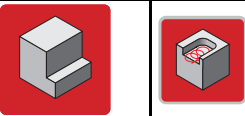




HIGH-PERFORMANCE SOLID CARBIDE END MILLS

4- Flute Variable Pitch Feeds & Speeds

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Material Group																						
											Haas Part #											
									03-0052	03-0053	03-0054	03-0055 03-0056	03-0057	03-0058 03-0059	03-0060 03-0061	03-0062 03-0063	03-0064 03-0065	03-0066				
		Side Milling (A) and Slotting (B)			Multi Layer TiAlN			Recommended feed per tooth (IPT = inch/th) for side milling (A). For slotting (B), reduce IPT by 20%.														
					Cutting Speed — vc SFM						D1 — Diameter											
		A		B				frac.	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1				
ap		ae	ap	min		max	dec.	.0625	0.1250	0.1875	0.2500	0.3125	0.3750	0.5000	0.6250	0.7500	1.0000					
P	0	1.5 x D	0.5 x D	1 x D	490	—	660	IPT	.0005	0.0009	0.0013	0.0018	0.0023	0.0027	0.0034	0.0039	0.0044	0.0049				
	1	1.5 x D	0.5 x D	1 x D	490	—	660	IPT	.0005	0.0009	0.0013	0.0018	0.0023	0.0027	0.0034	0.0039	0.0044	0.0049				
	2	1.5 x D	0.5 x D	1 x D	460	—	620	IPT	.0005	0.0009	0.0013	0.0018	0.0023	0.0027	0.0034	0.0039	0.0044	0.0049				
	3	1.5 x D	0.5 x D	1 x D	390	—	520	IPT	.0003	0.0007	0.0011	0.0015	0.0020	0.0023	0.0029	0.0034	0.0039	0.0045				
	4	1.5 x D	0.5 x D	0.75 x D	300	—	490	IPT	.0003	0.0007	0.0010	0.0014	0.0017	0.0020	0.0026	0.0030	0.0034	0.0039				
	5	1.5 x D	0.5 x D	1 x D	200	—	330	IPT	.0003	0.0006	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027	0.0031	0.0036				
M	6	1.5 x D	0.5 x D	0.75 x D	160	—	250	IPT	.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0019	0.0022	0.0025	0.0028				
	1	1.5 x D	0.5 x D	1 x D	300	—	380	IPT	.0003	0.0007	0.0011	0.0015	0.0020	0.0023	0.0029	0.0034	0.0039	0.0045				
	2	1.5 x D	0.5 x D	1 x D	200	—	260	IPT	.0003	0.0006	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027	0.0031	0.0036				
K	3	1.5 x D	0.5 x D	1 x D	200	—	230	IPT	.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0019	0.0022	0.0025	0.0028				
	1	1.5 x D	0.5 x D	1 x D	390	—	490	IPT	.0005	0.0009	0.0013	0.0018	0.0023	0.0027	0.0034	0.0039	0.0044	0.0049				
	2	1.5 x D	0.5 x D	1 x D	360	—	460	IPT	.0003	0.0007	0.0011	0.0015	0.0020	0.0023	0.0029	0.0034	0.0039	0.0045				
S	3	1.5 x D	0.5 x D	1 x D	360	—	430	IPT	.0003	0.0006	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027	0.0031	0.0036				
	1	1.5 x D	0.3 x D	0.3 x D	160	—	300	IPT	.0003	0.0007	0.0011	0.0015	0.0020	0.0023	0.0029	0.0034	0.0039	0.0045				
	2	1.5 x D	0.3 x D	0.3 x D	160	—	260	IPT	.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0015	0.0018	0.0021	0.0024				
	3	1.5 x D	0.5 x D	1 x D	80	—	130	IPT	.0003	0.0006	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027	0.0031	0.0036				
H	4	1.5 x D	0.5 x D	1 x D	160	—	200	IPT	.0002	0.0005	0.0008	0.0011	0.0014	0.0017	0.0021	0.0025	0.0028	0.0033				
	1	1.5 x D	0.5 x D	0.75 x D	260	—	460	IPT	.0004	0.0007	0.0010	0.0014	0.0017	0.0020	0.0026	0.0030	0.0034	0.0039				
	2	1.5 D	0.2 x D	0.5 x D	230	—	390	IPT	.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0019	0.0022	0.0025	0.0028				

P	Steel
M	Stainless Steel
K	Cast Iron
S	High-Temp Alloys
H	Hardened Materials

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
 Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
 Above parameters are based on ideal conditions. For smaller taper machining centers, please adjust parameters accordingly on >1/2" diameter.



MATERIAL GRADES

ANSI

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P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High-Temp Alloys
H	Hardened Materials

material group	description	content	tensile strength RM (MPa)*	hardness (HB)	hardness (HRC)	material number
P0	Low-Carbon Steels, Long Chipping	C <0,25%	<530	<125	–	A36, 1008, 1010, 1018 through 1029; 1108, 1117
P1	Low-Carbon Steels, Short Chipping, Free Machining	C <0,25%	<530	<125	–	10L18, 1200 Series, 1213, 12L14
P2	Medium- and High-Carbon Steels	C >0,25%	>530	<220	<25	1035, 1045, 10L45, 1050, 10L50, 1080, 1137, 1144, 11L44, 1525, 1545, 1572
P3	Alloy Steels and Tool Steels	C >0,25%	600–850	<330	<35	1300, 2000, 3000, 4000, 5000, 8000, P20, SAE: A, D, H, O, S, M, T
P4	Alloy Steels and Tool Steels	C >0,25%	850–1400	340–450	35–48	1300, 2000, 3000, 4000, 5000, 8000, P20, SAE: A, D, H, O, S, M, T
P5	Ferritic, Martensitic, and PH Stainless Steels	–	600–900	<330	<35	15–5 PH, 13–8 PH, 17–4 PH, 400 and 500 Series
P6	High-Strength Ferritic, Martensitic, and PH Stainless Steels	–	900–1350	350–450	35–48	15–5 PH, 13–8 PH, 17–4 PH, 400 and 500 Series
M1	Austenitic Stainless Steel	–	<600	130–200	–	200 Series, 301, 302, 304, 304L, 309
M2	High-Strength Austenitic Stainless and Cast Stainless Steels	–	600–800	150–230	<25	310, 316, 316L, 321, 347, 384 ASTM Cast XM-1, XM-5, XM-7, XM-21
M3	Duplex Stainless Steel	–	<800	135–275	<30	323, 329, F55, 2205, S329000
K1	Gray Cast Iron	–	125–500	120–290	<32	class 20, 25, 30, 35, 40, 45, 50, 55, 60, G1800, G3000, G3500, G4000
K2	Low- and Medium-Strength Ductile Irons (Nodular Irons) and Compacted Graphite Irons (CGI)	–	<600	130–260	<28	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
K3	High-Strength Ductile Irons and Austempered Ductile Iron (ADI)	–	>600	180–350	<43	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
N1	Wrought Aluminum	–	–	–	–	2025, 5050, 7050, 1000, 2017
N2	Low-Silicon Aluminum Alloys and Magnesium Alloys	Si <12,2%	–	–	–	2024, 6061, 7075
N3	High-Silicon Aluminum Alloys and Magnesium Alloys	Si >12,2%	–	–	–	–
N4	Copper-, Brass-, Zinc-Based on Machinability Index Range of 70–100	–	–	–	–	C81500
N5	Nylon, Plastics, Rubbers, Phenolics, Resins, Fiberglass	–	–	–	–	–
N6	Carbon, Graphite Composites, CFRP	–	–	–	–	Graphite, CFK, CFRP
N7	Metal Matrix Composites (MMC)	–	–	–	–	C63000
S1	Iron-Based, Heat-Resistant Alloys	–	500–1200	160–260	25–48	A-286, 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
S2	Cobalt-Based, Heat-Resistant Alloys	–	1000–1450	250–450	25–48	Haynes® 25 (L605), Haynes 188, J-1570, Stellite®, AlResist 213; Cast: AlResist 13, Haynes 21, MAR-M302, MAR-M509, NASA Co-W-Re, WI-52
S3	Nickel-Based, Heat-Resistant Alloys	–	600–1700	160–450	<48	Astrolloy®, 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®
S4	Titanium and Titanium Alloys	–	900–1600	300–400	33–48	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
H1	Hardened Materials	–	–	–	44–48	Tool Steel H10, H11, H13, D2, D3, 4340, P20
H2	Hardened Materials	–	–	–	48–55	Tool Steel H10, H11, H13, D2, D3, 4340, P20
H3	Hardened Materials	–	–	–	56–60	Tool Steel H10, H11, H13, D2, D3, 4340, P20
H4	Hardened Materials	–	–	–	>60	Tool Steel H10, H11, H13, D2, D3, 4340, P20