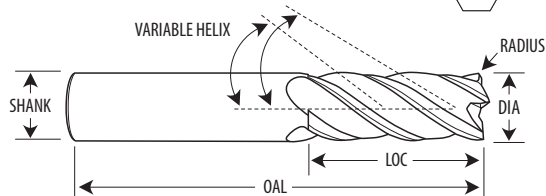
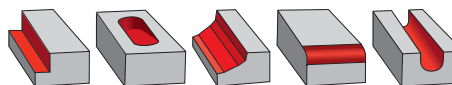
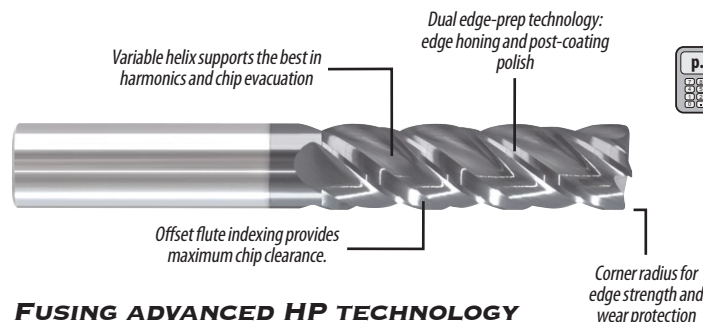


FUSION



FUSING ADVANCED HP TECHNOLOGY WITH CLASSIC GP AFFORDABILITY

DIAMETER TOLERANCE: +0.000 / -0.002"

SHANK TOLERANCE: +0.0000 / -0.0004"

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTiCrN
1/8	0.1250	1/4	1/8	1-1/2	Stub	0.010	284-000375	284-000376
						0.015	284-000377	284-000378
						0.020	284-000379	284-000380
						0.030	284-000381	284-000382
1/8	0.1250	1/2	1/8	1-1/2	Regular	0.010	284-000383	284-000384
						0.015	284-000385	284-000386
						0.020	284-000387	284-000388
						0.030	284-000389	284-000390
1/8	0.1250	3/4	1/8	2-1/4	Long	0.015	284-000391	284-000392
						0.020	284-000393	284-000394
						0.030	284-000395	284-000396
1/8	0.1250	1	1/8	3	X/Long	0.015	284-000397	284-000398
						0.020	284-000399	284-000400
						0.030	284-000401	284-000402
3/16	0.1875	3/8	3/16	2	Stub	0.010	284-000403	284-000404
						0.015	284-000405	284-000406
						0.020	284-000407	284-000408
						0.030	284-000409	284-000410
3/16	0.1875	5/8	3/16	2	Regular	0.045	284-000411	284-000412
						0.010	284-000413	284-000414
						0.015	284-000415	284-000416
						0.020	284-000417	284-000418
3/16	0.1875	3/4	3/16	2-1/2	Long	0.030	284-000419	284-000420
						0.045	284-000421	284-000422
						0.015	284-000423	284-000424
3/16	0.1875	1	3/16	4	Ext XX/Long	0.020	284-000425	284-000426
						0.030	284-000427	284-000428
						0.015	284-000435	284-000436
3/16	0.1875	1-1/8	3/16	3	X/Long	0.020	284-000437	284-000438
						0.030	284-000439	284-000440
						0.015	284-000429	284-000430
1/4	0.2500	1/2	1/4	2-1/2	Stub	0.020	284-000431	284-000432
						0.030	284-000433	284-000434
						0.015	284-000441	284-000442
						0.020	284-000443	284-000444
						0.030	284-000445	284-000446
						0.045	284-000447	284-000448
						0.060	284-000449	284-000450

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTiCRN
1/4	0.2500	3/4	1/4	2-1/2	Regular	0.015	284-000451	284-000452
						0.020	284-000453	284-000454
						0.030	284-000455	284-000456
						0.045	284-000457	284-000458
						0.060	284-000459	284-000460
1/4	0.2500	1	1/4	4	X/Long	0.015	284-000471	284-000472
						0.020	284-000473	284-000474
						0.030	284-000475	284-000476
						0.045	284-000477	284-000478
						0.060	284-000479	284-000480
1/4	0.2500	1-1/8	1/4	3	Long	0.015	284-000461	284-000462
						0.020	284-000463	284-000464
						0.030	284-000465	284-000466
						0.045	284-000467	284-000468
						0.060	284-000469	284-000470
1/4	0.2500	1-1/2	1/4	4	X/Long	0.015	284-000481	284-000482
						0.020	284-000483	284-000484
						0.030	284-000485	284-000486
						0.045	284-000487	284-000488
						0.060	284-000489	284-000490
1/4	0.2500	1-1/2	1/4	6	Ext XX/Long	0.015	284-000491	284-000492
						0.020	284-000493	284-000494
						0.030	284-000495	284-000496
						0.045	284-000497	284-000498
						0.060	284-000499	284-000500
5/16	0.3125	1/2	5/16	2-1/2	Stub	0.015	284-000501	284-000502
						0.020	284-000503	284-000504
						0.030	284-000505	284-000506
						0.045	284-000507	284-000508
						0.060	284-000509	284-000510
						0.090	284-000511	284-000512
						0.015	284-000513	284-000514
5/16	0.3125	13/16	5/16	2-1/2	Regular	0.020	284-000515	284-000516
						0.030	284-000517	284-000518
						0.045	284-000519	284-000520
						0.060	284-000521	284-000522
						0.090	284-000523	284-000524
5/16	0.3125	1-1/8	5/16	3	Long	0.015	284-000525	284-000526
						0.020	284-000527	284-000528
						0.030	284-000529	284-000530
						0.045	284-000531	284-000532
						0.060	284-000533	284-000534
5/16	0.3125	1-1/2	5/16	6	Ext XX/Long	0.015	284-000545	284-000546
						0.020	284-000547	284-000548
						0.030	284-000549	284-000550
						0.045	284-000551	284-000552
						0.060	284-000553	284-000554

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTiCRN
5/16	0.3125	1-5/8	5/16	4	X/Long	0.015	284-000535	284-000536
						0.020	284-000537	284-000538
						0.030	284-000539	284-000540
						0.045	284-000541	284-000542
						0.060	284-000543	284-000544
3/8	0.3750	5/8	3/8	2-1/2	Stub	0.015	284-000555	284-000556
						0.020	284-000557	284-000558
						0.030	284-000559	284-000560
						0.045	284-000561	284-000562
						0.060	284-000563	284-000564
3/8	0.3750	1	3/8	2-1/2	Regular	0.090	284-000565	284-000566
						0.015	284-000567	284-000568
						0.020	284-000569	284-000570
						0.030	284-000571	284-000572
						0.045	284-000573	284-000574
3/8	0.3750	1	3/8	4	Ext X/Long	0.060	284-000575	284-000576
						0.090	284-000577	284-000578
						0.015	284-000589	284-000590
						0.020	284-000591	284-000592
						0.030	284-000593	284-000594
3/8	0.3750	1-1/8	3/8	3	Long	0.045	284-000595	284-000596
						0.060	284-000597	284-000598
						0.015	284-000579	284-000580
						0.020	284-000581	284-000582
						0.030	284-000583	284-000584
3/8	0.3750	1-1/2	3/8	6	Ext XX/Long	0.045	284-000585	284-000586
						0.060	284-000587	284-000588
						0.015	284-000609	284-000610
						0.020	284-000611	284-000612
						0.030	284-000613	284-000614
3/8	0.3750	1-3/4	3/8	4	X/Long	0.045	284-000615	284-000616
						0.060	284-000617	284-000618
						0.015	284-000599	284-000600
						0.020	284-000601	284-000602
						0.030	284-000603	284-000604
7/16	0.4375	1	7/16	2-3/4	Regular	0.045	284-000605	284-000606
						0.060	284-000607	284-000608
						0.030	284-000619	284-000620
						0.045	284-000621	284-000622
						0.060	284-000623	284-000624
						0.090	284-000625	284-000626
						0.125	284-000627	284-000628

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTCRN
1/2	0.5000	5/8	1/2	3	Stub	0.015	284-000629	284-000630
						0.020	284-000631	284-000632
						0.030	284-000633	284-000634
						0.045	284-000635	284-000636
						0.060	284-000637	284-000638
						0.090	284-000639	284-000640
						0.125	284-000641	284-000642
1/2	0.5000	1	1/2	4	Sm/Med	0.015	284-000657	284-000658
						0.020	284-000659	284-000660
						0.030	284-000661	284-000662
						0.045	284-000663	284-000664
						0.060	284-000665	284-000666
						0.090	284-000667	284-000668
						0.125	284-000669	284-000670
1/2	0.5000	1-1/4	1/2	3	Regular	0.015	284-000643	284-000644
						0.020	284-000645	284-000646
						0.030	284-000647	284-000648
						0.045	284-000649	284-000650
						0.060	284-000651	284-000652
						0.090	284-000653	284-000654
						0.125	284-000655	284-000656
1/2	0.5000	1-1/2	1/2	4	Medium	0.015	284-000671	284-000672
						0.020	284-000673	284-000674
						0.030	284-000675	284-000676
						0.045	284-000677	284-000678
						0.060	284-000679	284-000680
						0.090	284-000681	284-000682
						0.125	284-000683	284-000684
1/2	0.5000	1-1/2	1/2	6	Ext X/Long	0.015	284-000699	284-000700
						0.020	284-000701	284-000702
						0.030	284-000703	284-000704
						0.045	284-000705	284-000706
						0.060	284-000707	284-000708
						0.090	284-000709	284-000710
						0.125	284-000711	284-000712
1/2	0.5000	2	1/2	4	Long	0.015	284-000685	284-000686
						0.020	284-000687	284-000688
						0.030	284-000689	284-000690
						0.045	284-000691	284-000692
						0.060	284-000693	284-000694
						0.090	284-000695	284-000696
						0.125	284-000697	284-000698
1/2	0.5000	3	1/2	6	X/Long	0.015	284-000713	284-000714
						0.020	284-000715	284-000716
						0.030	284-000717	284-000718
						0.045	284-000719	284-000720
						0.060	284-000721	284-000722
						0.090	284-000723	284-000724
						0.125	284-000725	284-000726

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTCRN
5/8	0.6250	3/4	5/8	3-1/2	Stub	0.015	284-000727	284-000728
						0.020	284-000729	284-000730
						0.030	284-000731	284-000732
						0.045	284-000733	284-000734
						0.060	284-000735	284-000736
						0.090	284-000737	284-000738
						0.125	284-000739	284-000740
5/8	0.6250	1-1/4	5/8	3-1/2	Regular	0.015	284-000741	284-000742
						0.020	284-000743	284-000744
						0.030	284-000745	284-000746
						0.045	284-000747	284-000748
						0.060	284-000749	284-000750
						0.090	284-000751	284-000752
						0.125	284-000753	284-000754
5/8	0.6250	1-1/2	5/8	6	Ext X/Long	0.030	284-000765	284-000766
						0.045	284-000767	284-000768
						0.060	284-000769	284-000770
						0.090	284-000771	284-000772
5/8	0.6250	2-1/4	5/8	5	Long	0.125	284-000773	284-000774
						0.030	284-000755	284-000756
						0.045	284-000757	284-000758
						0.060	284-000759	284-000760
5/8	0.6250	3	5/8	6	X/Long	0.090	284-000761	284-000762
						0.125	284-000763	284-000764
						0.030	284-000775	284-000776
						0.045	284-000777	284-000778
5/8	0.6250	3	5/8	6	X/Long	0.060	284-000779	284-000780
						0.090	284-000781	284-000782
						0.125	284-000783	284-000784
						0.030	284-000785	284-000786
3/4	0.7500	1	3/4	4	Stub	0.045	284-000787	284-000788
						0.060	284-000789	284-000790
						0.090	284-000791	284-000792
						0.125	284-000793	284-000794
						0.190	284-000795	284-000796
						0.250	284-000797	284-000798
						0.030	284-000799	284-000800
3/4	0.7500	1-1/2	3/4	4	Regular	0.045	284-000801	284-000802
						0.060	284-000803	284-000804
						0.090	284-000805	284-000806
						0.125	284-000807	284-000808
						0.190	284-000809	284-000810
						0.250	284-000811	284-000812
						0.030	284-000825	284-000826
3/4	0.7500	1-1/2	3/4	6	Ext X/Long	0.045	284-000827	284-000828
						0.060	284-000829	284-000830
						0.090	284-000831	284-000832
						0.125	284-000833	284-000834
3/4	0.7500	1-1/2	3/4	6	Ext X/Long	0.250	284-000835	284-000836

DIA	DEC IN	LOC	SHANK	OAL	LENGTH	RADIUS	BRIGHT	ALTiCRN
3/4	0.7500	2-1/4	3/4	5	Long	0.030	284-000813	284-000814
						0.045	284-000815	284-000816
						0.060	284-000817	284-000818
						0.090	284-000819	284-000820
						0.125	284-000821	284-000822
						0.250	284-000823	284-000824
3/4	0.7500	3	3/4	6	X/Long	0.030	284-000837	284-000838
						0.045	284-000839	284-000840
						0.060	284-000841	284-000842
						0.090	284-000843	284-000844
						0.125	284-000845	284-000846
						0.250	284-000847	284-000848
3/4	0.7500	4	3/4	7	XX/Long	0.030	284-000849	284-000850
						0.045	284-000851	284-000852
						0.060	284-000853	284-000854
						0.090	284-000855	284-000856
						0.125	284-000857	284-000858
						0.250	284-000859	284-000860
1	1.0000	1-1/2	1	4	Regular	0.030	284-000861	284-000862
						0.045	284-000863	284-000864
						0.060	284-000865	284-000866
						0.090	284-000867	284-000868
						0.125	284-000869	284-000870
						0.190	284-000871	284-000872
1	1.0000	1-1/2	1	6	Ext X/Long	0.250	284-000873	284-000874
						0.030	284-000887	284-000888
						0.045	284-000889	284-000890
						0.060	284-000891	284-000892
						0.090	284-000893	284-000894
						0.125	284-000895	284-000896
1	1.0000	2-1/4	1	5	Long	0.250	284-000897	284-000898
						0.030	284-000875	284-000876
						0.045	284-000877	284-000878
						0.060	284-000879	284-000880
						0.090	284-000881	284-000882
						0.125	284-000883	284-000884
1	1.0000	3	1	6	X/Long	0.250	284-000885	284-000886
						0.030	284-000899	284-000900
						0.045	284-000901	284-000902
						0.060	284-000903	284-000904
						0.090	284-000905	284-000906
						0.125	284-000907	284-000908
1	1.0000	4	1	7	XX/Long	0.250	284-000909	284-000910
						0.030	284-000911	284-000912
						0.045	284-000913	284-000914
						0.060	284-000915	284-000916
						0.090	284-000917	284-000918
						0.125	284-000919	284-000920
						0.250	284-000921	284-000922

MILLING RECOMMENDATIONS



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

PROFILING

Workpiece Material Group	Hardness	SFM based on RDOC					IPT* (BASELINE)									
		Cutting Diameter Engaged					Cutting Diameter									
		5%	10%	20%	30%	50%	1/8 [†]	3/16 [†]	1/4 [†]	5/16	3/8	1/2	5/8	3/4	1	
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	≤ 28 Rc	1050	700	385	375	350	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	28 - 38 Rc	630	420	320	250	210	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Tool & Die Steels	A2, H13, L6, P20, S7	28 - 44 Rc	525	350	300	275	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	≤ 28 Rc	650	600	550	500	450	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	≤ 28 Rc	525	400	350	300	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Super Alloys	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	> 28 Rc	525	400	350	300	250	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	High Temp, Nimonic, Inconel, Monel, Hastelloy	≤ 42 Rc	265	200	175	150	100	0.00048	0.00065	0.00096	0.0017	0.0019	0.0028	0.0032	0.0038	0.0054
Hardened Materials	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	≤ 42 Rc	230	200	175	150	125	0.00048	0.00065	0.00096	0.0017	0.0019	0.0028	0.0032	0.0038	0.0054
	Gray: SAE J431, ASTM A48	45-55 Rc	250	240	230	210	200	0.00360	0.00432	0.00504	0.0022	0.0025	0.0036	0.0043	0.0050	0.0072
Cast-Iron	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	≤ 240 HB	425	400	375	350	300	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	> 240 HB	320	300	250	225	200	0.00065	0.00097	0.00120	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite		1000	960	920	880	840	0.00048	0.00065	0.00096	0.0032	0.0038	0.0054	0.0065	0.0076	0.0108

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x

†1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%



Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)

Inches Per Tooth (IPT)

SLOTING

Workpiece Material Group	Hardness	SFM			IPT* (BASELINE)									
		Cutting Diameter Engaged			Cutting Diameter									
		25%	50%	100%	1/8 [†]	3/16 [†]	1/4 [†]	5/16	3/8	1/2	5/8	3/4	1	
Steels	Free Machining & Low Carbon: 10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	≤ 28 Rc	462	444	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX 51XX, 86XX, 93XX	28 - 38 Rc	294	276	2652	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Tool & Die Steels	A2, H13, L6, P20, S7	28 - 44 Rc	252	234	210	0.00048	0.00072	0.00096	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Stainless Steel	Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	≤ 28 Rc	462	444	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	≤ 28 Rc	294	252	210	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Super Alloys	Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	> 28 Rc	252	234	210	0.00036	0.00048	0.00060	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	High Temp, Nimonic, Inconel, Monel, Hastelloy	≤ 42 Rc	150	126	108	0.00036	0.00048	0.00060	0.0010	0.0012	0.0016	0.0019	0.0020	0.0031
Hardened Materials	Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	≤ 42 Rc	120	108	96	0.00036	0.00048	0.00060	0.0010	0.0012	0.0016	0.0019	0.0020	0.0031
	Gray: SAE J431, ASTM A48	34-45 Rc	294	276	252	0.00024	0.00036	0.00048	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Cast-Iron	Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	≤ 240 HB	540	480	420	0.00060	0.00084	0.00120	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
	Aluminum, Brass, Bronze, Copper, Plastics, Graphite	> 240 HB	360	300	270	0.00048	0.00084	0.00108	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060
Non-Ferrous	Aluminum, Brass, Bronze, Copper, Plastics, Graphite		900	720	540	0.00132	0.00204	0.00264	0.0019	0.0023	0.0030	0.0037	0.0046	0.0060

