

EPBTS-TH *Epoch TH Hard Ball*

Strong - Micro Grain Solid Carbide End Mill

Epoch Advanced TH Ball Series

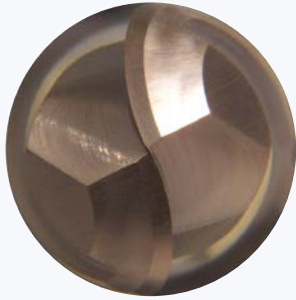
D1mm ~ D12mm

- High speed direct milling of Hardened steels $\leq 70\text{HRC}$
- Strong negative rake edge geometry for efficient roughing application
- 3D edge shape for good finishing

EPBTS | Epoch TH Hard Ball Strong

Features

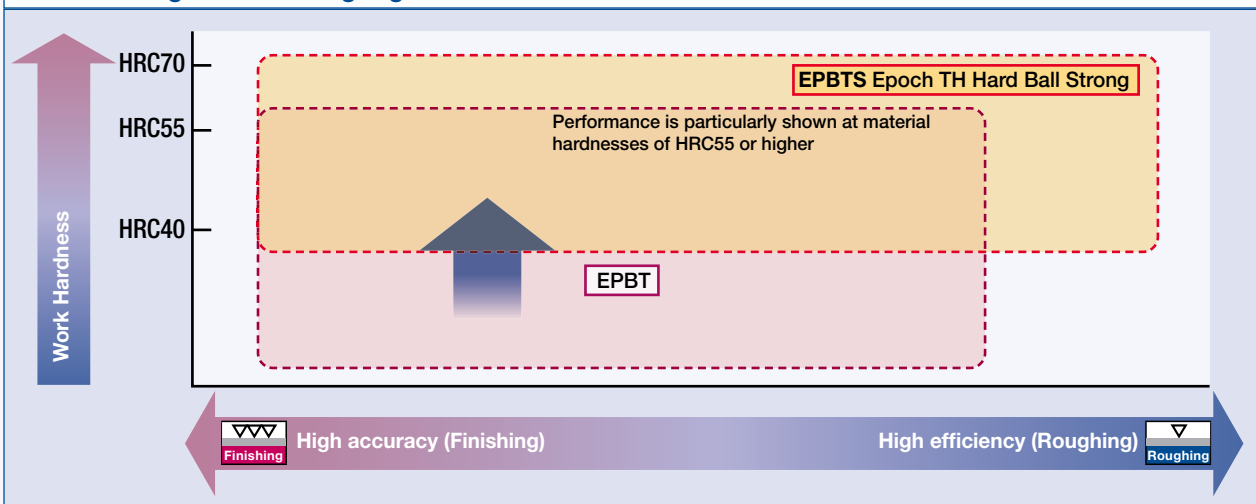
Flute tip shape provides both rigidity and good cutting performance.









3D ball shape provides good chip discharge characteristics and high rigidity.








Overview diagram of cutting regions



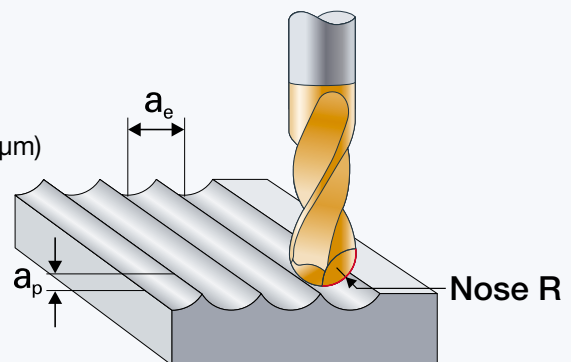
-  **Theoretical cusp height in end milling (μm)**
-  Die theoretische Rautiefe in der Fräsbearbeitung (μm)
-  Calcolo de altura de la cresta teórica en fresado (μm)
-  Cresta teórica de fresado (μm)
-  Hauteur de crête théorique en fraisage (μm)
-  Altura teórica da crista, em fresagem de acabamento (μm)

Feed pitch and cusp height

-  a_e (mm) Zeilensprung
-  Paso y altura de cresta
-  Relación Paso / Cresta
-  Pas et hauteur de crête
-  Passo e altura da crista

$$h = R - \sqrt{\frac{(2 \cdot R)^2 - a_{pe}^2}{4}}$$

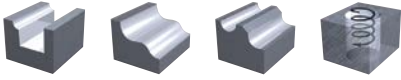
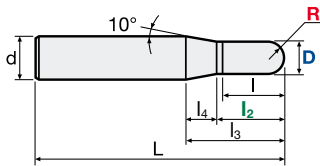
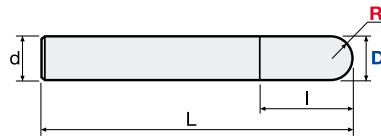
$$h = \frac{a_e^2}{8 \cdot R}$$



		a _e (Pick feed) mm										
		0.02	0.03	0.04	0.05	0.075	0.1	0.15	0.2	0.3	0.4	0.5
Nose R (mm)	0.5	0.10	0.23	0.40	0.63	1.41	2.51	5.66	10.10	23.03	41.74	66.99
	1	0.05	0.11	0.20	0.31	0.70	1.25	2.82	5.01	11.31	20.20	31.75
	1.5	0.03	0.08	0.13	0.21	0.47	0.83	1.88	3.34	7.52	13.39	20.98
	2	0.03	0.06	0.10	0.16	0.35	0.63	1.41	2.50	5.63	10.03	15.69
	2.5	0.02	0.05	0.08	0.13	0.28	0.50	1.13	2.00	4.50	8.01	12.53
	3	0.017	0.04	0.07	0.10	0.23	0.42	0.94	1.67	3.75	6.67	10.43
	4	0.013	0.03	0.05	0.08	0.18	0.31	0.70	1.25	2.81	5.00	7.82
	5	0.010	0.02	0.04	0.06	0.14	0.25	0.56	1.00	2.25	4.00	6.25
	6	0.008	0.02	0.03	0.05	0.12	0.21	0.47	0.83	1.88	3.33	5.21

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V max High Speed	Q max High Efficient	▽ Roughing	▽▽ Semi-Finishing	▽▽▽ Finishing	HRC 70	No. of Teeth 2
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A

B


Carbide Micro Grain	TH60+ Nano-PVD Coating	Rake Angle Negative
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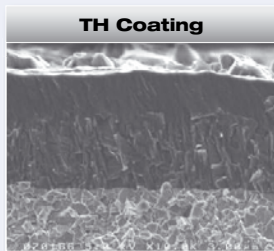
Helix Angle	R Tol. [mm]	d Tol.
30°	+/- 0.005	h5

ID Code	Item Code	Z	D	R	I	I ₂	I ₃	I ₄	L	d	Type
EP855	EPBTS-2010-TH	2	1	0.5	1.5	2.5	11.0	8.5	50	4	A
EP856	EPBTS-2020-TH		2	1	3	4.0	15.3	11.3	50	6	
EP857	EPBTS-2030-TH		3	1.5	4.5	5.5	14.0	8.5	70		
EP858	EPBTS-2040-TH		4	2	6	7.0	12.7	5.7	80		
EP859	EPBTS-2050-TH		5	2.5	7.5	8.5	11.3	2.8	90		
EP860	EPBTS-2060-TH		6	3	9	-	-	-	100	8	B
EP861	EPBTS-2080-TH		8	4	12				10		
EP862	EPBTS-2100-TH		10	5	15				110	12	
EP863	EPBTS-2120-TH		12	6	18						

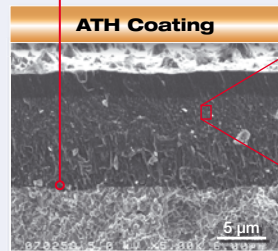
Cutting Conditions | Schnittwerte | Condizioni di taglio | Condiciones de Corte | Conditions de coupe | Valores de corte: Page 4-7

ATH (Advanced TH) Coating – Characteristics

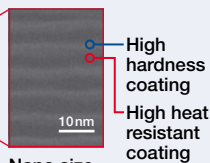
- Excellent adhesion strength
- Oxidation temperature: 1200°C
- Coating Hardness: 3800Hv
- Higher temperature resistance and wear resistance



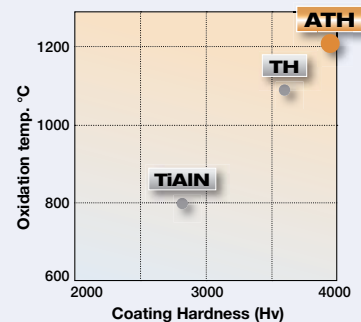
TH Coating (Conventional)



ATH Coating for hardened steel (45HRC-65HRC)



Nano size composite with atomic structure level



EPBTS | Epoch TH Hard Ball Strong | Recommended Cutting Conditions

Epoch TH Hard Ball Strong		D1				D2			
		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	270	380
	n (min ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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.



Modification if too high:

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

EPBTS | Epoch TH Hard Ball Strong | Recommended Cutting Conditions

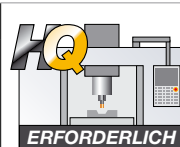
D3				D4				D5			
Roughing		Finishing		Roughing		Finishing		Roughing		Finishing	
Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed	Standard	High Speed
250	350	270	380	250	350	270	380	250	350	270	380
26,500	37,100	28,600	40,300	19,900	27,900	21,500	30,200	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, Konzentrität 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.

EPBTS | Epoch Hard Ball Strong | Recommended Cutting Conditions

Epoch TH Hard Ball Strong		D6				D8			
		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)	250	350	270	380	250	350	270	380
	n (min ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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 ⁻¹)	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

NOTA BENE:

I valori indicati nelle tabelle sono consigliati solo in presenza delle seguenti condizioni:

1. Utilizzo di una macchina e relativo mandrino ad alta precisione, concentricità e rigidità.

2. Tutti i componenti, inclusi macchina e controllo numerico, di ultima tecnologia.



In caso di parametri eccessivi:

- mantenere f_z stabile
- Ridurre rpm per ottenere un migliore risultato in caso di macchine non di ultima generazione

VEUILLEZ NOTER :

Les valeurs exprimées dans ces tableaux sont recommandées sous réserve que les conditions suivantes soient remplies :

1. L'utilisation d'un centre d'usinage et de portes outils de très haute précision, concentricité et rigidité

2. Tous les composants – dont la commande numérique – doivent être à la pointe de la technologie



Modification à apporter si conditions trop fortes :

- Garder la même f_z
- Réduire la rotation par minute (rpm) sur machine inadaptes

EPBTS | Epoch Hard Ball Strong | Recommended Cutting Conditions

D 10				D 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

⚠️ TENGA EN CUENTA:

Los valores de estas tablas sólo se recomiendan en las siguientes condiciones:

1. El uso de un centro de mecanizado y portaherramientas de máxima precisión, concentricidad y rigidez.

2. Todos los componentes – incluyendo máquina y control – son de la última generación.



Si estos valores son excesivos:

- Mantener la f_z .
- Reducir las rpm para conseguir mejores resultados en máquinas no-HQ

🇧🇷 TOME NOTA:

Os valores nestas tabelas são recomendados apenas nas seguintes condições:

1. Utilização de centro de maquinação e cone com a mais alta precisão, concentricidade e rigidez possível

2. Todos os componentes – incluindo máquina e controlador – devem utilizar a mais recente tecnologia



Modificação se condições de corte demasiado elevadas:

- manter f_z estável
- reduzir rpm para níveis de bons resultados em máquinas não-alta qualidade

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Attentions on Safety

1. Cautions regarding handling

- (1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
- (2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

- (1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
- (2) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (3) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

- (1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
- (2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
- (3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
- (4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. Please caution of fire while using oil base coolant, fire prevention is necessary.
- (5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

- (1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
- (2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
- (3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with the local laws and regulations regarding prevention of hazards due to specified chemical substances.

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