













**Micro Grain Solid Carbide End Mill**

**EPP-TH | Epoch TH Power Mill | Recommended Cutting Conditions**

		<b>D3</b>				<b>D4</b>				<b>D5</b>				
<b>EPP-CR-TH</b>		<b>EPP-CR-TH</b>				<b>EPP-CR-TH</b>				<b>EPP-CR-TH</b>				
Side milling		Slotting				2D/3D HSC				Side milling (a <sub>p</sub> x a <sub>e</sub> )				
<b>EPP-TH</b>		<b>EPP-TH</b>				<b>EPP-TH</b>				<b>EPP-TH</b>				
Side milling		Slotting				2D/3D HSC				Side milling (a <sub>p</sub> x a <sub>e</sub> )				
		high (a <sub>p</sub> )	high (a <sub>e</sub> )			high (a <sub>p</sub> )	high (a <sub>e</sub> )			high (a <sub>p</sub> )	high (a <sub>e</sub> )			
<b>I</b>	Construction Steel Carbon Steels Alloy Steels (~200HB)	V <sub>c</sub> (m/min)	195	105	96	330	195	105	96	330	195	105	96	330
		n (min <sup>-1</sup> )	20,700	11,100	10,200	35,000	15,500	8,400	7,600	26,300	12,400	6,700	6,100	21,000
		f <sub>z</sub> (mm/tooth)	0.035	0.025	0.025	0.100	0.050	0.035	0.035	0.135	0.065	0.050	0.050	0.170
		V <sub>f</sub> (mm/min)	2,900	1,110	1,020	14,000	3,100	1,180	1,060	14,200	3,220	1,340	1,220	14,280
		a <sub>p</sub> (mm)	4.5	3	3	0.2-0.5	6	4	4	0.2-0.5	7.5	5	5	0.2-0.5
		a <sub>e</sub> (mm)	0.3	1.5	3	0.2-0.5	0.4	2	4	0.2-0.5	0.5	2.5	5	0.2-0.5
<b>II</b>	Alloy Steels Case Hardened Steels Heat Treatable Steels (200~300HB)	V <sub>c</sub> (m/min)	155	90	84	260	155	90	84	260	155	90	84	260
		n (min <sup>-1</sup> )	16,400	9,500	8,900	27,600	12,300	7,200	6,700	20,700	9,900	5,700	5,300	16,600
		f <sub>z</sub> (mm/tooth)	0.030	0.020	0.020	0.090	0.040	0.030	0.030	0.120	0.055	0.040	0.040	0.150
		V <sub>f</sub> (mm/min)	1,970	760	710	9,940	1,970	860	800	9,940	2,180	910	850	9,960
		a <sub>p</sub> (mm)	4.5	3	3	0.2-0.5	6	4	4	0.2-0.5	7.5	5	5	0.2-0.5
		a <sub>e</sub> (mm)	0.3	1.5	3	0.2-0.5	0.4	2	4	0.2-0.5	0.5	2.5	5	0.2-0.5
<b>III</b>	Alloy Steels (30~45HRC)	V <sub>c</sub> (m/min)	117	52	48	200	117	52	48	200	117	52	48	200
		n (min <sup>-1</sup> )	12,400	5,500	5,100	21,200	9,300	4,100	3,800	15,900	7,400	3,300	3,100	12,700
		f <sub>z</sub> (mm/tooth)	0.021	0.015	0.015	0.060	0.028	0.025	0.025	0.090	0.035	0.031	0.031	0.100
		V <sub>f</sub> (mm/min)	1,040	330	310	5,090	1,040	410	380	5,720	1,040	410	380	5,080
		a <sub>p</sub> (mm)	4.5	1.5	1.5	0.1-0.3	6	2	2	0.1-0.3	7.5	2.5	2.5	0.1-0.3
		a <sub>e</sub> (mm)	0.3	1.5	3	0.1-0.3	0.4	2	4	0.1-0.3	0.5	2.5	5	0.1-0.3
<b>IV</b>	Tool Steels (hot&cold) Hardened Steels (45~55HRC)	V <sub>c</sub> (m/min)	90	35	40	170	90	35	40	170	90	35	40	170
		n (min <sup>-1</sup> )	9,500	3,700	4,200	18,000	7,200	2,800	3,200	13,500	5,700	2,200	2,500	10,800
		f <sub>z</sub> (mm/tooth)	0.015	0.013	0.013	0.043	0.020	0.018	0.018	0.064	0.025	0.025	0.025	0.071
		V <sub>f</sub> (mm/min)	570	190	220	3,100	580	200	230	3,460	570	220	250	3,070
		a <sub>p</sub> (mm)	4.5	0.6	0.6	0.1-0.3	6	0.8	0.8	0.1-0.3	7.5	1	1	0.1-0.3
		a <sub>e</sub> (mm)	0.15	1.5	3	0.1-0.3	0.2	2	4	0.1-0.3	0.25	2.5	5	0.1-0.3
<b>V</b>	Hardened Steels (55~70HRC)	V <sub>c</sub> (m/min)	60		20	110	60		20	110	60		20	110
		n (min <sup>-1</sup> )	6,400		2,100	11,700	4,800		1,600	8,800	3,800		1,300	7,000
		f <sub>z</sub> (mm/tooth)	0.011		0.009	0.030	0.014		0.013	0.045	0.018		0.018	0.050
		V <sub>f</sub> (mm/min)	270		80	1,400	270		80	1,580	270		90	1,400
		a <sub>p</sub> (mm)	4.5		0.6	0.05-0.3	6		0.8	0.05-0.3	7.5		1	0.05-0.3
		a <sub>e</sub> (mm)	0.12		3	0.05-0.3	0.16		4	0.05-0.3	0.2		5	0.05-0.3
<b>VI</b>	Stainless Steels (20~40HRC)	V <sub>c</sub> (m/min)	130	60	55	200	130	60	55	200	130	60	55	200
		n (min <sup>-1</sup> )	13,800	6,400	5,800	21,200	10,300	4,800	4,400	15,900	8,300	3,800	3,500	12,700
		f <sub>z</sub> (mm/tooth)	0.030	0.010	0.010	0.085	0.040	0.015	0.015	0.128	0.055	0.018	0.018	0.142
		V <sub>f</sub> (mm/min)	1,660	260	230	7,210	1,650	290	260	8,140	1,830	270	250	7,210
		a <sub>p</sub> (mm)	4.5	1.5	1.5	0.2-0.5	6	2	2	0.2-0.5	7.5	2.5	2.5	0.2-0.5
		a <sub>e</sub> (mm)	0.15	1.5	3	0.2-0.5	0.2	2	4	0.2-0.5	0.25	2.5	5	0.2-0.5
<b>VII</b>	Heat Resisting Steels Titanium, Inconel Nickel & Cobalt Alloys (25~60HRC)	V <sub>c</sub> (m/min)	60	40	36	120	60	40	36	120	60	40	36	120
		n (min <sup>-1</sup> )	6,400	4,200	3,800	12,700	4,800	3,200	2,900	9,500	3,800	2,500	2,300	7,600
		f <sub>z</sub> (mm/tooth)	0.015	0.010	0.010	0.043	0.020	0.015	0.015	0.064	0.025	0.018	0.018	0.071
		V <sub>f</sub> (mm/min)	380	170	150	2,180	380	190	170	2,430	380	180	170	2,160
		a <sub>p</sub> (mm)	4.5	0.9	0.9	0.05-0.3	6	1.2	1.2	0.05-0.3	7.5	1.5	1.5	0.05-0.3
		a <sub>e</sub> (mm)	0.15	1.5	3	0.05-0.3	0.2	2	4	0.05-0.3	0.25	2.5	5	0.05-0.3
<b>VIII</b>	Cast Irons: EN-JL(GG) Ductile Cast Iron: EN-JS(GGG) (EN-JL ~ 120HB) (EN-JS ~ 240HB)	V <sub>c</sub> (m/min)	195	78	72	300	195	78	72	300	195	78	72	300
		n (min <sup>-1</sup> )	20,700	8,300	7,600	31,800	15,500	6,200	5,700	23,900	12,400	5,000	4,600	19,100
		f <sub>z</sub> (mm/tooth)	0.035	0.035	0.035	0.100	0.050	0.050	0.050	0.150	0.065	0.065	0.065	0.165
		V <sub>f</sub> (mm/min)	2,900	1,160	1,060	12,720	3,100	1,240	1,140	14,340	3,220	1,300	1,200	12,610
		a <sub>p</sub> (mm)	4.5	1.5	1.5	0.2-0.5	6	2	2	0.2-0.5	7.5	2.5	2.5	0.2-0.5
		a <sub>e</sub> (mm)	0.3	1.5	3	0.2-0.5	0.4	2	4	0.2-0.5	0.5	2.5	5	0.2-0.5
<b>IX</b>	Aluminium Copper Alloys	V <sub>c</sub> (m/min)	260	195	180	350	260	195	180	350	260	195	180	350
		n (min <sup>-1</sup> )	27,600	20,700	19,100	37,100	20,700	15,500	14,300	27,900	16,600	12,400	11,500	22,300
		f <sub>z</sub> (mm/tooth)	0.035	0.025	0.025	0.100	0.050	0.035	0.035	0.150	0.065	0.050	0.050	0.165
		V <sub>f</sub> (mm/min)	3,860	2,070	1,910	14,840	4,140	2,170	2,000	16,740	4,320	2,480	2,300	14,720
		a <sub>p</sub> (mm)	4.5	3	3	0.2-0.5	6	4	4	0.2-0.5	7.5	5	5	0.2-0.5
		a <sub>e</sub> (mm)	0.3	1.5	3	0.2-0.5	0.4	2	4	0.2-0.5	0.5	2.5	5	0.2-0.5

D6				D8				D10				D12			
EPP-CR-TH				EPP-CR-TH				EPP-CR-TH				EPP-CR-TH			
EPP-TH				EPP-TH				EPP-TH				EPP-TH			
															
Side milling (a <sub>p</sub> x a <sub>e</sub> )	Slotting	2D/3D HSC		Side milling (a <sub>p</sub> x a <sub>e</sub> )	Slotting	2D/3D HSC		Side milling (a <sub>p</sub> x a <sub>e</sub> )	Slotting	2D/3D HSC		Side milling (a <sub>p</sub> x a <sub>e</sub> )	Slotting	2D/3D HSC	
high (a <sub>p</sub> )	high (a <sub>e</sub> )			high (a <sub>p</sub> )	high (a <sub>e</sub> )			high (a <sub>p</sub> )	high (a <sub>e</sub> )			high (a <sub>p</sub> )	high (a <sub>e</sub> )		
195	105	96	330	195	105	96	330	195	105	96	330	195	105	96	330
10,300	5,600	5,100	17,500	7,800	4,200	3,800	13,100	6,200	3,300	3,100	10,500	5,200	2,800	2,500	8,800
0.080	0.060	0.060	0.240	0.105	0.080	0.080	0.320	0.120	0.100	0.100	0.390	0.130	0.110	0.110	0.400
3,300	1,340	1,220	16,800	3,280	1,340	1,220	16,770	2,980	1,320	1,240	16,380	2,700	1,230	1,100	14,080
9	6	6	0.2-0.5	12	8	8	0.2-0.5	15	10	10	0.2-0.5	18	12	12	0.2-0.5
0.6	3	6	0.2-0.5	0.8	4	8	0.2-0.5	1	5	10	0.2-0.5	1.2	6	12	0.2-0.5
155	90	84	260	155	90	84	260	155	90	84	260	155	90	84	260
8,200	4,800	4,500	13,800	6,200	3,600	3,300	10,300	4,900	2,900	2,700	8,300	4,100	2,400	2,200	6,900
0.070	0.050	0.050	0.210	0.095	0.065	0.065	0.280	0.115	0.085	0.085	0.350	0.120	0.090	0.090	0.360
2,300	960	900	11,590	2,360	940	860	11,540	2,250	990	920	11,620	1,970	860	790	9,940
9	6	6	0.2-0.5	12	8	8	0.2-0.5	15	10	10	0.2-0.5	18	12	12	0.2-0.5
0.6	3	6	0.2-0.5	0.8	4	8	0.2-0.5	1	5	10	0.2-0.5	1.2	6	12	0.2-0.5
117	52	48	200	117	52	48	200	117	52	48	200	117	52	48	200
6,200	2,800	2,500	10,600	4,700	2,100	1,900	8,000	3,700	1,700	1,500	6,400	3,100	1,400	1,300	5,300
0.045	0.038	0.038	0.120	0.055	0.050	0.050	0.150	0.065	0.063	0.063	0.180	0.075	0.070	0.070	0.210
1,120	430	380	5,090	1,030	420	380	4,800	960	430	380	4,610	930	390	360	4,450
9	3	3	0.1-0.3	12	4	4	0.1-0.3	15	5	5	0.1-0.3	18	6	6	0.1-0.3
0.6	3	6	0.1-0.3	0.8	4	8	0.1-0.3	1	5	10	0.1-0.3	1.2	6	12	0.1-0.3
90	35	40	170	90	35	40	170	90	35	40	170	90	35	40	170
4,800	1,900	2,100	9,000	3,600	1,400	1,600	6,800	2,900	1,100	1,300	5,400	2,400	900	1,100	4,500
0.030	0.030	0.030	0.085	0.040	0.040	0.040	0.106	0.050	0.050	0.050	0.128	0.060	0.055	0.055	0.150
580	230	250	3,060	580	220	260	2,880	580	220	260	2,760	580	200	240	2,700
9	1.2	1.2	0.1-0.3	12	1.6	1.6	0.1-0.3	15	2	2	0.1-0.3	18	2.4	2.4	0.1-0.3
0.3	3	6	0.1-0.3	0.4	4	8	0.1-0.3	0.5	5	10	0.1-0.3	0.6	6	12	0.1-0.3
60		20	110	60		20	110	60		20	110	60		20	110
3,200		1,100	5,800	2,400		800	4,400	1,900		600	3,500	1,600		500	2,900
0.021		0.021	0.062	0.028		0.028	0.075	0.035		0.035	0.090	0.042		0.039	0.100
270		90	1,440	270		90	1,320	270		80	1,260	270		80	1,160
9		1.2	0.05-0.3	12		1.6	0.05-0.3	15		2	0.05-0.3	18		2.4	0.05-0.3
0.24		6	0.05-0.3	0.32		8	0.05-0.3	0.4		10	0.05-0.3	0.48		12	0.05-0.3
130	60	55	200	130	60	55	200	130	60	55	200	130	60	55	200
6,900	3,200	2,900	10,600	5,200	2,400	2,200	8,000	4,100	1,900	1,800	6,400	3,400	1,600	1,500	5,300
0.070	0.025	0.025	0.170	0.095	0.033	0.033	0.213	0.120	0.042	0.042	0.255	0.130	0.050	0.050	0.300
1,930	320	290	7,210	1,980	320	290	6,820	1,970	320	300	6,530	1,770	320	300	6,360
9	3	3	0.2-0.5	12	4	4	0.2-0.5	15	5	5	0.2-0.5	18	6	6	0.2-0.5
0.3	3	6	0.2-0.5	0.4	4	8	0.2-0.5	0.5	5	10	0.2-0.5	0.6	6	12	0.2-0.5
60	40	36	120	60	40	36	120	60	40	36	120	60	40	36	120
3,200	2,100	1,900	6,400	2,400	1,600	1,400	4,800	1,900	1,300	1,100	3,800	1,600	1,100	1,000	3,200
0.030	0.023	0.023	0.085	0.040	0.032	0.032	0.107	0.050	0.040	0.040	0.128	0.060	0.048	0.048	0.150
380	190	170	2,180	380	200	180	2,050	380	210	180	1,950	380	210	190	1,920
9	1.8	1.8	0.05-0.3	12	2.4	2.4	0.05-0.3	15	3	3	0.05-0.3	18	3.6	3.6	0.05-0.3
0.3	3	6	0.05-0.3	0.4	4	8	0.05-0.3	0.5	5	10	0.05-0.3	0.6	6	12	0.05-0.3
195	78	72	300	195	78	72	300	195	78	72	300	195	78	72	300
10,300	4,100	3,800	15,900	7,800	3,100	2,900	11,900	6,200	2,500	2,300	9,500	5,200	2,100	1,900	8,000
0.080	0.080	0.080	0.200	0.105	0.105	0.105	0.250	0.120	0.135	0.135	0.300	0.130	0.140	0.140	0.345
3,300	1,310	1,220	12,720	3,280	1,300	1,220	11,900	2,980	1,350	1,240	11,400	2,700	1,180	1,060	11,040
9	3	3	0.2-0.5	12	4	4	0.2-0.5	15	5	5	0.2-0.5	18	6	6	0.2-0.5
0.6	3	6	0.2-0.5	0.8	4	8	0.2-0.5	1	5	10	0.2-0.5	1.2	6	12	0.2-0.5
260	195	180	350	260	195	180	350	260	195	180	350	260	195	180	350
13,800	10,300	9,500	18,600	10,300	7,800	7,200	13,900	8,300	6,200	5,700	11,100	6,900	5,200	4,800	9,300
0.080	0.060	0.060	0.200	0.105	0.080	0.080	0.250	0.120	0.100	0.100	0.300	0.130	0.110	0.110	0.345
4,420	2,470	2,280	14,880	4,330	2,500	2,300	13,900	3,980	2,480	2,280	13,320	3,590	2,290	2,110	12,830
9	6	6	0.2-0.5	12	8	8	0.2-0.5	15	10	10	0.2-0.5	18	12	12	0.2-0.5
0.6	3	6	0.2-0.5	0.8	4	8	0.2-0.5	1	5	10	0.2-0.5	1.2	6	12	0.2-0.5