

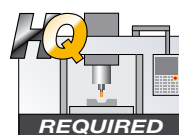
**Micro Grain Solid Carbide End Mill**
**EPBTS** | Epoch TH Hard Ball Strong | Recommended Cutting Conditions

Epoch TH Hard Ball Strong		ØD1				ØD2			
		Roughing		Finishing		Roughing		Finishing	
Workpiece Material	Parameter	Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed
		I Carbon Steels Alloy Steels Cast iron (180 ~ 250HB)	$V_c$ (m/min)	190	190	190	190	250	350
$n$ (min <sup>-1</sup> )	60,000		60,000	60,000	60,000	39,800	55,700	43,000	60,000
$f_z$ (mm/tooth)	0.020		0.032	0.017	0.017	0.040	0.064	0.034	0.034
$V_f$ (mm/min)	2,400		3,840	2,040	2,040	3,180	7,130	2,920	4,080
$a_p$ (mm)	0.125		0.100	0.07	0.07	0.250	0.200	0.1	0.1
$a_e$ (mm)	0.500		0.400	0.07	0.07	1.000	0.800	0.1	0.1
II Alloy steel, Tool steel (25 ~ 35HRC)	$V_c$ (m/min)	190	190	190	190	210	280	230	350
	$n$ (min <sup>-1</sup> )	60,000	60,000	60,000	60,000	33,400	44,600	36,600	55,700
	$f_z$ (mm/tooth)	0.018	0.029	0.016	0.016	0.036	0.058	0.032	0.032
	$V_f$ (mm/min)	2,160	3,460	1,920	1,920	2,400	5,140	2,340	3,560
	$a_p$ (mm)	0.120	0.100	0.07	0.07	0.240	0.200	0.1	0.1
	$a_e$ (mm)	0.480	0.400	0.07	0.07	0.960	0.800	0.1	0.1
III Alloy steel, Tool steel (35 ~ 45HRC)	$V_c$ (m/min)	185	190	190	190	185	240	200	300
	$n$ (min <sup>-1</sup> )	58,900	60,000	60,000	60,000	29,400	38,200	31,800	47,700
	$f_z$ (mm/tooth)	0.015	0.024	0.014	0.014	0.030	0.048	0.028	0.028
	$V_f$ (mm/min)	1,770	2,880	1,680	1,680	1,760	3,670	1,780	2,670
	$a_p$ (mm)	0.110	0.090	0.07	0.07	0.220	0.180	0.1	0.1
	$a_e$ (mm)	0.440	0.360	0.07	0.07	0.880	0.720	0.1	0.1
IV Hardened steels Tool steels (45 ~ 55HRC)	$V_c$ (m/min)	155	190	170	190	155	190	170	250
	$n$ (min <sup>-1</sup> )	49,300	60,000	54,100	60,000	24,700	30,200	27,100	39,800
	$f_z$ (mm/tooth)	0.012	0.019	0.014	0.014	0.024	0.038	0.028	0.028
	$V_f$ (mm/min)	1,180	2,300	1,510	1,680	1,190	2,320	1,520	2,230
	$a_p$ (mm)	0.100	0.075	0.07	0.07	0.200	0.150	0.1	0.1
	$a_e$ (mm)	0.400	0.300	0.07	0.07	0.800	0.600	0.1	0.1
V Hardened steels Tool steels (55 ~ 65HRC)	$V_c$ (m/min)	125	160	140	190	125	160	140	200
	$n$ (min <sup>-1</sup> )	39,800	50,900	44,600	60,000	19,900	25,500	22,300	31,800
	$f_z$ (mm/tooth)	0.010	0.016	0.013	0.013	0.020	0.032	0.026	0.026
	$V_f$ (mm/min)	800	1,630	1,160	1,560	800	1,630	1,160	1,650
	$a_p$ (mm)	0.080	0.050	0.07	0.07	0.160	0.100	0.1	0.1
	$a_e$ (mm)	0.320	0.200	0.07	0.07	0.640	0.400	0.1	0.1
VI Hardened Steels HSS powder steel (65 ~ 72HRC)	$V_c$ (m/min)	75	110	110	160	75	110	110	160
	$n$ (min <sup>-1</sup> )	23,900	35,000	35,000	50,900	11,900	17,500	17,500	25,500
	$f_z$ (mm/tooth)	0.008	0.012	0.012	0.012	0.016	0.023	0.024	0.024
	$V_f$ (mm/min)	380	810	840	1,220	380	810	840	1,220
	$a_p$ (mm)	0.070	0.040	0.07	0.07	0.140	0.080	0.1	0.1
	$a_e$ (mm)	0.280	0.160	0.07	0.07	0.560	0.320	0.1	0.1

**PLEASE NOTE:**

The values in these tables are only recommended under the following conditions:

1. The use of a machining centre and toolholder with highest precision, concentricity and rigidity.
2. All components – including machine and controller – are of the latest technology.


**REQUIRED**

## Modification if too high:

- Keep  $f_z$  stable.
- Reduce rpm to set best result on non-HQ machines.

**Micro Grain Solid Carbide End Mill**

**EPBTS** | Epoch TH Hard Ball Strong | Recommended Cutting Conditions

ØD3				ØD4				ØD5			
Roughing		Finishing		Roughing		Finishing		Roughing		Finishing	
Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed
250	350	270	380	250	350	270	380	250	350	270	380
26,500	37,100	28,600	40,300	19,900	27,900	21,500	30,200	15,900	22,300	17,200	24,200
0.061	0.098	0.052	0.052	0.083	0.133	0.071	0.071	0.104	0.166	0.088	0.088
3,240	7,270	2,980	4,190	3,310	7,430	3,040	4,270	3,310	7,420	3,040	4,280
0.375	0.300	0.12	0.12	0.500	0.400	0.14	0.14	0.625	0.500	0.16	0.16
1.500	1.200	0.12	0.12	2.000	1.600	0.14	0.14	2.500	2.000	0.16	0.16
210	280	230	350	210	280	230	350	210	280	230	350
22,300	29,700	24,400	37,100	16,700	22,300	18,300	27,900	13,400	17,800	14,600	22,300
0.055	0.088	0.049	0.049	0.075	0.120	0.067	0.067	0.094	0.150	0.083	0.083
2,460	5,230	2,390	3,630	2,500	5,340	2,440	3,710	2,510	5,330	2,430	3,710
0.360	0.300	0.12	0.12	0.480	0.400	0.14	0.14	0.600	0.500	0.16	0.16
1.440	1.200	0.12	0.12	1.920	1.600	0.14	0.14	2.400	2.000	0.16	0.16
185	240	200	300	185	240	200	300	185	240	200	300
19,600	25,500	21,200	31,800	14,700	19,100	15,900	23,900	11,800	15,300	12,700	19,100
0.046	0.073	0.043	0.043	0.062	0.100	0.058	0.058	0.078	0.125	0.073	0.073
1,800	3,750	1,820	2,720	1,830	3,810	1,850	2,780	1,840	3,820	1,850	2,780
0.330	0.270	0.12	0.12	0.440	0.360	0.14	0.14	0.550	0.450	0.16	0.16
1.320	1.080	0.12	0.12	1.760	1.440	0.14	0.14	2.200	1.800	0.16	0.16
155	190	170	250	155	190	170	250	155	190	170	250
16,400	20,200	18,000	26,500	12,300	15,100	13,500	19,900	9,900	12,100	10,800	15,900
0.037	0.059	0.043	0.043	0.050	0.080	0.058	0.058	0.062	0.100	0.073	0.073
1,200	2,370	1,540	2,270	1,230	2,410	1,570	2,320	1,240	2,420	1,570	2,320
0.300	0.225	0.12	0.12	0.400	0.300	0.14	0.14	0.500	0.375	0.16	0.16
1.200	0.900	0.12	0.12	1.600	1.200	0.14	0.14	2.000	1.500	0.16	0.16
125	160	140	200	125	160	140	200	125	160	140	200
13,300	17,000	14,900	21,200	9,900	12,700	11,100	15,900	8,000	10,200	8,900	12,700
0.031	0.049	0.040	0.040	0.042	0.067	0.054	0.054	0.052	0.083	0.068	0.068
810	1,660	1,190	1,690	820	1,690	1,200	1,720	830	1,700	1,200	1,720
0.240	0.150	0.12	0.12	0.320	0.200	0.14	0.14	0.400	0.250	0.16	0.16
0.960	0.600	0.12	0.12	1.280	0.800	0.14	0.14	1.600	1.000	0.16	0.16
75	110	110	160	75	110	110	160	75	110	110	160
8,000	11,700	11,700	17,000	6,000	8,800	8,800	12,700	4,800	7,000	7,000	10,200
0.024	0.035	0.037	0.037	0.033	0.048	0.050	0.050	0.042	0.060	0.062	0.062
390	820	860	1,250	400	840	880	1,270	400	840	870	1,270
0.210	0.120	0.12	0.12	0.280	0.160	0.14	0.14	0.350	0.200	0.16	0.16
0.840	0.480	0.12	0.12	1.120	0.640	0.14	0.14	1.400	0.800	0.16	0.16

**BITTE BEACHTEN SIE:**  
Die Werte in diesen Tabellen sind nur unter den folgenden Bedingungen empfohlen:

1. Die Verwendung eines Bearbeitungszentrums und Werkzeughalters höchster Präzision, Konzentrizität und Stabilität.

2. Alle Komponenten – einschließlich Maschine und Steuerung – sind auf dem neuesten Stand der Technik.



Bei zu hohen Werten:  
 • Halten Sie  $f_z$  konstant.  
 • Reduzieren Sie die Drehzahl, um auch mit Bearbeitungszentren geringerer Leistung beste Ergebnisse zu erzielen.

**Micro Grain Solid Carbide End Mill**
**EPBTS** | Epoch Hard Ball Strong | Recommended Cutting Conditions

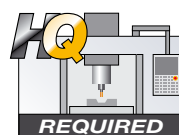
Epoch TH Hard Ball Strong		ØD6				ØD8				
Workpiece Material		Parameter	Roughing		Finishing		Roughing		Finishing	
			Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed
I Carbon Steels Alloy Steels Cast iron (180 ~ 250HB)	$V_c$ (m/min)	250	350	270	380	250	350	270	380	
	$n$ (min <sup>-1</sup> )	13,300	18,600	14,300	20,200	9,900	13,900	10,700	15,100	
	$f_z$ (mm/tooth)	0.124	0.198	0.105	0.105	0.166	0.265	0.141	0.141	
	$V_f$ (mm/min)	3,290	7,360	3,000	4,240	3,280	7,370	3,010	4,250	
	$a_p$ (mm)	0.750	0.600	0.18	0.18	1.000	0.800	0.2	0.2	
	$a_e$ (mm)	3.000	2.400	0.18	0.18	4.000	3.200	0.2	0.2	
II Alloy steel, Tool steel (25 ~ 35HRC)	$V_c$ (m/min)	210	280	230	350	210	280	230	350	
	$n$ (min <sup>-1</sup> )	11,100	14,900	12,200	18,600	8,400	11,100	9,200	13,900	
	$f_z$ (mm/tooth)	0.111	0.178	0.099	0.099	0.149	0.238	0.132	0.132	
	$V_f$ (mm/min)	2,470	5,300	2,410	3,680	2,500	5,290	2,440	3,680	
	$a_p$ (mm)	0.720	0.600	0.18	0.18	0.960	0.800	0.2	0.2	
	$a_e$ (mm)	2.880	2.400	0.18	0.18	3.840	3.200	0.2	0.2	
III Alloy steel, Tool steel (35 ~ 45HRC)	$V_c$ (m/min)	185	240	200	300	185	240	200	300	
	$n$ (min <sup>-1</sup> )	9,800	12,700	10,600	15,900	7,400	9,500	8,000	11,900	
	$f_z$ (mm/tooth)	0.093	0.148	0.087	0.087	0.124	0.199	0.116	0.116	
	$V_f$ (mm/min)	1,820	3,770	1,830	2,750	1,840	3,780	1,850	2,760	
	$a_p$ (mm)	0.660	0.540	0.18	0.18	0.880	0.720	0.2	0.2	
	$a_e$ (mm)	2.640	2.160	0.18	0.18	3.520	2.880	0.2	0.2	
IV Hardened steels Tool steels (45 ~ 55HRC)	$V_c$ (m/min)	155	190	170	250	155	190	170	250	
	$n$ (min <sup>-1</sup> )	8,200	10,100	9,000	13,300	6,200	7,600	6,800	9,900	
	$f_z$ (mm/tooth)	0.074	0.119	0.087	0.087	0.099	0.159	0.116	0.116	
	$V_f$ (mm/min)	1,220	2,400	1,560	2,300	1,230	2,420	1,580	2,300	
	$a_p$ (mm)	0.600	0.450	0.18	0.18	0.800	0.600	0.2	0.2	
	$a_e$ (mm)	2.400	1.800	0.18	0.18	3.200	2.400	0.2	0.2	
V Hardened steels Tool steels (55 ~ 65HRC)	$V_c$ (m/min)	125	160	140	200	125	160	140	200	
	$n$ (min <sup>-1</sup> )	6,600	8,500	7,400	10,600	5,000	6,400	5,600	8,000	
	$f_z$ (mm/tooth)	0.062	0.099	0.080	0.080	0.083	0.132	0.108	0.108	
	$V_f$ (mm/min)	820	1,680	1,190	1,700	830	1,700	1,210	1,720	
	$a_p$ (mm)	0.480	0.300	0.18	0.18	0.640	0.400	0.2	0.2	
	$a_e$ (mm)	1.920	1.200	0.18	0.18	2.560	1.600	0.2	0.2	
VI Hardened Steels HSS powder steel (65 ~ 72HRC)	$V_c$ (m/min)	75	110	110	160	75	110	110	160	
	$n$ (min <sup>-1</sup> )	4,000	5,800	5,800	8,500	3,000	4,400	4,400	6,400	
	$f_z$ (mm/tooth)	0.049	0.071	0.074	0.074	0.066	0.095	0.099	0.099	
	$V_f$ (mm/min)	400	830	860	1,260	400	840	870	1,270	
	$a_p$ (mm)	0.420	0.240	0.18	0.18	0.560	0.320	0.2	0.2	
	$a_e$ (mm)	1.680	0.960	0.18	0.18	2.240	1.280	0.2	0.2	

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Modification if too high:

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**Micro Grain Solid Carbide End Mill**

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ØD 10				ØD 12			
Roughing		Finishing		Roughing		Finishing	
Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed
250	350	270	380	250	350	270	380
8,000	11,100	8,600	12,100	6,600	9,300	7,200	10,100
0.200	0.320	0.170	0.170	0.233	0.372	0.198	0.198
3,200	7,100	2,920	4,110	3,070	6,930	2,850	4,000
1.250	1.000	0.23	0.23	1.500	1.200	0.25	0.25
5.000	4.000	0.23	0.23	6.000	4.800	0.25	0.25
210	280	230	350	210	280	230	350
6,700	8,900	7,300	11,100	5,600	7,400	6,100	9,300
0.180	0.288	0.160	0.160	0.210	0.335	0.186	0.186
2,410	5,130	2,340	3,550	2,350	4,960	2,270	3,460
1.200	1.000	0.23	0.23	1.440	1.200	0.25	0.25
4.800	4.000	0.23	0.23	5.760	4.800	0.25	0.25
185	240	200	300	185	240	200	300
5,900	7,600	6,400	9,500	4,900	6,400	5,300	8,000
0.150	0.240	0.140	0.140	0.175	0.279	0.163	0.163
1,770	3,650	1,790	2,660	1,710	3,580	1,730	2,610
1.100	0.900	0.23	0.23	1.320	1.080	0.25	0.25
4.400	3.600	0.23	0.23	5.280	4.320	0.25	0.25
155	190	170	250	155	190	170	250
4,900	6,000	5,400	8,000	4,100	5,000	4,500	6,600
0.120	0.192	0.140	0.140	0.140	0.223	0.163	0.163
1,180	2,300	1,510	2,240	1,150	2,230	1,470	2,150
1.000	0.750	0.23	0.23	1.200	0.900	0.25	0.25
4.000	3.000	0.23	0.23	4.800	3.600	0.25	0.25
125	160	140	200	125	160	140	200
4,000	5,100	4,500	6,400	3,300	4,200	3,700	5,300
0.100	0.160	0.130	0.130	0.116	0.186	0.151	0.151
800	1,630	1,170	1,660	770	1,560	1,120	1,600
0.800	0.500	0.23	0.23	0.960	0.600	0.25	0.25
3.200	2.000	0.23	0.23	3.840	2.400	0.25	0.25
75	110	110	160	75	110	110	160
2,400	3,500	3,500	5,100	2,000	2,900	2,900	4,200
0.080	0.115	0.120	0.120	0.093	0.134	0.140	0.140
380	810	840	1,220	370	780	810	1,170
0.700	0.400	0.23	0.23	0.840	0.480	0.25	0.25
2.800	1.600	0.23	0.23	3.360	1.920	0.25	0.25

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