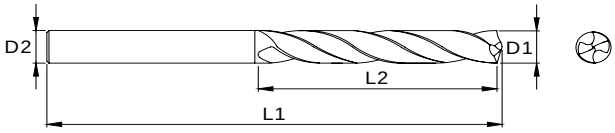
5X Solid carbide 5x high performance drill

Carbide | 5X | 142° | 30° | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6.7	FBJ0501161	48	91	8
6.8	FBJ0501162	48	91	8
6.9	FBJ0501163	48	91	8
7	FBJ0501164	48	91	8
7.1	FBJ0501165	48	91	8
7.2	FBJ0501166	48	91	8
7.3	FBJ0501167	48	91	8
7.4	FBJ0501168	48	91	8
7.5	FBJ0501169	48	91	8
7.6	FBJ0501170	48	91	8
7.7	FBJ0501171	48	91	8
7.8	FBJ0501172	48	91	8
7.9	FBJ0501173	48	91	8
8	FBJ0501174	48	91	8
8.1	FBJ0501175	55	103	10
8.2	FBJ0501176	55	103	10
8.3	FBJ0501177	55	103	10
8.4	FBJ0501178	55	103	10

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
8.5	FBJ0501179	55	103	10
8.6	FBJ0501180	55	103	10
8.7	FBJ0501181	55	103	10
8.8	FBJ0501182	55	103	10
8.9	FBJ0501183	55	103	10
9	FBJ0501184	55	103	10
9.1	FBJ0501185	55	103	10
9.2	FBJ0501186	55	103	10
9.25	FBJ0501187	55	103	10
9.3	FBJ0501188	55	103	10
9.4	FBJ0501189	55	103	10
9.5	FBJ0501190	55	103	10
9.6	FBJ0501191	55	103	10
9.7	FBJ0501192	55	103	10
9.8	FBJ0501193	55	103	10
9.9	FBJ0501194	55	103	10
10	FBJ0501195	55	103	10
10.1	FBJ0501196	60	120	12

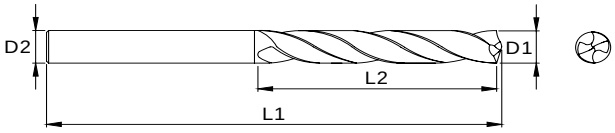
Tensile strength: N/mm² I Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

5X Solid carbide 5x high performance drill

Carbide | 5X | 142° | 30° | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
10.2	FBJ0501197	60	120	12
10.3	FBJ0501198	60	120	12
10.4	FBJ0501199	60	120	12
10.5	FBJ0501200	60	120	12
10.6	FBJ0501201	60	120	12
10.7	FBJ0501202	60	120	12
10.8	FBJ0501203	60	120	12
10.9	FBJ0501204	60	120	12
11	FBJ0501205	60	120	12
11.1	FBJ0501206	66	120	12
11.2	FBJ0501207	66	120	12
11.3	FBJ0501208	66	120	12
11.4	FBJ0501209	66	120	12
11.5	FBJ0501210	66	120	12
11.6	FBJ0501211	66	120	12
11.7	FBJ0501212	66	120	12
11.8	FBJ0501213	66	120	12
11.9	FBJ0501214	66	120	12

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
12	FBJ0501215	66	120	12
12.1	FBJ0501216	72	126	14
12.5	FBJ0501217	72	126	14
12.8	FBJ0501218	72	126	14
12.83	FBJ0501219	72	126	14
12.9	FBJ0501220	72	126	14
13	FBJ0501221	72	126	14
13.5	FBJ0501222	77	134	14
13.7	FBJ0501223	77	134	14
14	FBJ0501224	77	134	14
14.5	FBJ0501225	80	140	16
14.7	FBJ0501226	80	140	16
15	FBJ0501227	80	140	16
15.3	FBJ0501228	82	146	16
15.5	FBJ0501229	82	146	16
15.7	FBJ0501230	82	146	16
16	FBJ0501231	82	146	16

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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FEED RATE CHART

Series 2TDSS/2TDSR METRIC

Workpiece Material Group		Material	SMM	Tool Diameter					
				3	6	10	12	16	20
				mm/rev					
Steels	P	Low Carbon Steels 1018/12L14	105-125	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	85-105						
		Alloy Steels (36-45 Rc) 4140/A2/D2	50-65	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	125-150	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	95-115						
Austenitic	M	304/316	40-60	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH	30-50	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
		13-8 PH							
Special Alloys	S	Titanium	45	0.025	0.064	0.102	0.127	0.152	0.191
		6AL-4V							
		Cobalt-Based Alloys	15						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	25						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	30						
		Monel							

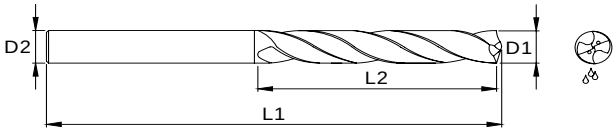
#RPM = SMM x 318.057/Tool Dia. #mm/min = RPM x mm/rev

Series 2TDSS/2TDSR INCH

Workpiece Material Group		Material	SFM	Tool Diameter					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	345-405	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	280-350						
		Alloy Steels (36-45 Rc) 4140/A2/D2	170-210	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	315-375	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18							
Austenitic	M	304/316	125-190	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH	95-155	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
		13-8 PH							
Special Alloys	S	Titanium	150	0.001	0.0025	0.004	0.005	0.006	0.0075
		6AL-4V							
		Cobalt-Based Alloys	40						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	80						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	100						
		Monel							

3X Solid carbide 3x high performance drill with coolant feed

Carbide | STUB | 3X | 142° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
3	FBJ0502493	16	57	3
3.1	FBJ0502494	22	63	4
3.2	FBJ0502495	22	63	4
3.3	FBJ0502496	22	63	4
3.4	FBJ0502497	22	63	4
3.5	FBJ0502498	22	63	4
3.6	FBJ0502499	22	63	4
3.7	FBJ0502500	22	63	4
3.8	FBJ0502501	22	63	4
3.9	FBJ0502502	22	63	4
4	FBJ0502503	22	63	4
4.1	FBJ0502504	26	65	5
4.2	FBJ0502505	26	65	5
4.3	FBJ0502506	26	65	5
4.4	FBJ0502507	26	65	5
4.5	FBJ0502508	26	65	5
4.6	FBJ0502509	26	65	5
4.7	FBJ0502510	26	65	5
4.8	FBJ0502511	26	65	5
4.9	FBJ0502512	26	65	5

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
5	FBJ0502513	26	65	5
5.1	FBJ0502514	26	65	6
5.2	FBJ0502515	26	65	6
5.3	FBJ0502516	26	65	6
5.4	FBJ0502517	26	65	6
5.5	FBJ0502518	26	65	6
5.6	FBJ0502519	26	65	6
5.7	FBJ0502520	26	65	6
5.8	FBJ0502521	26	65	6
5.9	FBJ0502522	26	65	6
6	FBJ0502523	26	65	6
6.1	FBJ0502524	35	80	8
6.2	FBJ0502525	35	80	8
6.3	FBJ0502526	35	80	8
6.4	FBJ0502527	35	80	8
6.5	FBJ0502528	35	80	8
6.6	FBJ0502529	35	80	8
6.7	FBJ0502530	35	80	8
6.8	FBJ0502531	35	80	8
6.9	FBJ0502532	35	80	8

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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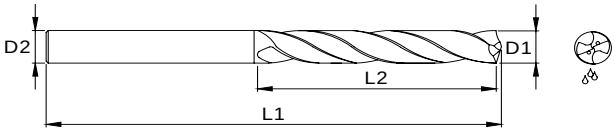
3X Solid carbide 3x high performance drill with coolant feed

Carbide | STUB | 3X | 142° | 30° | TiAlN

P0-P6
K1-K3
M1-M3
N1-N7



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
7	FBJ0502533	35	80	8
7.1	FBJ0502534	38	80	8
7.2	FBJ0502535	38	80	8
7.3	FBJ0502536	38	80	8
7.4	FBJ0502537	38	80	8
7.5	FBJ0502538	38	80	8
7.6	FBJ0502539	38	80	8
7.8	FBJ0502540	38	80	8
7.9	FBJ0502541	38	80	8
8	FBJ0502542	38	80	8
8.1	FBJ0502543	41	82	10
8.2	FBJ0502544	41	82	10
8.3	FBJ0502545	41	82	10
8.4	FBJ0502546	41	82	10
8.5	FBJ0502547	41	82	10
8.6	FBJ0502548	41	82	10
8.7	FBJ0502549	41	82	10
8.8	FBJ0502550	41	82	10
8.9	FBJ0502551	41	82	10

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
9	FBJ0502552	41	82	10
9.1	FBJ0502553	41	82	10
9.2	FBJ0502554	41	82	10
9.3	FBJ0502555	41	82	10
9.4	FBJ0502556	41	82	10
9.5	FBJ0502557	41	82	10
9.6	FBJ0502558	41	82	10
9.7	FBJ0502559	41	82	10
9.8	FBJ0502560	41	82	10
9.9	FBJ0502561	41	82	10
10	FBJ0502562	41	82	10
10.1	FBJ0502563	55	102	12
10.2	FBJ0502564	55	102	12
10.3	FBJ0502565	55	102	12
10.4	FBJ0502566	55	102	12
10.5	FBJ0502567	55	102	12
10.6	FBJ0502568	55	102	12
10.7	FBJ0502569	55	102	12
10.8	FBJ0502570	55	102	12

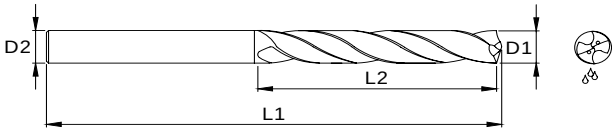
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

3X Solid carbide 3x high performance drill with coolant feed

Carbide | STUB | 3X | 142° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
10.9	FBJ0502571	55	102	12
11	FBJ0502572	55	102	12
11.1	FBJ0502573	55	102	12
11.2	FBJ0502574	55	102	12
11.3	FBJ0502575	55	102	12
11.4	FBJ0502576	55	102	12
11.5	FBJ0502577	55	102	12
11.6	FBJ0502578	55	102	12
11.7	FBJ0502579	55	102	12
11.8	FBJ0502580	55	102	12
11.9	FBJ0502581	55	102	12
12	FBJ0502582	55	102	12
12.1	FBJ0502583	60	107	14
12.5	FBJ0502584	60	107	14
12.8	FBJ0502585	60	107	14
12.9	FBJ0502587	60	107	14
13	FBJ0502588	60	107	14
13.5	FBJ0502589	60	107	14
13.7	FBJ0502590	60	107	14

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
14	FBJ0502591	60	107	14
14.5	FBJ0502592	60	110	16
14.7	FBJ0502593	60	110	16
15	FBJ0502594	60	110	16
15.3	FBJ0502595	60	110	16
15.5	FBJ0502596	60	110	16
15.7	FBJ0502597	60	110	16
16	FBJ0502598	60	110	16
16.3	FBJ0502599	73	122	18
16.5	FBJ0502600	73	122	18
17	FBJ0502601	73	122	18
17.5	FBJ0502602	73	122	18
18	FBJ0502603	73	122	18
18.5	FBJ0502604	80	133	20
19.1	FBJ0502605	80	133	20
19.3	FBJ0502607	80	133	20
19.5	FBJ0502608	80	133	20
20	FBJ0502609	80	133	20

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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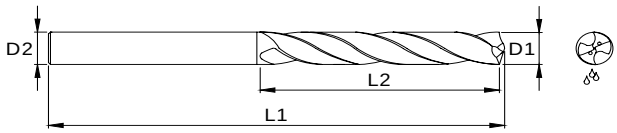
5X Solid carbide 5x high performance drill with coolant feed

Carbide | REG | 5X | 142° | 30° | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0501232	24	75	3
3.1	FBJ0501233	32	80	4
3.2	FBJ0501234	32	80	4
3.3	FBJ0501235	32	80	4
3.4	FBJ0501236	32	80	4
3.5	FBJ0501237	32	80	4
3.6	FBJ0501238	32	80	4
3.7	FBJ0501239	32	80	4
3.8	FBJ0501240	32	80	4
3.9	FBJ0501241	32	80	4
4	FBJ0501242	32	80	4
4.1	FBJ0501243	38	82	5
4.2	FBJ0501244	38	82	5
4.3	FBJ0501245	38	82	5
4.4	FBJ0501246	38	82	5
4.5	FBJ0501247	38	82	5
4.6	FBJ0501248	38	82	5
4.7	FBJ0501249	38	82	5
4.8	FBJ0501250	38	82	5
4.9	FBJ0501251	38	82	5

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
5	FBJ0501252	38	82	5
5.1	FBJ0501253	40	82	6
5.2	FBJ0501254	40	82	6
5.3	FBJ0501255	40	82	6
5.4	FBJ0501256	40	82	6
5.5	FBJ0501257	40	82	6
5.7	FBJ0501258	40	82	6
5.8	FBJ0501259	40	82	6
5.9	FBJ0501260	40	82	6
6	FBJ0501261	40	82	6
6.1	FBJ0501262	48	91	8
6.2	FBJ0501263	48	91	8
6.3	FBJ0501264	48	91	8
6.4	FBJ0501265	48	91	8
6.5	FBJ0501266	48	91	8
6.6	FBJ0501267	48	91	8
6.7	FBJ0501268	48	91	8
6.8	FBJ0501269	48	91	8
6.9	FBJ0501270	48	91	8
7	FBJ0501271	48	91	8

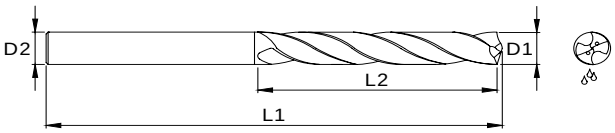
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

5X Solid carbide 5x high performance drill with coolant feed

Carbide | REG | 5X | 142° | 30° | TiAlN



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

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
7.1	FBJ0501272	48	91	8
7.14	FBJ0501273	48	91	8
7.2	FBJ0501274	48	91	8
7.3	FBJ0501275	48	91	8
7.4	FBJ0501276	48	91	8
7.5	FBJ0501277	48	91	8
7.6	FBJ0501278	48	91	8
7.7	FBJ0501279	48	91	8
7.8	FBJ0501280	48	91	8
7.9	FBJ0501281	48	91	8
8	FBJ0501282	48	91	8
8.1	FBJ0501283	55	103	10
8.2	FBJ0501284	55	103	10
8.3	FBJ0501285	55	103	10
8.4	FBJ0501286	55	103	10
8.5	FBJ0501287	55	103	10
8.6	FBJ0501288	55	103	10
8.7	FBJ0501289	55	103	10
8.8	FBJ0501290	55	103	10
8.9	FBJ0501291	55	103	10

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
9	FBJ0501292	55	103	10
9.1	FBJ0501293	55	103	10
9.2	FBJ0501294	55	103	10
9.25	FBJ0501295	55	103	10
9.3	FBJ0501296	55	103	10
9.4	FBJ0501297	55	103	10
9.5	FBJ0501298	55	103	10
9.6	FBJ0501299	55	103	10
9.7	FBJ0501300	55	103	10
9.8	FBJ0501301	55	103	10
9.9	FBJ0501302	55	103	10
10	FBJ0501303	55	103	10
10.1	FBJ0501304	60	120	12
10.2	FBJ0501305	60	120	12
10.3	FBJ0501306	60	120	12
10.4	FBJ0501307	60	120	12
10.5	FBJ0501308	60	120	12
10.6	FBJ0501309	60	120	12
10.7	FBJ0501310	60	120	12
10.8	FBJ0501311	60	120	12

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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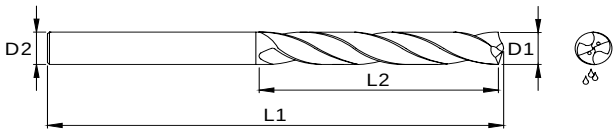
5X Solid carbide 5x high performance drill with coolant feed

Carbide | REG | 5X | 142° | 30° | TiAlN

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



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
10.9	FBJ0501312	60	120	12
11	FBJ0501313	60	120	12
11.1	FBJ0501314	66	120	12
11.2	FBJ0501315	66	120	12
11.3	FBJ0501316	66	120	12
11.4	FBJ0501317	66	120	12
11.5	FBJ0501318	66	120	12
11.6	FBJ0501319	66	120	12
11.7	FBJ0501320	66	120	12
11.8	FBJ0501321	66	120	12
11.9	FBJ0501322	66	120	12
12	FBJ0501323	66	120	12
12.1	FBJ0501324	72	126	14
12.5	FBJ0501325	72	126	14
12.8	FBJ0501326	72	126	14
12.83	FBJ0501327	72	126	14
12.9	FBJ0501328	72	126	14
13	FBJ0501329	72	126	14
13.5	FBJ0501330	77	134	14
13.7	FBJ0501331	77	134	14

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
14	FBJ0501332	77	134	14
14.5	FBJ0501333	80	146	16
14.7	FBJ0501334	80	146	16
15	FBJ0501335	80	146	16
15.3	FBJ0501336	82	146	16
15.5	FBJ0501337	82	146	16
15.7	FBJ0501338	82	146	16
16	FBJ0501339	82	146	16
16.08	FBJ0501340	90	158	18
16.3	FBJ0501341	90	158	18
16.5	FBJ0501342	90	158	18
17	FBJ0501343	90	158	18
17.5	FBJ0501344	95	158	18
18	FBJ0501345	95	158	18
18.5	FBJ0501346	100	160	20
19.16	FBJ0501347	100	160	20
19.25	FBJ0501348	100	160	20
19.3	FBJ0501349	100	160	20
19.5	FBJ0501350	100	160	20
20	FBJ0501351	100	160	20

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

FEED RATE CHART

Series 2TDCS/2TDCR METRIC

Workpiece Material Group		Material	SMM	Tool Diameter					
				3	6	10	12	16	20
				mm/rev					
Steels	P	Low Carbon Steels 1018/12L14	150-190	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	95-130						
		Alloy Steels (36-45 Rc) 4140/A2/D2	60-75	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	150-190	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	106-129						
Austenitic	M	304/316	65-95	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH	45-65	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
		13-8 PH							
Special Alloys	S	Titanium	55	0.025	0.064	0.102	0.127	0.152	0.191
		6AL-4V							
		Cobalt-Based Alloys	15						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	30						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	35						
		Monel							

#RPM = SMM x 318.057/Tool Dia. #mm/min = RPM x mm/rev

Series 2TDCS/2TDCR INCH

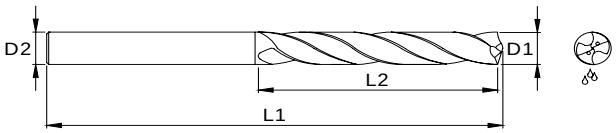
Workpiece Material Group		Material	SFM	Tool Diameter					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	500-625	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	315-435						
		Alloy Steels (36-45 Rc) 4140/A2/D2	190-250	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	500-625	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18	350-425						
Austenitic	M	304/316	220-315	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH	155-220	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
		13-8 PH							
Special Alloys	S	Titanium	180	0.001	0.0025	0.004	0.005	0.006	0.0075
		6AL-4V							
		Cobalt-Based Alloys	50						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	95						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	120						
		Monel							

#RPM = SFM x 3.82/Tool Dia. #IPM = RPM x IPR

7X Solid carbide 7x high performance drill with coolant feed

Carbide | LONG | 7X | 142° | 30° | TiAlN

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



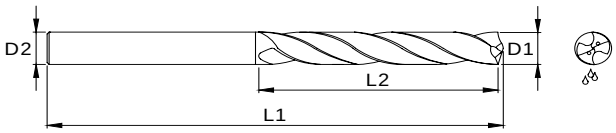
Unit : mm

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

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

7X Solid carbide 7x high performance drill with coolant feed

Carbide | LONG | 7X | 142° | 30° | TiAlN



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

Unit : mm

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

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

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FEED RATE CHART

Series 2TDCL METRIC

Workpiece Material Group		Material	SMM	Tool Diameter (mm)					
				3	6	10	12	16	19
				mm/rev					
Steels	P	Low Carbon Steels 1018/12L14	160-180	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	85-115						
		Alloy Steels (36-45 Rc) 4140/A2/D2	50-70	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	160-180	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
		Ductile Cast Iron 60-40-18	106-129						
Austenitic	M	304/316	55-85	.102-.152	.152-.229	.229-.279	.254-.330	.279-.381	.305-.432
Precipitation Hardened Stainless Steels	M	17-4 PH	40-60	.051-.076	.102-.152	.127-.229	.152-.254	.229-.305	.254-.356
		13-8 PH							
Special Alloys	S	Titanium	55	0.025	0.064	0.102	0.127	0.152	0.191
		6AL-4V							
		Cobalt-Based Alloys	15						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	30						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	35						
		Monel							

#RPM = SMM x 318.057/Tool Dia. #mm/min = RPM x mm/rev

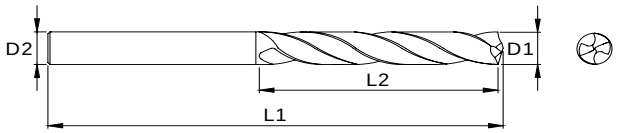
Series 2TDCL INCH

Workpiece Material Group		Material	SFM	Tool Diameter (inch)					
				1/8	1/4	3/8	1/2	5/8	3/4
				IPR					
Steels	P	Low Carbon Steels 1018/12L14	530-595	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	280-375						
		Alloy Steels (36-45 Rc) 4140/A2/D2	170-225	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	530-590	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
		Ductile Cast Iron 60-40-18	350-425						
Austenitic	M	304/316	185-280	.0038-.0063	.0063-.0088	.0088-.0110	.0100-.0125	.0110-.0150	.0120-.0170
Precipitation Hardened Stainless Steels	M	17-4 PH	125-190	.0019-.0031	.0038-.0063	.0050-.0088	.0063-.0100	.0088-.0120	.0100-.0140
		13-8 PH							
Special Alloys	S	Titanium	180	0.001	0.0025	0.004	0.005	0.006	0.0075
		6AL-4V							
		Cobalt-Based Alloys	50						
		Stellite, Haynes 25/188							
		Nickel-Based Alloys	95						
		Inconel 625/718							
		Iron-Based Alloys							
		Incoloy 800-802/Multimet							
		High Nickel Alloys	120						
		Monel							

#RPM = SFM x 3.82/Tool Dia. #IPM = RPM x IPR

5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | BF



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0500001	33	61	3
3.1	FBJ0500003	36	65	3.1
3.2	FBJ0500005	36	65	3.2
3.3	FBJ0500007	36	65	3.3
3.4	FBJ0500009	39	70	3.4
3.5	FBJ0500011	39	70	3.5
3.6	FBJ0500013	39	70	3.6
3.7	FBJ0500015	39	70	3.7
3.8	FBJ0500017	43	75	3.8
3.9	FBJ0500019	43	75	3.9
4	FBJ0500021	43	75	4
4.1	FBJ0500023	43	75	4.1
4.2	FBJ0500025	43	75	4.2
4.3	FBJ0500027	47	80	4.3
4.4	FBJ0500029	47	80	4.4
4.5	FBJ0500031	47	80	4.5
4.6	FBJ0500033	47	80	4.6
4.7	FBJ0500035	47	80	4.7

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4.8	FBJ0500037	52	86	4.8
4.9	FBJ0500039	52	86	4.9
5	FBJ0500041	52	86	5
5.1	FBJ0500043	52	86	5.1
5.2	FBJ0500045	52	86	5.2
5.3	FBJ0500047	52	86	5.3
5.4	FBJ0500049	57	93	5.4
5.5	FBJ0500051	57	93	5.5
5.6	FBJ0500053	57	93	5.6
5.7	FBJ0500055	57	93	5.7
5.8	FBJ0500057	57	93	5.8
5.9	FBJ0500059	57	93	5.9
6	FBJ0500061	57	93	6
6.1	FBJ0500063	63	101	6.1
6.2	FBJ0500065	63	101	6.2
6.3	FBJ0500067	63	101	6.3
6.4	FBJ0500069	63	101	6.4

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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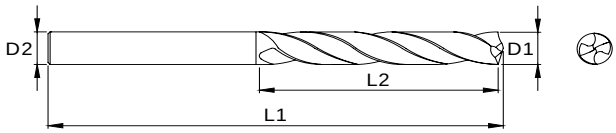
5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | BF

P0-P6
K1-K3
M1-M3
N1-N7



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6.5	FBJ0500071	63	101	6.5
6.6	FBJ0500073	63	101	6.6
6.7	FBJ0500075	63	101	6.7
6.8	FBJ0500077	69	109	6.8
6.9	FBJ0500079	69	109	6.9
7	FBJ0500081	69	109	7
7.1	FBJ0500083	69	109	7.1
7.2	FBJ0500085	69	109	7.2
7.3	FBJ0500087	69	109	7.3
7.4	FBJ0500089	69	109	7.4
7.5	FBJ0500091	69	109	7.5
7.6	FBJ0500093	75	117	7.6
7.7	FBJ0500095	75	117	7.7
7.8	FBJ0500097	75	117	7.8
7.9	FBJ0500099	75	117	7.9
8	FBJ0500101	75	117	8
8.1	FBJ0500103	75	117	8.1

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
8.2	FBJ0500105	75	117	8.2
8.3	FBJ0500107	75	117	8.3
8.4	FBJ0500109	75	117	8.4
8.5	FBJ0500111	75	117	8.5
8.6	FBJ0500113	81	125	8.6
8.7	FBJ0500115	81	125	8.7
8.8	FBJ0500117	81	125	8.8
8.9	FBJ0500119	81	125	8.9
9	FBJ0500121	81	125	9
9.1	FBJ0500123	81	125	9.1
9.2	FBJ0500125	81	125	9.2
9.3	FBJ0500127	81	125	9.3
9.4	FBJ0500129	81	125	9.4
9.5	FBJ0500131	81	125	9.5
9.6	FBJ0500133	87	133	9.6
9.7	FBJ0500135	87	133	9.7
9.8	FBJ0500137	87	133	9.8
9.9	FBJ0500139	87	133	9.9

Tensile strength: N/mm² | Hardness: HRC

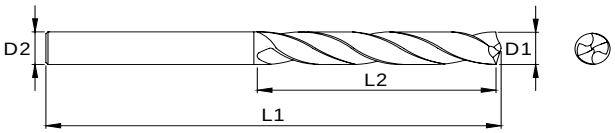
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

DRILLS

5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | BF



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
10	FBJ0500141	87	133	10
10.1	FBJ0500143	87	133	10.1
10.2	FBJ0500145	87	133	10.2
10.3	FBJ0500147	87	133	10.3
10.4	FBJ0500149	87	133	10.4
10.5	FBJ0500151	87	133	10.5
10.6	FBJ0500153	87	133	10.6
10.7	FBJ0500155	94	142	10.7
10.8	FBJ0500157	94	142	10.8
10.9	FBJ0500159	94	142	10.9
11	FBJ0500161	94	142	11
11.1	FBJ0500163	94	142	11.1
11.2	FBJ0500165	94	142	11.2
11.3	FBJ0500167	94	142	11.3
11.4	FBJ0500169	94	142	11.4
11.5	FBJ0500171	94	142	11.5
11.6	FBJ0500173	94	142	11.6
11.7	FBJ0500175	94	142	11.7
11.8	FBJ0500177	94	142	11.8

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
11.9	FBJ0500179	101	151	11.9
12	FBJ0500181	101	151	12
12.5	FBJ0500183	101	151	12.5
13	FBJ0500185	101	151	13
13.5	FBJ0500187	108	160	13.5
14	FBJ0500189	108	160	14
14.5	FBJ0500191	114	169	14.5
15	FBJ0500193	114	169	15
15.5	FBJ0500195	120	178	15.5
16	FBJ0500197	120	178	16
16.5	FBJ0500199	125	184	16.5
17	FBJ0500201	125	184	17
17.5	FBJ0500203	130	191	17.5
18	FBJ0500205	130	191	18
18.5	FBJ0500207	135	198	18.5
19	FBJ0500209	135	198	19
20	FBJ0500211	140	205	20

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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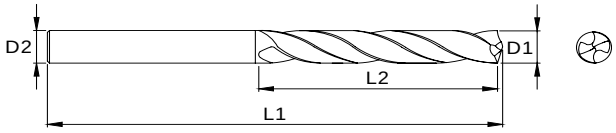
5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

DRILLS

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0500002	33	61	3
3.1	FBJ0500004	36	65	3.1
3.2	FBJ0500006	36	65	3.2
3.3	FBJ0500008	36	65	3.3
3.4	FBJ0500010	39	70	3.4
3.5	FBJ0500012	39	70	3.5
3.6	FBJ0500014	39	70	3.6
3.7	FBJ0500016	39	70	3.7
3.8	FBJ0500018	43	75	3.8
3.9	FBJ0500020	43	75	3.9
4	FBJ0500022	43	75	4
4.1	FBJ0500024	43	75	4.1
4.2	FBJ0500026	43	75	4.2
4.3	FBJ0500028	47	80	4.3
4.4	FBJ0500030	47	80	4.4
4.5	FBJ0500032	47	80	4.5
4.6	FBJ0500034	47	80	4.6

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4.7	FBJ0500036	47	80	4.7
4.8	FBJ0500038	52	86	4.8
4.9	FBJ0500040	52	86	4.9
5	FBJ0500042	52	86	5
5.1	FBJ0500044	52	86	5.1
5.2	FBJ0500046	52	86	5.2
5.3	FBJ0500048	52	86	5.3
5.4	FBJ0500050	57	93	5.4
5.5	FBJ0500052	57	93	5.5
5.6	FBJ0500054	57	93	5.6
5.7	FBJ0500056	57	93	5.7
5.8	FBJ0500058	57	93	5.8
5.9	FBJ0500060	57	93	5.9
6	FBJ0500062	57	93	6
6.1	FBJ0500064	63	101	6.1
6.2	FBJ0500066	63	101	6.2
6.3	FBJ0500068	63	101	6.3

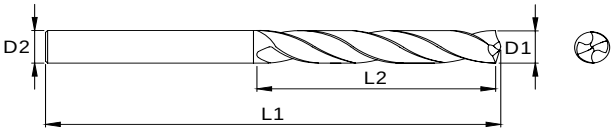
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6.4	FBJ0500070	63	101	6.4
6.5	FBJ0500072	63	101	6.5
6.6	FBJ0500074	63	101	6.6
6.7	FBJ0500076	63	101	6.7
6.8	FBJ0500078	69	109	6.8
6.9	FBJ0500080	69	109	6.9
7	FBJ0500082	69	109	7
7.1	FBJ0500084	69	109	7.1
7.2	FBJ0500086	69	109	7.2
7.3	FBJ0500088	69	109	7.3
7.4	FBJ0500090	69	109	7.4
7.5	FBJ0500092	69	109	7.5
7.6	FBJ0500094	75	117	7.6
7.7	FBJ0500096	75	117	7.7
7.8	FBJ0500098	75	117	7.8
7.9	FBJ0500100	75	117	7.9
8	FBJ0500102	75	117	8
8.1	FBJ0500104	75	117	8.1
8.2	FBJ0500106	75	117	8.2

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
8.3	FBJ0500108	75	117	8.3
8.4	FBJ0500110	75	117	8.4
8.5	FBJ0500112	75	117	8.5
8.6	FBJ0500114	81	125	8.6
8.7	FBJ0500116	81	125	8.7
8.8	FBJ0500118	81	125	8.8
8.9	FBJ0500120	81	125	8.9
9	FBJ0500122	81	125	9
9.1	FBJ0500124	81	125	9.1
9.2	FBJ0500126	81	125	9.2
9.3	FBJ0500128	81	125	9.3
9.4	FBJ0500130	81	125	9.4
9.5	FBJ0500132	81	125	9.5
9.6	FBJ0500134	87	133	9.6
9.7	FBJ0500136	87	133	9.7
9.8	FBJ0500138	87	133	9.8
9.9	FBJ0500140	87	133	9.9
10	FBJ0500142	87	133	10
10.1	FBJ0500144	87	133	10.1

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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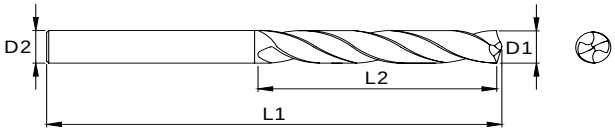
5X Solid carbide jobber drill

Carbide | REG | 5X | 118° | 30° | TiAlN

P0-P6
K1-K3
M1-M3
N1-N7



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
10.2	FBJ0500146	87	133	10.2
10.3	FBJ0500148	87	133	10.3
10.4	FBJ0500150	87	133	10.4
10.5	FBJ0500152	87	133	10.5
10.6	FBJ0500154	87	142	10.6
10.7	FBJ0500156	94	142	10.7
10.8	FBJ0500158	94	142	10.8
10.9	FBJ0500160	94	142	10.9
11	FBJ0500162	94	142	11
11.1	FBJ0500164	94	142	11.1
11.2	FBJ0500166	94	142	11.2
11.3	FBJ0500168	94	142	11.3
11.4	FBJ0500170	94	142	11.4
11.5	FBJ0500172	94	142	11.5
11.6	FBJ0500174	94	142	11.6
11.7	FBJ0500176	94	142	11.7
11.8	FBJ0500178	94	142	11.8
11.9	FBJ0500180	101	151	11.9
12	FBJ0500182	101	151	12

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
12.5	FBJ0500184	101	151	12.5
13	FBJ0500186	101	151	13
13.5	FBJ0500188	108	160	13.5
14	FBJ0500190	108	160	14
14.5	FBJ0500192	114	169	14.5
15	FBJ0500194	114	169	15
15.5	FBJ0500196	120	178	15.5
16	FBJ0500198	120	178	16
16.5	FBJ0500200	125	184	16.5
17	FBJ0500202	125	184	17
17.5	FBJ0500204	130	191	17.5
18	FBJ0500206	130	191	18
18.5	FBJ0500208	135	198	18.5
19	FBJ0500210	135	198	19
20	FBJ0500212	140	205	20

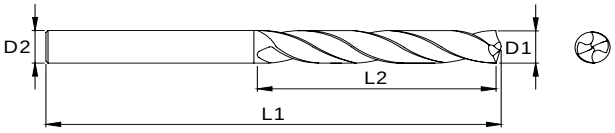
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | BF



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0500213	16	46	3
3.1	FBJ0500215	18	49	3.1
3.2	FBJ0500217	18	49	3.2
3.3	FBJ0500219	18	49	3.3
3.4	FBJ0500221	20	52	3.4
3.5	FBJ0500223	20	52	3.5
3.6	FBJ0500225	20	52	3.6
3.7	FBJ0500227	20	52	3.7
3.8	FBJ0500229	22	55	3.8
3.9	FBJ0500231	22	55	3.9
4	FBJ0500233	22	55	4
4.1	FBJ0500235	22	55	4.1
4.2	FBJ0500237	22	55	4.2
4.3	FBJ0500239	24	58	4.3
4.4	FBJ0500241	24	58	4.4
4.5	FBJ0500243	24	58	4.5
4.7	FBJ0500247	24	58	4.7
4.8	FBJ0500249	26	62	4.8

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4.9	FBJ0500251	26	62	4.9
5	FBJ0500253	26	62	5
5.1	FBJ0500255	26	62	5.1
5.2	FBJ0500257	26	62	5.2
5.3	FBJ0500259	26	62	5.3
5.4	FBJ0500261	28	66	5.4
5.5	FBJ0500263	28	66	5.5
5.6	FBJ0500265	28	66	5.6
5.7	FBJ0500267	28	66	5.7
5.8	FBJ0500269	28	66	5.8
5.9	FBJ0500271	28	66	5.9
6	FBJ0500273	28	66	6
6.1	FBJ0500275	31	70	6.1
6.2	FBJ0500277	31	70	6.2
6.3	FBJ0500279	31	70	6.3
6.4	FBJ0500281	31	70	6.4
6.5	FBJ0500283	31	70	6.5
6.6	FBJ0500285	31	70	6.6

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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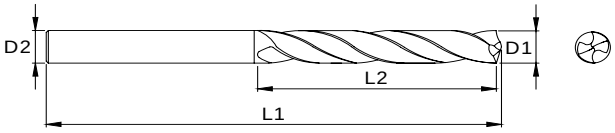
3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | BF

P0-P6
K1-K3
M1-M3
N1-N7



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
6.7	FBJ0500287	31	70	6.7
6.8	FBJ0500289	34	74	6.8
6.9	FBJ0500291	34	74	6.9
7	FBJ0500293	34	74	7
7.1	FBJ0500295	34	74	7.1
7.2	FBJ0500297	34	74	7.2
7.3	FBJ0500299	34	74	7.3
7.4	FBJ0500301	34	74	7.4
7.5	FBJ0500303	34	74	7.5
7.6	FBJ0500305	37	79	7.6
7.7	FBJ0500307	37	79	7.7
7.8	FBJ0500309	37	79	7.8
7.9	FBJ0500311	37	79	7.9
8	FBJ0500313	37	79	8
8.1	FBJ0500315	37	79	8.1
8.2	FBJ0500317	37	79	8.2
8.3	FBJ0500319	37	79	8.3
8.4	FBJ0500321	37	79	8.4

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
8.5	FBJ0500323	37	79	8.5
8.6	FBJ0500325	40	84	8.6
8.7	FBJ0500327	40	84	8.7
8.8	FBJ0500329	40	84	8.8
8.9	FBJ0500331	40	84	8.9
9	FBJ0500333	40	84	9
9.1	FBJ0500335	40	84	9.1
9.2	FBJ0500337	40	84	9.2
9.3	FBJ0500339	40	84	9.3
9.4	FBJ0500341	40	84	9.4
9.5	FBJ0500343	40	84	9.5
9.6	FBJ0500345	43	89	9.6
9.7	FBJ0500347	43	89	9.7
9.8	FBJ0500349	43	89	9.8
9.9	FBJ0500351	43	89	9.9
10	FBJ0500353	43	89	10
10.1	FBJ0500355	43	89	10.1

Tensile strength: N/mm² I Hardness: HRC

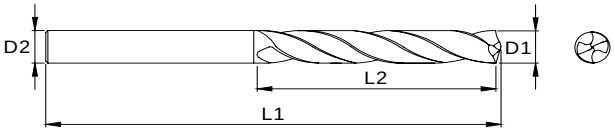
P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

DRILLS

3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | BF



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
10.2	FBJ0500357	43	89	10.2
10.3	FBJ0500359	43	89	10.3
10.4	FBJ0500361	43	89	10.4
10.5	FBJ0500363	43	89	10.5
10.6	FBJ0500365	43	89	10.6
10.7	FBJ0500367	47	95	10.7
10.8	FBJ0500369	47	95	10.8
10.9	FBJ0500371	47	95	10.9
11	FBJ0500373	47	95	11
11.1	FBJ0500375	47	95	11.1
11.2	FBJ0500377	47	95	11.2
11.3	FBJ0500379	47	95	11.3
11.4	FBJ0500381	47	95	11.4
11.5	FBJ0500383	47	95	11.5
11.6	FBJ0500385	47	95	11.6
11.7	FBJ0500387	47	95	11.7
11.8	FBJ0500389	47	95	11.8

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
11.9	FBJ0500391	51	102	11.9
12	FBJ0500393	51	102	12
12.5	FBJ0500395	51	102	12.5
13	FBJ0500397	51	102	13
13.5	FBJ0500399	54	107	13.5
14	FBJ0500401	54	107	14
14.5	FBJ0500403	56	111	14.5
15	FBJ0500405	56	111	15
15.5	FBJ0500407	58	115	15.5
16	FBJ0500409	58	115	16
16.5	FBJ0500411	60	119	16.5
17	FBJ0500413	60	119	17
17.5	FBJ0500415	62	123	17.5
18	FBJ0500417	62	123	18
18.5	FBJ0500419	64	127	18.5
19	FBJ0500421	64	127	19
20	FBJ0500423	66	131	20

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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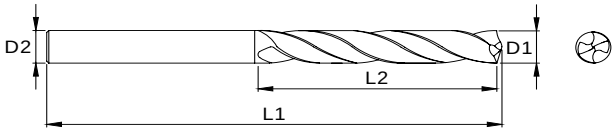
3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | TiAlN

P0-P6
K1-K3
M1-M3
N1-N7



Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
3	FBJ0500214	16	46	3
3.1	FBJ0500216	18	49	3.1
3.2	FBJ0500218	18	49	3.2
3.3	FBJ0500220	18	49	3.3
3.4	FBJ0500222	20	52	3.4
3.5	FBJ0500224	20	52	3.5
3.6	FBJ0500226	20	52	3.6
3.7	FBJ0500228	20	52	3.7
3.8	FBJ0500230	22	55	3.8
3.9	FBJ0500232	22	55	3.9
4	FBJ0500234	22	55	4
4.1	FBJ0500236	22	55	4.1
4.2	FBJ0500238	22	55	4.2
4.3	FBJ0500240	24	58	4.3
4.4	FBJ0500242	24	58	4.4
4.5	FBJ0500244	24	58	4.5
4.7	FBJ0500248	24	58	4.7
4.8	FBJ0500250	26	62	4.8

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter ØD2
4.9	FBJ0500252	26	62	4.9
5	FBJ0500254	26	62	5
5.1	FBJ0500256	26	62	5.1
5.2	FBJ0500258	26	62	5.2
5.3	FBJ0500260	26	62	5.3
5.4	FBJ0500262	28	66	5.4
5.5	FBJ0500264	28	66	5.5
5.6	FBJ0500266	28	66	5.6
5.7	FBJ0500268	28	66	5.7
5.8	FBJ0500270	28	66	5.8
5.9	FBJ0500272	28	66	5.9
6	FBJ0500274	28	66	6
6.1	FBJ0500276	31	70	6.1
6.2	FBJ0500278	31	70	6.2
6.3	FBJ0500280	31	70	6.3
6.4	FBJ0500282	31	70	6.4
6.5	FBJ0500284	31	70	6.5
6.6	FBJ0500286	31	70	6.6

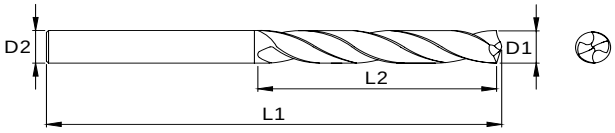
Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
6.7	FBJ0500288	31	70	6.7
6.8	FBJ0500290	34	74	6.8
6.9	FBJ0500292	34	74	6.9
7	FBJ0500294	34	74	7
7.1	FBJ0500296	34	74	7.1
7.2	FBJ0500298	34	74	7.2
7.3	FBJ0500300	34	74	7.3
7.4	FBJ0500302	34	74	7.4
7.5	FBJ0500304	34	74	7.5
7.6	FBJ0500306	37	79	7.6
7.7	FBJ0500308	37	79	7.7
7.8	FBJ0500310	37	79	7.8
7.9	FBJ0500312	37	79	7.9
8	FBJ0500314	37	79	8
8.1	FBJ0500316	37	79	8.1
8.2	FBJ0500318	37	79	8.2
8.3	FBJ0500320	37	79	8.3
8.4	FBJ0500322	37	79	8.4

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
8.5	FBJ0500324	37	79	8.5
8.6	FBJ0500326	40	84	8.6
8.7	FBJ0500328	40	84	8.7
8.8	FBJ0500330	40	84	8.8
8.9	FBJ0500332	40	84	8.9
9	FBJ0500334	40	84	9
9.1	FBJ0500336	40	84	9.1
9.2	FBJ0500338	40	84	9.2
9.3	FBJ0500340	40	84	9.3
9.4	FBJ0500342	40	84	9.4
9.5	FBJ0500344	43	89	9.5
9.6	FBJ0500346	43	89	9.6
9.7	FBJ0500348	43	89	9.7
9.8	FBJ0500350	43	89	9.8
9.9	FBJ0500352	43	89	9.9
10	FBJ0500354	43	89	10
10.1	FBJ0500356	43	89	10.1
10.2	FBJ0500358	43	89	10.2

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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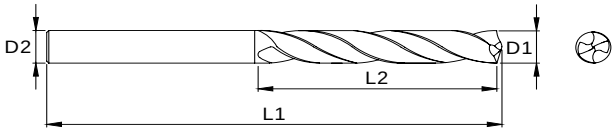
3X Solid carbide jobber drill

Carbide | STUB | 3X | 118° | 30° | TiAlN



P0-P6
K1-K3
M1-M3
N1-N7

DRILLS

Unit : mm

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
10.3	FBJ0500360	43	89	10.3
10.4	FBJ0500362	43	89	10.4
10.5	FBJ0500364	43	89	10.5
10.6	FBJ0500366	43	89	10.6
10.7	FBJ0500368	47	95	10.7
10.8	FBJ0500370	47	95	10.8
10.9	FBJ0500372	47	95	10.9
11	FBJ0500374	47	95	11
11.1	FBJ0500376	47	95	11.1
11.2	FBJ0500378	47	95	11.2
11.3	FBJ0500380	47	95	11.3
11.4	FBJ0500382	47	95	11.4
11.5	FBJ0500384	47	95	11.5
11.6	FBJ0500386	47	95	11.6
11.7	FBJ0500388	47	95	11.7
11.8	FBJ0500390	47	95	11.8
11.9	FBJ0500392	51	102	11.9
12	FBJ0500394	51	102	12

Diameter ØD1	EDP No	Flute Length L2	Overall Length L1	Shank Diameter D2
12.5	FBJ0500396	51	102	12.5
13	FBJ0500398	51	102	13
13.5	FBJ0500400	54	107	13.5
14	FBJ0500402	54	107	14
14.5	FBJ0500404	56	111	14.5
15	FBJ0500406	56	111	15
15.5	FBJ0500408	58	115	15.5
16	FBJ0500410	58	115	16
16.5	FBJ0500412	60	119	16.5
17	FBJ0500414	60	119	17
17.5	FBJ0500416	62	123	17.5
18	FBJ0500418	62	123	18
18.5	FBJ0500420	64	127	18.5
19	FBJ0500422	64	127	19
20	FBJ0500424	66	131	20

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

FEED RATE CHART

Series F224/F226 METRIC

Workpiece Material Group		Material	SMM		Tool Diameter (mm)					
			F224	F226	3	6	10	12	20	25
					IPR					
Steels	P	Low Carbon Steels 1018/12L14	55	55	0.127	0.152	0.2	0.254	0.305	0.356
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	50	50						
		Alloy Steels (36-45 Rc) 4140/A2/D2	45	45	0.127	0.152	0.2	0.254	0.305	0.356
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	40	40	0.127	0.152	0.2	0.254	0.305	0.356
		Ductile Cast Iron 60-40-18	55	55						
Austenitic	M	304/316	85	85	0.127	0.152	0.2	0.254	0.305	0.356
Precipitation Hardened Stainless Steels	M	17-4 PH	30	30	0.127	0.152	0.2	0.254	0.305	0.356
		13-8 PH								
Non Ferrous	N	Plastic	120	120	0.05	0.076	0.1	0.152	0.225	0.25
		Kevlar/Graphite	120	120	0.05	0.076	0.1	0.152	0.225	0.25

#RPM = SMM x 318.057/Tool Dia. #mm/min = RPM x mm/rev

Series F224/F226 INCH

Workpiece Material Group		Material	SFM		Tool Diameter (inch)					
			F224	F226	1/8	1/4	3/8	1/2	3/4	1
					IPR					
Steels	P	Low Carbon Steels 1018/12L14	175	175	0.004	0.006	0.008	0.01	0.012	0.014
		Alloy Steels (up to 35 Rc) 4140/A2/D2/400	165	165						
		Alloy Steels (36-45 Rc) 4140/A2/D2	150	150	0.004	0.006	0.008	0.01	0.012	0.014
Cast Irons	K	Gray Cast Iron A48, Class 20/G4000 405-500	275	275	0.004	0.006	0.008	0.01	0.012	0.014
		Ductile Cast Iron 60-40-18	175	175						
Austenitic	M	304/316	135	135	0.004	0.006	0.008	0.01	0.012	0.014
Precipitation Hardened Stainless Steels	M	17-4 PH	100	100	0.004	0.006	0.008	0.01	0.012	0.014
		13-8 PH								
Non Ferrous	N	Plastic	400	400	0.002	0.004	0.006	0.008	0.01	0.012
		Kevlar/Graphite	400	400	0.002	0.004	0.006	0.008	0.01	0.012

#RPM = SFM x 3.82/Tool Dia. #IPM = RPM x IPR

Tensile strength: N/mm² | Hardness: HRC

P0	P1	P2	P3	P4	P5	P6	M1	M2	M3	K1	K2	K3
<530	<530	<530	600-850	850-1400	600-900	900-1350	<600	600-800	<800	125-500	<600	>600
-	-	<25	<35	35-48	<35	35-48	-	<25	<30	<32	<28	<43

N1	N2	N3	N4	N5	N6	N7	S1-Fe Based	S2-Co Based	S3-Ni Based	S4-Ti Based	H1	H2	H3	H4
Wrought Al	Si<12.2%	Si>12.2%	Cu, Zn Alloy	Ny, Pl, Ru, Re, Fg	C, Gr, CFRP, Comp	NMC	500-1200	1000-1500	600-1700	900-1600	-	-	-	-
-	-	-	-	-	-	-	25-48	25-48	<48	33-48	44-48	48-55	56-60	61-70

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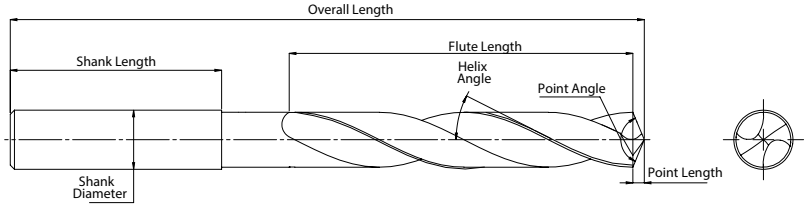
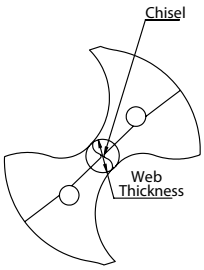
SOLID CARBIDE DRILL NOMENCLATURE

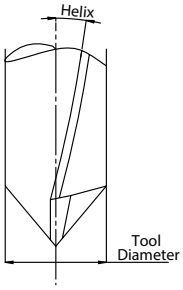


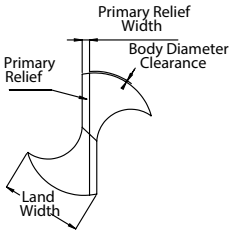


Chisel Edge – The non-cutting tip of the drill. Pushes, rather than cuts material. Having a smaller chisel means that a tool will cut more aggressively. A larger chisel means that a tool will be stronger.

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.

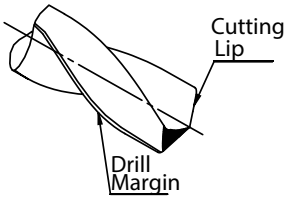
Helix Angle - Varies from 0° to 35° helix on standard tools. Lower helix angle means more rigidity and strength and a higher helix angle means more aggressive drilling and better chip evacuation.

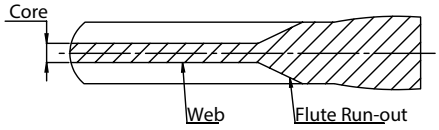




Margin Width – Provides a surface to support the drill inside the hole during the drilling operation. Totem® offers both single margin and double margin geometries. Margin widths are a balancing act between friction build-up vs. tool support in the drilling operation.

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

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

DRILL TROUBLESHOOTING

		Tool Deterioration													Chip Formation		
	Problem	Flank wear	Margin wear	Breakage	Flaking	Creater 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									

		Tool Life	Workpiece								Process						
	Problem	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

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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	

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

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 Reqd.: .....
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 ..... Vertical:..... Other: .....
Tool holding System: ..... Tool run out after holding.....
Max. Spindle Speed: ..... Spindle HP: .....
Work Holding system: ..... Approach Length : .....
Coolant Type : ..... 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:.....

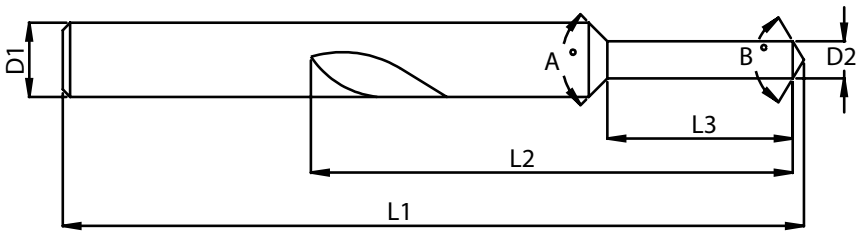
Comments: .....

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

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 requirments.

Customer Name: _____

Phone: _____

* Work Material Machined: _____

Hardness: _____

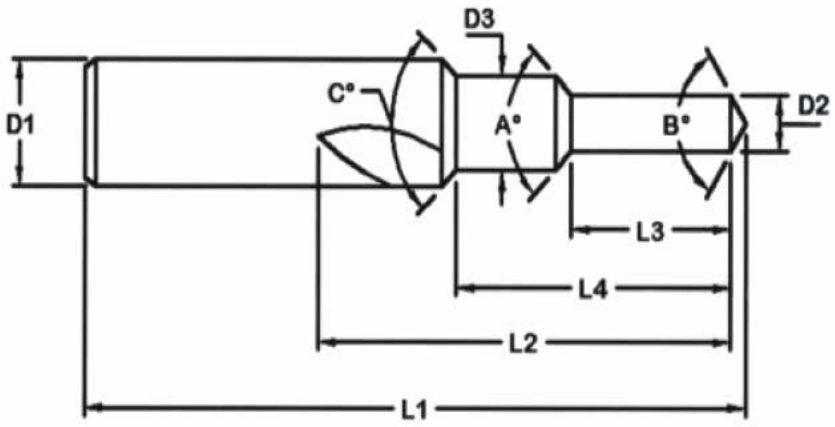
Distributor: _____

Quantities: _____

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

Number of Flutes:
☐ Two
☐ Three

Existing Data:
Speed = _____ Toollife = _____
Feed = _____ No. of Regrinds = _____

Tool Consumption/Year = _____
Cost/Component = _____
Cycle Time of Operations = _____

Flute Form:
☐ Straight
☐ Helical _____ ☐ Helix on Major Dia.
☐ Square Drill

Material:
☐ Solid Carbide
☐ Carbide Coolant Thru

Coating:
☐ TiN ☐ TiCN ☐ TiAlN ☐ Other __

Customer Name: _____
Phone Number: _____
Work Material Machined: _____
Hardness: _____

Sales Engineer: _____

Tolerances unless otherwise specified:
Angles ± 1^0
Corners and Edges .25 Rad. Max

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

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

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

Deep hole high performance drills

Introducing the latest range of high performance solid carbide drills for deep hole drilling.

Deep hole through coolant drills tailor made to your specification with an industry proven high performance geometry with the latest coating technology and superior substarte with a high toughness and micrograin structure to ensure supeiror tool life and lesser breakage.

Application:- Oil Hole Drilling in Crankshaft

Material:- Forged Steel

Dia = 3.0–10,0mm

Length = 15D, 20D

Cutting conditions within a range of vc = 60–100 m/min, fz= 0,10–0,25mm/rev

Connecting rod bolt hole high performance drills

Introducing the latest range of high performance solid carbide drills for con rod drilling

Through coolant step drills as per con rod specification available with the latest coating combined with the latest high performance geometry, sub micron substrate and superior coating to give 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 = 60–100 m/min, fz= 0,15–0,35mm/rev

High Performance Custom Solution Drills

We have what you need....

Solid carbide high performance round tools tailor made to your specification based on your application needs. Please contact our trained sales and application experts to come and study your application. We commit to deliver superior solutions with the lowest cost per part.

Industry:-

Aerospace, Autmotive, Defense, Railways, General Engineering & Energy Equpiments.

Dia 1.00- 32.00mm

Options:- Solid, Thorough Coolant 30 degree Helis, 40 Degree Helix, Axial Coolant Duct, Parralel Coolant Ducts.

High performance micro drills

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

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Forbes & Company Limited

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