

TuffCut® SS

112 / 113 Recommended Cutting Data - Profile Milling

Inch

Workpiece Material Group	ISO	Hardness	Coolant			Profile Milling (ae)					End Mill Diameter								
			● Preferred ○ Possible x Not Possible								1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
						5%	10%	20%	30%	50%	*Profile milling at ≥ 50% ap is not recommended for diameters 1/4" and below.								
			Max.	Air	MMS	vc - SFM					← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.								
								fz - in/tooth											
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	1200	800	600	440	400	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	●	●	●	720	480	320	265	240	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	600	400	320	220	200	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Hardened Steels	H	35-45 Rc	●	○	○	480	320	250	175	160	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Hardened Steels		45-55 Rc	●	○	○	360	240	200	175	150	.0004	.0007	.0017	.0021	.0024	.0035	.0042	.0049	.0070
Hardened Steels		55-65 Rc	●	○	○	320	220	175	150	100	.0003	.0005	.0012	.0014	.0017	.0024	.0028	.0033	.0047
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	○	1200	800	500	440	400	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	○	600	400	300	220	200	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	○	600	400	300	220	200	.0006	.0008	.0010	.0024	.0028	.0039	.0047	.0055	.0070
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	300	200	150	110	100	.0004	.0005	.0013	.0016	.0018	.0026	.0032	.0037	.0053
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	260	175	125	100	95	.0004	.0005	.0013	.0016	.0018	.0026	.0032	.0037	.0053
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	●	○	○	400	350	325	300	250	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	●	○	○	230	200	190	175	150	.0007	.0011	.0026	.0032	.0037	.0053	.0063	.0074	.0100

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.







Metric

Workpiece Material Group	ISO	Hardness	Coolant					Profile Milling (ae)					End Mill Diameter (mm)										
			● Preferred ○ Possible x Not Possible										3*	5*	6*	8	10	12	16	20	25		
										2.3	1.8	1.2	1.1	1	*Profile milling at ≥ 50% ap is not recommended for diameters 6mm and below.								
			Max.	Air	MMS	vc - m/min					← Multiply fz by this Factor based on ae. When finishing, use the standard fz per chart below. Only add chip thinning when roughing or semi-finishing.												
												fz - mm/tooth											
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	365	250	180	135	120	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	●	●	●	220	150	100	80	75	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	185	125	100	70	60	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Hardened Steels	H	35-45 Rc	●	○	○	145	100	75	55	50	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Hardened Steels		45-55 Rc	●	○	○	110	75	60	55	45	.0102	.0178	.0432	.0533	.0610	.0889	.1067	.1245	.1776				
Hardened Steels		55-65 Rc	●	○	○	100	70	55	45	30	.0076	.0127	.0305	.0356	.0432	.0610	.0710	.0838	.1194				
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	○	365	250	150	135	120	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	○	185	125	95	70	60	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	○	185	125	95	70	60	.0152	.0203	.0254	.0610	.0711	.0991	.1194	.1397	.1778				
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	90	60	45	35	30	.0102	.0127	.0330	.0406	.0457	.0660	.0813	.0940	.1346				
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	80	55	40	30	25	.0102	.0127	.0330	.0406	.0457	.0660	.0813	.0940	.1346				
Cast Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	●	○	○	125	110	100	90	75	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	●	○	○	70	65	60	55	45	.0178	.0279	.0660	.0813	.0940	.1346	.1600	.1880	.2540				

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

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





112 Recommended Cutting Data - Slotting Inch

Workpiece Material Group	ISO	Hardness	Coolant			Slotting			End Mill Diameter								
			● Preferred ○ Possible x Not Possible						1/8*	3/16*	1/4*	5/16	3/8	1/2	5/8	3/4	1
						25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 1/4" and below.								
			Max.	Air	MMS	vc - SFM			fz - in/tooth								
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	440	420	400	.0004	.0005	.0013	.0015	.0014	.0026	.0031	.0036	.0051
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	●	●	●	280	260	240	.0004	.0005	.0013	.0015	.0014	.0026	.0031	.0036	.0051
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	240	220	200	.0004	.0005	.0013	.0015	.0014	.0026	.0031	.0036	.0051
Hardened Steels		35-45 Rc	●	○	○	400	360	320	.0004	.0005	.0012	.0014	.0016	.0023	.0028	.0033	.0050
Hardened Steels	H	45-55 Rc	●	○	○	280	260	240	.0002	.0004	.0005	.0010	.0012	.0017	.0021	.0024	.0035
Hardened Steels		55-65 Rc	●	○	○	200	180	160	.0002	.0003	.0006	.0006	.0006	.0012	.0014	.0017	.0024
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	○	440	420	400	.0004	.0005	.0013	.0015	.0014	.0026	.0031	.0036	.0051
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	○	280	240	200	.0004	.0005	.0013	.0015	.0016	.0026	.0031	.0036	.0051
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	○	240	220	200	.0004	.0005	.0013	.0015	.0016	.0026	.0031	.0036	.0051
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	140	120	100	.0002	.0003	.0006	.0008	.0010	.0013	.0016	.0017	.0026
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr-4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	115	100	90	.0002	.0003	.0006	.0008	.0010	.0013	.0016	.0017	.0026
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	●	○	○	600	550	500	.0004	.0005	.0013	.0015	.0016	.0026	.0031	.0036	.0051
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	●	○	○	320	275	250	.0004	.0005	.0013	.0015	.0016	.0026	.0031	.0036	.0051

Technical data provided should be considered advisory only as variations may be necessary depending on the particular application.

TuffCut® SS

112 Recommended Cutting Data - Slotting Metric

Workpiece Material Group	ISO	Hardness	Coolant			Slotting			End Mill Diameter (mm)								
			● Preferred ○ Possible x Not Possible						3*	5*	6*	8	10	12	16	20	25
						25%	50%	100%	*Slotting at > 25% ap is not recommended for diameters 6mm and below.								
			Max.	Air	MMS	vc - m/min			fz - mm/tooth								
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	P	up to 28 Rc	●	●	●	135	130	120	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	P	28 to 38 Rc	●	●	●	85	80	75	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	P	28 to 44 Rc	●	●	●	75	70	60	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
Hardened Steels		35-45 Rc	●	○	○	125	110	100	.0089	.0114	.0305	.0356	.0406	.0584	.0711	.0838	.1270
Hardened Steels	H	45-55 Rc	●	○	○	85	80	75	.0051	.0089	.0135	.0254	.0305	.0432	.0533	.0610	.0889
Hardened Steels		55-65 Rc	●	○	○	60	55	50	.0051	.0064	.0142	.0145	.0150	.0305	.0356	.0432	.0610
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	M	up to 28 Rc	●	x	○	135	130	120	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	M	up to 28 Rc	●	x	○	85	75	60	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M	over 28 Rc	●	x	○	75	70	60	.0089	.0127	.0330	.0381	.0356	.0660	.0787	.0914	.1295
High Temp Alloys Nimonic, Inconel, Monel, Hastelloy	S	up to 42 Rc	●	x	x	45	40	30	.0051	.0064	.0157	.0203	.0254	.0330	.0406	.0432	.0660
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2 Sn-4Zr-6Mo, 3Al-8V-6Cr-4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	S	up to 42 Rc	●	x	x	35	30	25	.0051	.0064	.0157	.0203	.0254	.0330	.0406	.0432	.0660
Cast-Iron - Gray CG, ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	K	up to 240 HB	●	○	○	185	170	150	.0089	.0127	.0330	.0381	.0406	.0660	.0787	.0914	.1295
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	K	over 240 HB	●	○	○	100	85	75	.0089	.0127	.0330	.0381	.0406	.0660	.0787	.0914	.1295

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