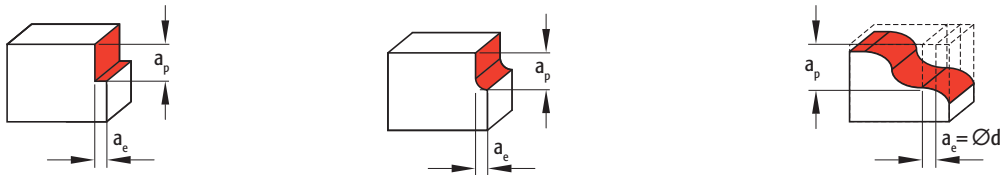


Cutting conditions

- 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	Coolant
		Vc m/min	
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



Multi flute finisher



Multi flute finisher with extra teeth



Multi flute finisher with corner radius



Multi flute finisher with corner radius and extra teeth

End mills for hardened steels 45-70 HRc

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

END MILLS

Program

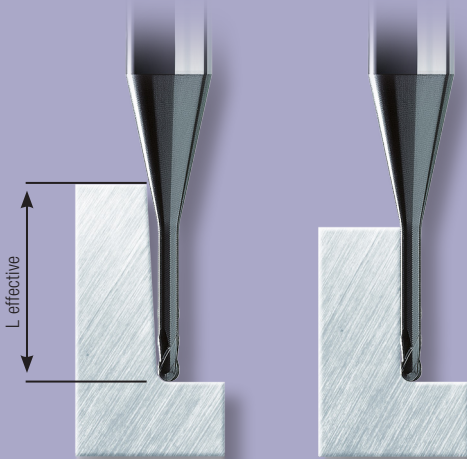
- Centre cutting high performance ball nose 2 flute for 45-70 HRc
- Centre cutting high performance ball nose 4 flute for 45-70 HRc
- Centre cutting high performance torus 2 flute for 45-70 HRc
- Centre cutting high performance torus 4 flute for 45-70 HRc
- Centre cutting high performance multi flute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



Ballnose geometries

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

Effective length compared with incline angle-
Increases the effective length



FBK0503554

Workpiece material: 1.2162

Hardness: 60 HRc

	Competitor	Totem
∅	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



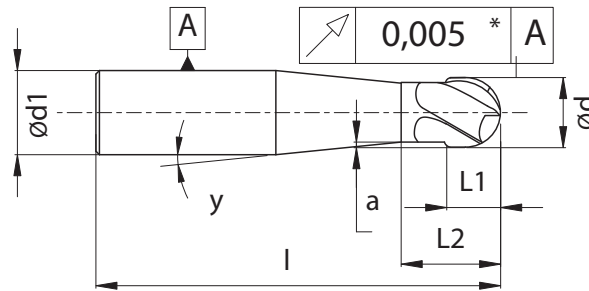
Q	0.11 mm ³ /min	0.75 mm ³ /min
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Higher productivity



2 Flute

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



P3-P4

H1-H4

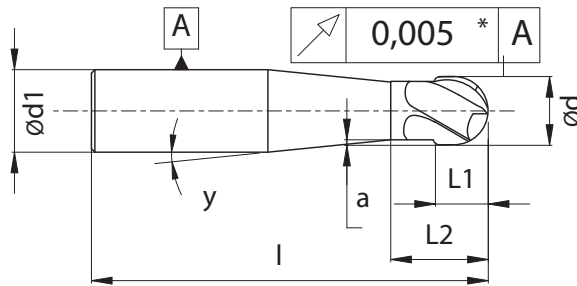
Unit : mm

Ød	r	Ød1	L	L1	L2	a	z	γ	EDP No
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(°)	
1	0.5	6	64	2	4	0.05	2	7	FBK0504478
1	0.5	6	78	2	4	0.05	2	4	FBK0504479
1.5	0.8	6	64	2	4	0.05	2	6	FBK0504480
1.5	0.8	6	78	2	4	0.05	2	4	FBK0504481
2	1.0	6	64	3	5	0.05	2	6	FBK0504482
2	1.0	6	64	3	8	0.05	2	9	FBK0505816
2	1.0	6	78	3	8	0.05	2	4	FBK0505817
2	1.0	6	78	3	15	0.05	2	5	FBK0504483
3	1.5	6	64	4	7	0.05	2	5	FBK0504484
3	1.5	6	78	4	15	0.05	2	4	FBK0504485
3	1.5	6	100	4	7	0.05	2	2	FBK0504486
4	2.0	6	64	5	8	0.1	2	4	FBK0504487
4	2.0	6	78	5	15	0.1	2	3	FBK0504488
4	2.0	6	100	5	8	0.1	2	1	FBK0504489
5	2.5	6	64	5	10	0.15	2	2	FBK0504490
5	2.5	6	78	5	20	0.15	2	2	FBK0504491
6	3.0	6	64	6	25	0.2	2	-	FBK0504492
6	3.0	6	78	6	35	0.2	2	-	FBK0504493
6	3.0	8	100	6	25	0.2	2	2	FBK0504494
8	4.0	8	64	8	25	0.3	2	-	FBK0504495
8	4.0	8	78	8	35	0.3	2	-	FBK0504496
8	4.0	8	100	8	50	0.3	2	-	FBK0504497
8	4.0	10	120	8	30	0.3	2	2	FBK0504498
10	5.0	10	78	10	35	0.3	2	-	FBK0504499
10	5.0	10	100	10	55	0.3	2	-	FBK0504500
10	5.0	12	120	10	30	0.3	2	2	FBK0504501
12	6.0	12	78	12	35	0.3	2	-	FBK0504502
12	6.0	12	100	12	55	0.3	2	-	FBK0504503
12	6.0	16	120	12	40	0.3	2	5	FBK0504504
16	8.0	16	100	20	50	0.3	2	-	FBK0504505
16	8.0	16	150	20	100	0.3	2	-	FBK0504506

Application data on page no 2.025

4 Flute

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



P3-P4

H1-H4


Unit : mm

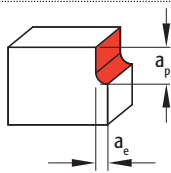
Ød (mm)	r (mm)	Ød1 (mm)	L (mm)	L1 (mm)	L2 (mm)	a (mm)	z	γ (°)	EDP No
6	3	6	64	6	25	0.2	4	-	FBK0504511
6	3	6	78	6	35	0.2	4	-	FBK0504512
6	3	8	100	6	25	0.2	4	2	FBK0504513
8	4	8	64	8	25	0.3	4	-	FBK0504514
8	4	8	78	8	35	0.3	4	-	FBK0504515
8	4	8	100	8	50	0.3	4	-	FBK0504516
8	4	10	120	8	30	0.3	4	2	FBK0504517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

Cutting conditions

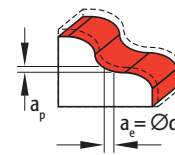
- Centre cutting high performance ball nose 2 flute for 45-70 HRc
- Centre cutting high performance ball nose 4 flute for 45-70 HRc

Material group	TSR	Hardness	Cutting speed	Coolant
	(N/mm ²)	HRc	Vc m/min	
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 precision tolerance



Roughing
P3 / P4



Finishing
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

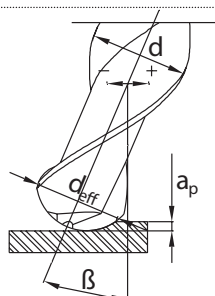
Roughing
H1 / H2 / H3 / H4

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

Finishing
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

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

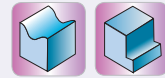


For the cutting speed Vc calculation the effective cutting diameter d_{eff} has to be taken into account. See formula.

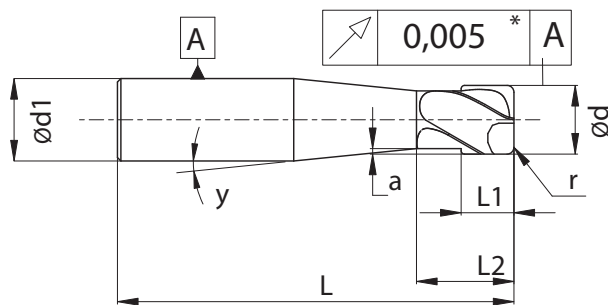
$$\beta \neq 0; \quad d_{\text{eff}} = d \times \sin \left[\beta \pm \arccos \left(\frac{d - 2a_p}{d} \right) \right]$$

2 Flute

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



END MILLS



P3-P4

H1-H4

Unit : mm

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