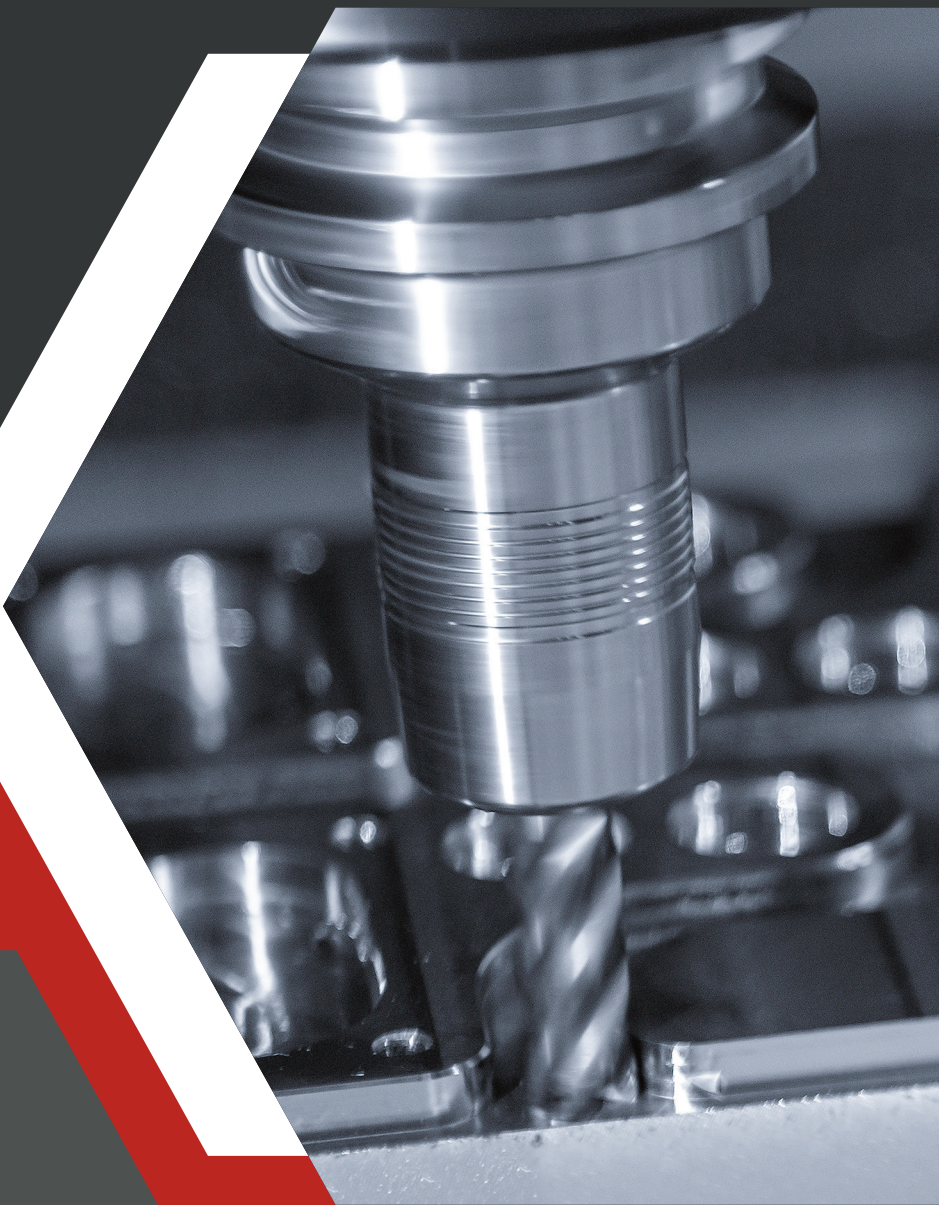


Exclusively From



SOLID CARBIDE END MILLS

2023-2024

OVER 3500 ITEMS AVAILABLE!
GENERAL PURPOSE • VARIABLE PITCH
HIGH PERFORMANCE • ALUMINUM

GENERAL PURPOSE

Shank Tolerance: +0.0000"/-0.0004"
Diameter Tolerance: +0.0000"/-0.0020"

General Purpose 30 Degree Helix 10% micrograin carbide. All tools honed to improve tool life. Available Uncoated & TiALN Coated.

Good

GENERAL PURPOSE

Square End 2, 3 & 4 Flute - Fractional	3-5
Square End 2, 3 & 4 Flute - Metric	6
Ball Nose 2, 3 & 4 Flute - Fractional	7-9
Engraving Tools	9
Spot Drills	9
Ball Nose 2 & 4 Flute - Metric	10
90 Degree Drill/Mills 2 & 4 Flute - Fractional	10
Double Ended Square End 2 & 4 Flute - Fractional	11
Double Ended Ball Nose End 2 & 4 Flute - Fractional	12

HIGH PERFORMANCE

Shank Tolerance: +0.0000"/-0.0004"
Diameter Tolerance: +0.0000"/-0.0015"

High Performance Variable Pitch to reduce chatter. General Purpose 10% micrograin carbide. All tools honed to improve tool life. TiALN Coated for enhanced heat & abrasion resistance providing higher tool life. Special core & heal design to enhance rigidity.

Better

HP Variable Pitch

Square End & Corner Radius 4 & 5 Flute - Fractional	14-15
Ball Nose 4 Flute - Fractional	16
Long Reach Neck Relief Square & Corner Radius 4 Flute - Fractional	16-17
Long Reach Neck Relief Ball Nose 4 Flute - Fractional	16-17

ULTRA HIGH PERFORMANCE

Shank Tolerance: +0.0000"/-0.0004"
Diameter Tolerance: +0.0000"/-0.0015"

Extreme Production Variable Pitch to reduce chatter. Ultra Premium 10% micrograin carbide. All tools honed to improve tool life. TiALN Coated with a unique post coating polishing process to reduce built up edge. Special core & heal design to enhance rigidity. Experience the highest performance & tool life.

Best

HP Ultra Variable Pitch - EXTREME PRODUCTION

Square End & Corner Radius 4 & 5 Flute - Fractional	19-20
Ball Nose 4 Flute - Fractional	21
Square & Corner Radius HEM 5, 6 & 7 Flute - Fractional	22-24

ALUMINUM

Shank Tolerance: +0.0000"/-0.0004"
Diameter Tolerance: +0.0000"/-0.0004"

Specifically designed for high performance Aluminum machining. Medium/Finishing applications & Medium/Roughing applications. Unique variable pitch & variable helix combined with a polished surface, chipbreaking geometry & cylindrical margin. Available Uncoated, ZrN Coated & DLC Coated.

Best

HP Ultra Variable Pitch for Aluminum - EXTREME PRODUCTION

Square End & Corner Radius - Fractional Medium/Roughing	27
Square End & Corner Radius - Fractional Medium/Finishing	28
Ball Nose - Fractional	29

GENERAL PURPOSE

Speeds & Feeds

Material Classification	Speed (SFM)		Feed Per Tooth By End Mill Diameter (IPT)							
	Uncoated	TiALN	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
Aluminum Alloys & Aluminum	600-1200	900-1800	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080
Copper Alloys & Copper	350-850	525-1275	.0020	.0025	.0025	.0030	.0030	.0035	.0040	.0060
Bronze & Brass	250-400	375-600	.0020	.0025	.0025	.0030	.0030	.0035	.0040	.0050
Graphite	500-800	500-1200	.0030	.0035	.0025	.0030	.0030	.0040	.0050	.0070
Plastics	600-1100	600-1650	.0030	.0035	.0040	.0050	.0060	.0080	.0100	.0150
Softer Cast Iron	250-450	375-650	.0020	.0022	.0025	.0027	.0030	.0045	.0060	.0080
Harder Cast Iron	100-250	100-375	.0008	.0010	.0015	.0017	.0020	.0025	.0030	.0040
Ductile Iron	80-400	100-600	.0010	.0012	.0015	.0017	.0020	.0030	.0040	.0060
Malleable Iron	150-500	225-650	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0070
Low Carbon Steels (1020 & Under)	200-400	300-600	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0070
Medium Carbon Steels (1030-1060)	100-250	150-375	.0015	.0016	.0017	.0018	.0020	.0030	.0040	.0050
Alloy Steels Hardened to 35 Rc	130-230	130-345	.0010	.0011	.0012	.0013	.0015	.0017	.0020	.0030
Alloy Steels Hardened to 40-50 Rc	70-130	70-160	.0007	.0007	.0008	.0009	.0010	.0015	.0020	.0030
Die Steels Hardened to 51-60 Rc	--	--	--	--	--	--	--	--	--	--
Tool Steels	100-250	150-375	.0010	.0012	.0015	.0017	.0020	.0025	.0030	.0040
Mold Steels	200-350	300-525	.0010	.0012	.0015	.0017	.0020	.0025	.0030	.0040
Softer Stainless Steels	200-350	300-450	.0010	.0012	.0015	.0012	.0020	.0030	.0040	.0060
Harder Stainless Steels	100-200	150-300	.0005	.0006	.0007	.0008	.0010	.0020	.0030	.0050
Monel & High Nickel Steel	75-175	75-200	.0010	.0012	.0015	.0017	.0020	.0025	.0030	.0040
Softer Titanium	125-300	125-375	.0010	.0012	.0015	.0017	.0020	.0030	.0040	.0060
Harder Titanium	50-150	50-175	.0005	.0006	.0007	.0008	.0010	.0015	.0020	.0020
Nickel Based High Temp Alloys	50-100	50-125	.0008	.0008	.0009	.0009	.0010	.0012	.0015	.0020

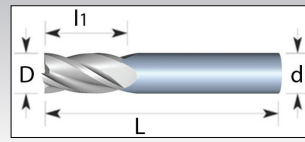
Note: These are guidelines only & the following points are important to consider:

- Higher Feed Per Tooth should be used to start for radial depths of cut less than 25% of the tool diameter. Lower Feed Per Tooth should be used to start for radial depths of cut greater than 25% of the tool diameter.
- The above recommendations are for axial lengths of cut not to exceed 1 times the tool diameter for profiling and .5 times the diameter for full slotting.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Light Radial Depths of cut, make certain to increase the feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.



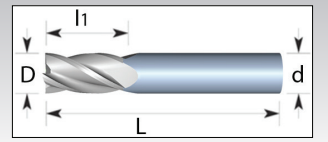
P	●	Steel
M	◐	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S		High Temp. Alloys
H		Hardened Steel

- Square End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



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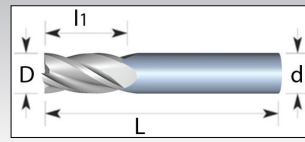


Square End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1/32	1/8	1/16	1-1/2	540213	540214	540215	540261	540262	540263
		3/32		540309	540310	540311	540498	540499	540500
3/64	1/8	3/32	1-1/2	540216	540217	540218	540264	540265	540266
		1/8		540312	540313	540314	540501	540502	540503
1/16	1/8	1/8	1-1/2	540219	540220	540221	540267	540268	540269
		3/16		540315	540316	540317	540504	540505	540506
5/64	1/8	1/4	1-1/2	540318	540319	540320	540507	540508	540509
3/32	1/8	3/16	1-1/2	540222	540223	540224	540270	540271	540272
		3/8		540321	540322	540323	540510	540511	540512
7/64	1/8	3/8	1-1/2	540327	540328	540329	540516	540517	540518
1/8	1/8	1/4	1-1/2	540228	540229	540230	540276	540277	540278
		1/2		540330	540331	540332	540519	540520	540521
		3/4	2-1/2	540689	--	540690	540711	--	540712
		1		3	540736	--	540737	540768	--
9/64	3/16	9/16	2	540333	540334	540335	540522	540523	540524
5/32	3/16	5/16	2	540231	540232	540233	540279	540280	540281
		9/16		540336	540337	540338	540525	540526	540527
11/64	3/16	9/16	2	540339	540340	540341	540528	540529	540530
		3/8		540234	540235	540236	540282	540283	540284
3/16	3/16	5/8	2	540342	540343	540344	540531	540532	540533
		3/4		540691	--	540692	540713	--	540714
		1-1/8	3	540738	--	540739	540770	--	540771
13/64	1/4	5/8	2-1/2	540345	540346	540347	540534	540535	540536
7/32	1/4	7/16	2	540237	540238	540239	540285	540286	540287
		5/8		540348	540349	540350	540537	540538	540539
15/64	1/4	3/4	2-1/2	540351	540352	540353	540540	540541	540542
1/4	1/4	1/2	2	540240	540241	540242	540288	540289	540290
		3/4		540354	540355	540356	540543	540544	540545
		1-1/8	3	540693	--	540694	540715	--	540716
		1-1/2		4	540740	--	540741	540772	--
17/64	5/16	7/8	2-1/2	540357	540358	540359	540546	540547	540548
9/32	5/16	7/8	2-1/2	540360	540361	540362	540549	540550	540551
19/64	5/16	7/8	2-1/2	540363	540364	540365	540552	540553	540554
5/16	5/16	1/2	2	540243	540244	540245	540291	540292	540293
		7/8		540366	540367	540368	540555	540556	540557
		1-1/8	3	540695	--	540696	540717	--	540718
		1-5/8		4	540744	--	540745	540776	--
21/64	3/8	7/8	2-1/2	540369	540370	540371	540558	540559	540560

Square End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
11/32	3/8	7/8	2-1/2	540372	540373	540374	540561	540562	540563
		23/64		540375	540376	540377	540564	540565	540566
3/8	3/8	5/8	2	540246	540247	540248	540294	540295	540296
		1		2-1/2	540378	540379	540380	540567	540568
		1-1/8	3	540697	--	540698	540719	--	540720
		1-3/4		4	540750	--	540751	540782	--
25/64	7/16	1	2-1/2	540381	540382	540383	540570	540571	540572
13/32	7/16	1	2-1/2	540384	540385	540386	540573	540574	540575
27/64	7/16	1	2-1/2	540387	540388	540389	540576	540577	540578
7/16	7/16	5/8	2-1/2	540249	540250	540251	540297	540298	540299
		1		540390	540391	540392	540579	540580	540581
		2	4	540699	--	540700	540721	--	540722
29/64	1/2	1	3	540393	540394	540395	540582	540583	540584
15/32	1/2	1	3	540396	540397	540398	540585	540586	540587
31/64	1/2	1	3	540399	540400	540401	540588	540589	540590
1/2	1/2	5/8	2-1/2	540252	540253	540254	540300	540301	540302
		1		3	540402	540403	540404	540591	540592
		1-1/4	3	--	--	542519	--	--	542518
2	4	540701		--	540702	540723	--	540724	
33/64	9/16	3	6	540754	--	540755	540786	--	540787
		1-1/4		3-1/2	540405	540406	540407	540594	540595
		1-1/4	3-1/2	540408	540409	540410	540597	540598	540599
35/64	9/16	1-1/4	3-1/2	540411	540412	540413	540600	540601	540602
9/16	9/16	1-1/4	3-1/2	540414	540415	540416	540603	540604	540605
37/64	5/8	1-1/4	3-1/2	540417	540418	540419	540606	540607	540608
19/32	5/8	1-1/4	3-1/2	540420	540421	540422	540609	540610	540611
39/64	5/8	1-1/4	3-1/2	540423	540424	540425	540612	540613	540614
5/8	5/8	3/4	3	540255	540256	540257	540303	540304	540305
		1-1/4		3-1/2	540426	540427	540428	540615	540616
		2-1/4	5	540705	--	540706	540727	--	540728
		3		6	540758	--	540759	540790	--
41/64	3/4	1-1/2	4	540429	540430	540431	540618	540619	540620
21/32	3/4	1-1/2	4	540432	540433	540434	540621	540622	540623
43/64	3/4	1-1/2	4	540435	540436	540437	540624	540625	540626
11/16	3/4	1-1/2	4	540438	540439	540440	540627	540628	540629
45/64	3/4	1-1/2	4	540441	540442	540443	540630	540631	540632
23/32	3/4	1-1/2	4	540444	540445	540446	540633	540634	540635
47/64	3/4	1-1/2	4	540447	540448	540449	540636	540637	540638

P	●	Steel	
M	◐	Stainless Steel	
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N	○	Non-Ferrous	
S		High Temp. Alloys	
H		Hardened Steel	
●	GOOD	◐ OK	○ NOT OPTIMAL

- Square End
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- Single End
- Round Shanks
- Center Cutting
- Fractional & Metric
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
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- Slotting, Ramping
- Profiling



Square End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
3/4	3/4	1	3	540258	540259	540260	540306	540307	540308
		1-1/2	4	540450	540451	540452	540639	540640	540641
		2-1/4	5	540707	--	540708	540729	--	540730
		3	6	540760	--	540761	540792	--	540793
49/64	7/8	1-1/2	4	540453	540454	540455	540642	540643	540644
25/32	7/8	1-1/2	4	540456	540457	540458	540645	540646	540647
51/64	7/8	1-1/2	4	540459	540460	540461	540648	540649	540650
13/16	7/8	1-1/2	4	540462	540463	540464	540651	540652	540653
53/64	7/8	1-1/2	4	540465	540466	540467	540654	540655	540656
27/32	7/8	1-1/2	4	540468	540469	540470	540657	540658	540659
55/64	7/8	1-1/2	4	540471	540472	540473	540660	540661	540662
7/8	7/8	1-1/2	4	540474	540475	540476	540663	540664	540665
57/64	1	1-1/2	4	540477	540478	540479	540666	540667	540668
29/32	1	1-1/2	4	540480	540481	540482	540669	540670	540671
59/64	1	1-1/2	4	540483	540484	540485	540672	540673	540674
15/16	1	1-1/2	4	540486	540487	540488	540675	540676	540677
61/64	1	1-1/2	4	540489	540490	540491	540678	540679	540680
31/32	1	1-1/2	4	540492	540493	540494	540681	540682	540683
63/64	1	1-1/2	4	540495	540496	540497	540684	540685	540686
1	1	1	3	540225	540226	540227	540273	540274	540275
		1-1/2	4	540324	540325	540326	540513	540514	540515
		2-1/4	5	540687	--	540688	540709	--	540710
		3	6	540731	--	540733	540764	--	540765

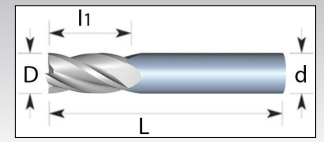


Precision Grinding with high quality surface finishes for maximum tool life!

Square End - Metric									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1	1	3	38	541618	541619	541620	541684	541685	541686
1.5	2	5	38	541621	541622	541623	541687	541688	541689
2	2	6	38	541624	541625	541626	541690	541691	541692

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S		High Temp. Alloys	
H		Hardened Steel	
●	GOOD	◐ OK	○ NOT OPTIMAL

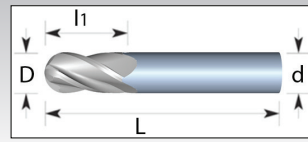
- Square End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Metric Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
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- Profiling



Square End - Metric									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
3	3	12	38	541630	541631	541632	541696	541697	541698
		25	75	541838	--	541839	541862	--	541863
		25	100	541886	--	541887	541902	--	541903
3.5	4	12	50	541633	541634	541635	541699	541700	541701
		14	50	541636	541637	541638	541702	541703	541704
4	4	25	75	541840	--	541841	541864	--	541865
		50	100	541888	--	541889	541904	--	541905
4.5	5	14	50	541639	541640	541641	541705	541706	541707
		16	50	541642	541643	541644	541708	541709	541710
5	5	25	75	541842	--	541843	541866	--	541867
		30	100	541890	--	541891	541906	--	541907
		19	63	541645	541646	541647	541711	541712	541713
6	6	25	75	541844	--	541845	541868	--	541869
		50	100	541892	--	541893	541908	--	541909
7	7	19	63	541648	541649	541650	541714	541715	541716
		19	63	541651	541652	541653	541717	541718	541719
8	8	30	100	541846	--	541847	541870	--	541871
		50	150	541894	--	541895	541910	--	541911
9	10	22	70	541654	541655	541656	541720	541721	541722
		22	70	541657	541658	541659	541723	541724	541725
10	10	38	100	541848	--	541849	541872	--	541873
		75	150	541896	--	541897	541912	--	541913
		25	70	541660	541661	541662	541726	541727	541728
12	12	25	75	541663	541664	541665	541729	541730	541731
		50	100	541850	--	541851	541874	--	541875
		75	150	541898	--	541899	541914	--	541915
14	14	30	88	541666	541667	541668	541732	541733	541734
		50	125	541852	--	541853	541876	--	541877
		75	150	541900	--	541901	541916	--	541917
16	16	32	88	541669	541670	541671	541735	541736	541737
		75	150	541854	--	541855	541878	--	541879
18	18	36	100	541672	541673	541674	541738	541739	541740
		75	150	541856	--	541857	541880	--	541881
20	20	38	100	541675	541676	541677	541741	541742	541743
		75	150	541858	--	541859	541882	--	541883
22	25	38	100	541678	541679	541680	541744	541745	541746
		38	100	541681	541682	541683	541747	541748	541749
25	25	38	100	541684	541685	541686	541750	541751	541752
		75	150	541860	--	541861	541884	--	541885

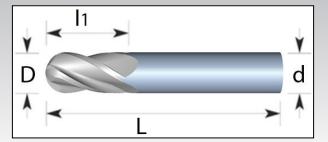
P	●	Steel
M	○	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S	○	High Temp. Alloys
H	○	Hardened Steel

- Ball Nose End
- 2, 3, 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



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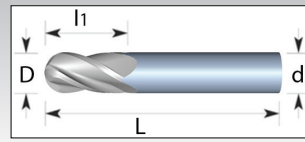
Ball Nose - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1/32	1/8	1/16 3/32	1-1/2	540796 540892	540797 540893	540798 540894	540844 541081	540845 541082	540846 541083
3/64	1/8	3/32 1/8	1-1/2	540799 540895	540800 540896	540801 540897	540847 541084	540848 541085	540849 541086
1/16	1/8	1/8 3/16	1-1/2	540802 540898	540803 540899	540804 540900	540850 541087	540851 541088	540852 541089
5/64	1/8	1/4	1-1/2	540901	540902	540903	541090	541091	541092
3/32	1/8	3/16 3/8	1-1/2	540805 540904	540806 540905	540807 540906	540853 541093	540854 541094	540855 541095
7/64	1/8	3/8	1-1/2	540910	540911	540912	541099	541100	541101
1/8	1/8	1/4	1-1/2	540811	540812	540813	540859	540860	540861
		1/2	2-1/2	540913	540914	540915	541102	541103	541104
		3/4	2-1/2	541272	--	541273	541294	--	541295
9/64	3/16	1	3	541318	--	541319	541350	--	541351
		9/16	2	540916	540917	540918	541105	541106	541107
		5/16 9/16	2	540814 540919	540815 540920	540816 540921	540862 541108	540863 541109	540864 541110
11/64	3/16	9/16	2	540922	540923	540924	541111	541112	541113
3/16	3/16	3/8	2	540817	540818	540819	540865	540866	540867
		5/8	2	540925	540926	540927	541114	541115	541116
		3/4 1-1/8	2-1/2 3	541274 541320	-- --	541275 541321	541296 541352	-- --	541297 541353
13/64	1/4	5/8	2-1/2	540928	540929	540930	541117	541118	541119
7/32	1/4	7/16 5/8	2	540820 540931	540821 540932	540822 540933	540868 541120	540869 541121	540870 541122
15/64	1/4	3/4	2-1/2	540934	540935	540936	541123	541124	541125
1/4	1/4	1/2	2	540823	540824	540825	540871	540872	540873
		3/4	2-1/2	540937	540938	540939	541126	541127	541128
		1-1/8 1-1/2	3 4	541276 541322	-- --	541277 541323	541298 541354	-- --	541299 541355
17/64	5/16	7/8	2-1/2	540940	540941	540942	541129	541130	541131
9/32	5/16	7/8	2-1/2	540943	540944	540945	541132	541133	541134
19/64	5/16	7/8	2-1/2	540946	540947	540948	541135	541136	541137
5/16	5/16	1/2	2	540826	540827	540828	540874	540875	540876
		7/8	2-1/2	540949	540950	540951	541138	541139	541140
		1-1/8 1-5/8	3 4	541278 541326	-- --	541279 541327	541300 541358	-- --	541301 541359

Ball Nose - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
11/32	3/8	7/8	2-1/2	540952	540953	540954	541141	541142	541143
23/64	3/8	7/8	2-1/2	540955	540956	540957	541144	541145	541146
3/8	3/8	5/8	2	540958	540959	540960	541147	541148	541149
		1	2-1/2	540829	540830	540831	540877	540878	540879
		1-1/8 1-3/4	3 4	540961 541280	540962 --	540963 541281	541150 541302	541151 --	541152 541303
25/64	7/16	1	2-1/2	541332	--	541333	541364	--	541365
13/32	7/16	1	2-1/2	540964	540965	540966	541153	541154	541155
27/64	7/16	1	2-1/2	540967	540968	540969	541156	541157	541158
7/16	7/16	5/8	2-1/2	540970	540971	540972	541159	541160	541161
		1	2-1/2	540832	540833	540834	540880	540881	540882
		2	4	540973	540974	540975	541162	541163	541164
29/64	1/2	1	3	541282	--	541283	541304	--	541305
15/32	1/2	1	3	540976	540977	540978	541165	541166	541167
31/64	1/2	1	3	540979	540980	540981	541168	541169	541170
1/2	1/2	5/8	2-1/2	540982	540983	540984	541171	541172	541173
		1	3	540835	540836	540837	540883	540884	540885
		1-1/4 2 3	3 4 6	540985 541284 541336	540986 -- --	540987 541285 541337	541174 541306 541368	541175 -- --	541176 541307 541369
33/64	9/16	1-1/4	3-1/2	540988	540989	540990	541177	541178	541179
17/32	9/16	1-1/4	3-1/2	540991	540992	540993	541180	541181	541182
35/64	9/16	1-1/4	3-1/2	540994	540995	540996	541183	541184	541185
9/16	9/16	1-1/4	3-1/2	540997	540998	540999	541186	541187	541188
37/64	5/8	1-1/4	3-1/2	541000	541001	541002	541189	541190	541191
19/32	5/8	1-1/4	3-1/2	541003	541004	541005	541192	541193	541194
39/64	5/8	1-1/4	3-1/2	541006	541007	541008	541195	541196	541197
5/8	5/8	3/4	3	540838	540839	540840	540886	540887	540888
		1-1/4 2-1/4	3-1/2 5	541009 541288	541010 --	541011 541289	541198 541310	541199 --	541200 541311
		3	6	541340	--	541341	541372	--	541373
41/64	3/4	1-1/2	4	541012	541013	541014	541201	541202	541203
21/32	3/4	1-1/2	4	541015	541016	541017	541204	541205	541206
43/64	3/4	1-1/2	4	541018	541019	541020	541207	541208	541209
11/16	3/4	1-1/2	4	541021	541022	541023	541210	541211	541212
45/64	3/4	1-1/2	4	541024	541025	#N/A	541213	541214	541215
23/32	3/4	1-1/2	4	541027	541028	541029	541216	541217	541218
47/64	3/4	1-1/2	4	541030	541031	541032	541219	541220	541221

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- Uncoated & TiALN Coated
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- Slotting, Ramping
- Profiling

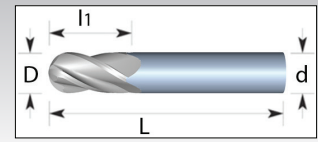


Ball Nose - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
3/4	3/4	1	3	540841	540842	540843	540889	540890	540891
		1-1/2	4	541033	541034	541035	541222	541223	541224
		2-1/4	5	541290	--	541291	541312	--	541313
		3	6	541342	--	541343	541374	--	541375
49/64	7/8	1-1/2	4	541036	541037	541038	541225	541226	541227
25/32	7/8	1-1/2	4	541039	541040	541041	541228	541229	541230
51/64	7/8	1-1/2	4	541042	541043	541044	541231	541232	541233
13/16	7/8	1-1/2	4	541045	541046	541047	541234	541235	541236
53/64	7/8	1-1/2	4	541048	541049	541050	541237	541238	541239
27/32	7/8	1-1/2	4	541051	541052	541053	541240	541241	541242
55/64	7/8	1-1/2	4	541054	541055	541056	541243	541244	541245
7/8	7/8	1-1/2	4	541057	541058	541059	541246	541247	541248
57/64	1	1-1/2	4	541060	541061	541062	541249	541250	541251
29/32	1	1-1/2	4	541063	541064	541065	541252	541253	541254
59/64	1	1-1/2	4	541066	541067	541068	541255	541256	541257
15/16	1	1-1/2	4	541069	541070	541071	541258	541259	541260
61/64	1	1-1/2	4	541072	541073	541074	541261	541262	541263
31/32	1	1-1/2	4	541075	541076	541077	541264	541265	541266
63/64	1	1-1/2	4	541078	541079	541080	541267	541268	541269
1	1	1	3	540808	540809	540810	540856	540857	540858
		1-1/2	4	540907	540908	540909	541096	541097	541098
		2-1/4	5	541270	--	541271	541292	--	541293
		3	6	541314	--	541315	541346	--	541347

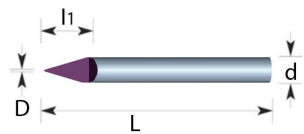
P	●	Steel
M	⊖	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S		High Temp. Alloys
H		Hardened Steel

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- 2 & 4 Flute
- Single End
- Round Shanks
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- Metric Sizes
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- Uncoated & TiALN Coated
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- Slotting, Ramping
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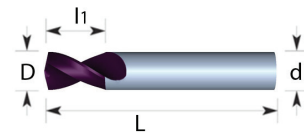


Ball Nose - Metric									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1	1	3	38	541750	--	541751	541794	--	541795
1.5	2	5	38	541752	--	541753	541796	--	541797
2	2	6	38	541754	--	541755	541798	--	541799
3	3	12	38	541758	--	541759	541802	--	541803
3.5	4	12	50	541760	--	541761	541804	--	541805
4	4	14	50	541762	--	541763	541806	--	541807
4.5	5	14	50	541764	--	541765	541808	--	541809
5	5	16	50	541766	--	541767	541810	--	541811
6	6	19	63	541768	--	541769	541812	--	541813
7	7	19	63	541770	--	541771	541814	--	541815
8	8	19	63	541772	--	541773	541816	--	541817
9	9	22	70	541774	--	541775	541818	--	541819
10	10	22	70	541776	--	541777	541820	--	541821
11	11	25	70	541778	--	541779	541822	--	541823
12	12	25	75	541780	--	541781	541824	--	541825
14	14	30	88	541782	--	541783	541826	--	541827
16	16	32	88	541784	--	541785	541828	--	541829
18	18	36	100	541786	--	541787	541830	--	541831
20	20	38	100	541788	--	541789	541832	--	541833
22	25	38	100	541790	--	541791	541834	--	541835
25	25	38	100	541792	--	541793	541836	--	541837



- Engraving Tools with 30 Degree angle
- 3 tip sizes to choose from

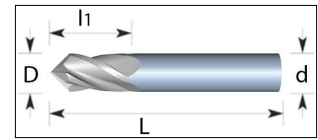
Engraving Tools				
Tip D	Shank d	LOC l1	Overall L	TiALN 1 Flute
.005	1/4	1/2	2-1/2	542510
.010	1/4	1/2	2-1/2	542511
.020	1/4	1/2	2-1/2	542512



- Allows High Performance drills to center properly without damaging their outside edge
- 145 Degree Point Carbide with honed edges

Spot Drills				
Drill D	Shank d	LOC l1	Overall L	TiALN 2 Flute
1/4	1/4	1/2	3	542513
3/8	3/8	3/4	3	542514
1/2	1/2	1	4	542515
5/8	5/8	1	4	542516
3/4	3/4	1-1/8	4	542517

- 90 Degree End
- 2 & 4 Flute
- Single End
- Round Shanks
- Center Cutting
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Milling, Drilling
- Countersinking
- Chamfering, De-burring

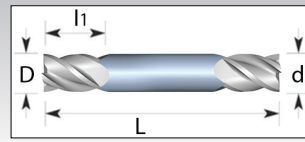


Drill/Mill 90 Degree - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1/8	1/8	1/2	1-1/2	541918	--	541919	541936	--	541937
3/16	3/16	5/8	2	541920	--	541921	541938	--	541939
1/4	1/4	3/4	2-1/2	541922	--	541923	541940	--	541941
5/16	5/16	7/8	2-1/2	541924	--	541925	541942	--	541943
3/8	3/8	1	2-1/2	541926	--	541927	541944	--	541945
7/16	7/16	1	2-3/4	541928	--	541929	541946	--	541947
1/2	1/2	1	3	541930	--	541931	541948	--	541949
5/8	5/8	1-1/4	3-1/2	541932	--	541933	541950	--	541951
3/4	3/4	1-1/2	4	541934	--	541935	541952	--	541953

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N	○	Non-Ferrous
S		High Temp. Alloys
H		Hardened Steel

● GOOD ◐ OK ○ NOT OPTIMAL

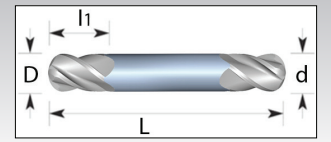
- Square End
- 2 & 4 Flute
- Double End
- 1/32-7/32 Round Shanks
- 1/4-3/4 Weldon Shanks
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



P	●	Steel
M	◐	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S		High Temp. Alloys
H		Hardened Steel

● GOOD ◐ OK ○ NOT OPTIMAL

- Ball Nose End
- 2 & 4 Flute
- Double End
- 1/32-7/32 Round Shanks
- 1/4-3/4 Weldon Shanks
- Fractional Sizes
- General Purpose
- Micrograin Carbide
- Uncoated & TiALN Coated
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



Square Double End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1/32	1/8	1/16	1-1/2	541378	--	541379	541414	--	541415
3/64	1/8	3/32	1-1/2	541380	--	541381	541416	--	541417
1/16	1/8	1/8	1-1/2	541382	--	541383	541418	--	541419
3/32	1/8	3/16	1-1/2	541384	--	541385	541420	--	541421
7/64	1/8	7/32	1-1/2	541386	--	541387	541422	--	541423
1/8	1/8	1/4	1-1/2	541388	--	541389	541424	--	541425
5/32	3/16	5/16	2	541390	--	541391	541426	--	541427
		7/16	3	541522	--	541523	541546	--	541547
3/16	3/16	5/16	2	541392	--	541393	541428	--	541429
		1/2	3	541524	--	541525	541548	--	541549
7/32	1/4	3/8	2-1/2	541394	--	541395	541430	--	541431
		9/16	4	541526	--	541527	541550	--	541551
1/4	1/4	1/2	2-1/2	541396	--	541397	541432	--	541433
		5/8	4	541528	--	541529	541552	--	541553
9/32	5/16	1/2	2-1/2	541398	--	541399	541434	--	541435
5/16	5/16	1/2	2-1/2	541400	--	541401	541436	--	541437
		3/4	4	541530	--	541531	541554	--	541555
3/8	3/8	9/16	2-1/2	541402	--	541403	541438	--	541439
		3/4	4	541534	--	541535	541558	--	541559
7/16	1/2	9/16	2-3/4	541404	--	541405	541440	--	541441
		7/8	4	541536	--	541537	541560	--	541561
1/2	1/2	5/8	3	541406	--	541407	541442	--	541443
		1	4	541538	--	541539	541562	--	541563
9/16	5/8	11/16	3-1/2	541408	--	541409	541444	--	541445
5/8	5/8	11/16	3-1/2	541410	--	541411	541446	--	541447
		1-1/2	6	541542	--	541543	541566	--	541567
3/4	3/4	7/8	4	541412	--	541413	541448	--	541449
		1-1/2	6	541544	--	541545	541568	--	541569

Ball Nose Double End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	Uncoated			TiALN		
				2 Flute	3 Flute	4 Flute	2 Flute	3 Flute	4 Flute
1/32	1/8	1/16	1-1/2	541450	--	541451	541486	--	541487
3/64	1/8	3/32	1-1/2	541452	--	541453	541488	--	541489
1/16	1/8	1/8	1-1/2	541454	--	541455	541490	--	541491
3/32	1/8	3/16	1-1/2	541456	--	541457	541492	--	541493
7/64	1/8	7/32	1-1/2	541458	--	541459	541494	--	541495
1/8	1/8	1/4	1-1/2	541460	--	541461	541496	--	541497
5/32	3/16	5/16	2	541462	--	541463	541498	--	541499
		7/16	3	541570	--	541571	541594	--	541595
3/16	3/16	5/16	2	541464	--	541465	541500	--	541501
		1/2	3	541572	--	541573	541596	--	541597
7/32	1/4	3/8	2-1/2	541466	--	541467	541502	--	541503
		9/16	4	541574	--	541575	541598	--	541599
1/4	1/4	1/2	2-1/2	541468	--	541469	541504	--	541505
		5/8	4	541576	--	541577	541600	--	541601
9/32	5/16	1/2	2-1/2	541470	--	541471	541506	--	541507
5/16	5/16	1/2	2-1/2	541472	--	541473	541508	--	541509
		3/4	4	541578	--	541579	541602	--	541603
3/8	3/8	9/16	2-1/2	541474	--	541475	541510	--	541511
		3/4	4	541582	--	541583	541606	--	541607
7/16	1/2	9/16	2-3/4	541476	--	541477	541512	--	541513
		7/8	4	541584	--	541585	541608	--	541609
1/2	1/2	5/8	3	541478	--	541479	541514	--	541515
		1	4	541586	--	541587	541610	--	541611
9/16	5/8	11/16	3-1/2	541480	--	541481	541516	--	541517
5/8	5/8	11/16	3-1/2	541482	--	541483	541518	--	541519
		1-1/2	6	541590	--	541591	541614	--	541615
3/4	3/4	7/8	4	541484	--	541485	541520	--	541521
		1-1/2	6	541592	--	541593	541616	--	541617

HIGH PERFORMANCE

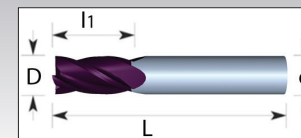
Speeds & Feeds

Material Classification	Speed SFM	Feed Per Tooth By End Mill Diameter (IPT)							
		1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
Aluminum Alloys & Aluminum	900-1800	.0025	.0030	.0035	.0040	.0045	.0055	.0065	.0085
Copper Alloys & Copper	525-1275	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0065
Bronze & Brass	375-600	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0055
Graphite	--	--	--	--	--	--	--	--	--
Plastics	--	--	--	--	--	--	--	--	--
Softer Cast Iron	375-650	.0025	.0027	.0030	.0032	.0035	.0040	.0065	.0085
Harder Cast Iron	100-375	.0013	.0015	.0020	.0022	.0025	.0030	.0035	.0045
Ductile Iron	100-600	.0015	.0017	.0020	.0022	.0025	.0035	.0045	.0065
Malleable Iron	225-650	.0015	.0020	.0025	.0030	.0035	.0045	.0055	.0075
Low Carbon Steels (1020 & Under)	300-600	.0015	.0020	.0025	.0030	.0035	.0045	.0055	.0075
Medium Carbon Steels (1030-1060)	150-375	.0020	.0021	.0022	.0023	.0025	.0035	.0045	.0055
Alloy Steels Hardened to 35 Rc	130-345	.0015	.0016	.0017	.0018	.0020	.0022	.0025	.0035
Alloy Steels Hardened to 40-50 Rc	70-160	.0012	.0012	.0013	.0014	.0015	.0020	.0025	.0035
Die Steels Hardened to 51-60 Rc	--	--	--	--	--	--	--	--	--
Tool Steels	150-375	.0015	.0017	.0020	.0022	.0025	.0030	.0035	.0045
Mold Steels	300-525	.0015	.0017	.0020	.0022	.0025	.0030	.0035	.0045
Softer Stainless Steels	300-450	.0015	.0017	.0020	.0017	.0025	.0035	.0045	.0065
Harder Stainless Steels	150-300	.0010	.0011	.0012	.0013	.0015	.0025	.0035	.0055
Monel & High Nickel Steel	75-200	.0015	.0017	.0020	.0021	.0025	.0030	.0035	.0045
Softer Titanium	125-375	.0015	.0017	.0020	.0021	.0025	.0035	.0045	.0065
Harder Titanium	50-175	.0010	.0011	.0012	.0012	.0014	.0017	.0022	.0023
Nickel Based High Temp Alloys	50-125	.0013	.0012	.0011	.0011	.0014	.0015	.0017	.0023

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

● BETTER ○ OK ○ NOT OPTIMAL

- Square & Corner Radius End
- 4 Flute TiAlN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- High Performance
- Micrograin Carbide
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping
- Profiling

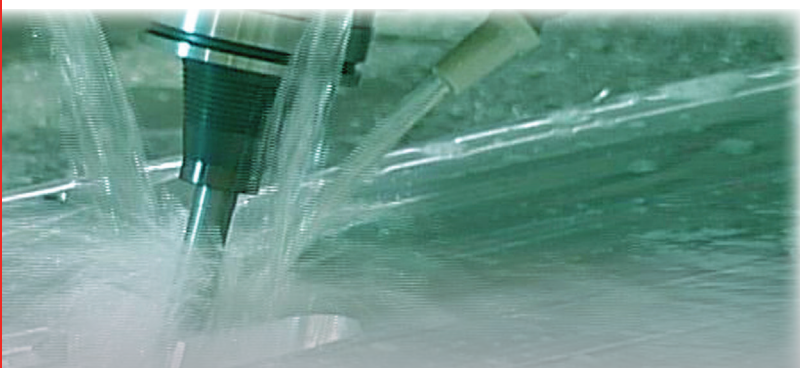


Square & Corner Radius End - Fractional

Cutter D	Shank d	LOC l1	Overall L	End Face	TiAlN		
					4 Flute Round Shank	4 Flute Weldon Shank	5 Flute Round Shank
1/8	1/8	1/2	1-1/2	SQ	542520	--	--
		1/2	1-1/2	.010"R	542521	--	--
3/16	3/16	3/8	2	SQ	542448	--	--
		3/8	2	.015"R	542449	--	--
		5/8	2	SQ	542305	--	--
		5/8	2	.015"R	542306	--	--
		3/4	2-1/2	SQ	542354	--	--
		3/4	2-1/2	.015"R	542355	--	--
		1-1/8	3	SQ	542433	--	--
		1-1/8	3	.015"R	542523	--	--
1/4	1/4	3/8	2	SQ	542450	--	--
		3/8	2	.015"R	542451	--	--
		3/4	2-1/2	SQ	542307	542331	542540
		3/4	2-1/2	.020"R	542308	542332	542541
		1-1/8	3	SQ	542356	542379	542554
		1-1/8	3	.020"R	542357	542380	542555
		1-1/2	4	SQ	542434	--	542568
		1-1/2	4	.020"R	542524	--	542569
5/16	5/16	3/8	2	SQ	542452	--	--
		3/8	2	.020"R	542453	--	--
		13/16	2-1/2	SQ	542309	542333	542542
		13/16	2-1/2	.020"R	542310	542334	542543
		1-1/8	3	SQ	542358	542381	542556
		1-1/8	3	.020"R	542359	542382	542557
		1-5/8	4	SQ	542435	--	542570
		1-5/8	4	.020"R	542525	--	542571
3/8	3/8	1/2	2	SQ	542454	--	--
		1/2	2	.020"R	542455	--	--
		7/8	2-1/2	SQ	542311	542335	542544
		7/8	2-1/2	.020"R	542312	542336	542545
		1-1/8	3	SQ	542360	542383	542558
		1-1/8	3	.020"R	542361	542384	542559
		1-3/4	4	SQ	542436	--	542572
		1-3/4	4	.020"R	542526	--	542573
7/16	7/16	1	2-3/4	SQ	542314	542337	--
		2	4	SQ	542362	542385	--
1/2	1/2	5/8	2-1/2	SQ	542456	542462	--
		5/8	2-1/2	.030"R	542457	542463	--
		1-1/4	3	SQ	542315	542338	542546
		1-1/4	3	.015"R	542316	542339	--
		1-1/4	3	.030"R	542317	542340	542547
		1-1/4	3	.060"R	542318	542341	--

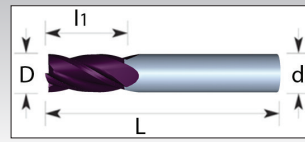
Note: These are guidelines only & the following points are important to consider:

- Higher Feed Per Tooth should be used to start for radial depths of cut less than 25% of the tool diameter.
- The above recommendations are for axial lengths of cut not to exceed 1.25 times the tool diameter for profiling and .75 times the diameter for full slotting.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Light Radial Depths of cut, make certain to increase the feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.



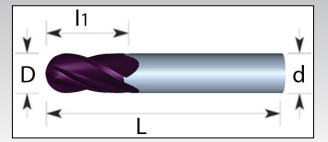
P	●	Steel
M	◐	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S	○	High Temp. Alloys
H	○	Hardened Steel

- Square & Corner Radius End
- 4 Flute TiAlN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- High Performance
- Micrograin Carbide
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



P	●	Steel
M	◐	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S	○	High Temp. Alloys
H	○	Hardened Steel

- Ball Nose End
- 4 Flute TiAlN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- High Performance
- Micrograin Carbide
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping
- Profiling



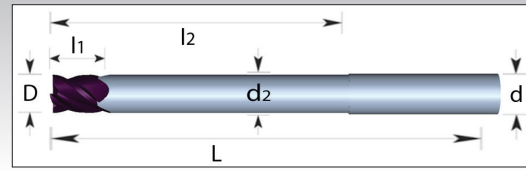
Square & Corner Radius End - Fractional								
Cutter D	Shank d	LOC l1	Overall L	End Face	TiAlN			
					4 Flute Round Shank	4 Flute Weldon Shank	5 Flute Round Shank	
1/2	1/2	2	4	SQ	542363	542386	542560	
		2	4	.015"R	542364	542387	--	
		2	4	.030"R	542365	542388	542561	
		2	4	.060"R	542366	542389	--	
		3	6	SQ	542437	--	542574	
		3	6	.030"R	542527	--	542575	
5/8	5/8	3/4	3	SQ	542458	542464	--	
		3/4	3	.030"R	542459	542465	--	
		1-1/4	3-1/2	SQ	542319	542342	542548	
		1-1/4	3-1/2	.030"R	542320	542343	542549	
		1-1/4	3-1/2	.060"R	542321	542344	--	
		1-1/4	3-1/2	.125"R	542322	542345	--	
		2-1/4	5	SQ	542367	542390	542562	
		2-1/4	5	.030"R	542368	542391	542563	
		2-1/4	5	.060"R	542369	542392	--	
		2-1/4	5	.125"R	542370	542393	--	
		3	6	SQ	542438	--	542576	
		3	6	.030"R	542528	--	542577	
3/4	3/4	1	3	SQ	542460	542466	--	
		1	3	.030"R	542461	542467	--	
		1-1/2	4	SQ	542323	542346	542550	
		1-1/2	4	.030"R	542324	542347	542551	
		1-1/2	4	.060"R	542325	542348	--	
		1-1/2	4	.125"R	542326	542349	--	
		2-1/4	5	SQ	542371	542394	542564	
		2-1/4	5	.030"R	542372	542395	542565	
		2-1/4	5	.060"R	542373	542396	--	
		2-1/4	5	.125"R	542374	542397	--	
		3	6	SQ	542439	--	542578	
		3	6	.030"R	542529	--	542579	
1	1	1-1/2	4	SQ	542301	542327	542538	
		1-1/2	4	.030"R	542302	542328	542539	
		1-1/2	4	.060"R	542303	542329	--	
		1-1/2	4	.125"R	542304	542330	--	
		2-1/4	5	SQ	542350	542375	542552	
		2-1/4	5	.030"R	542351	542376	542553	
		2-1/4	5	.060"R	542352	542377	--	
		2-1/4	5	.125"R	542353	542378	--	
		3	6	SQ	542432	--	542566	
		3	6	.030"R	542522	--	542567	

Ball Nose - Fractional								
Cutter D	Shank d	LOC l1	Overall L	End Face	TiAlN			
					4 Flute Round Shank	4 Flute Weldon Shank		
3/16	3/16	5/8	2	BN	542399	--		
		3/4	2-1/2	BN	542416	--		
		1-1/8	3	BN	542441	--		
1/4	1/4	3/4	2-1/2	BN	542400	542408		
		1-1/8	3	BN	542417	542425		
		1-1/2	4	BN	542442	--		
5/16	5/16	13/16	2-1/2	BN	542401	542409		
		1-1/8	3	BN	542418	542426		
		1-5/8	4	BN	542443	--		
3/8	3/8	7/8	2-1/2	BN	542402	542410		
		1-1/8	3	BN	542419	542427		
		1-3/4	4	BN	542444	--		
7/16	7/16	1	2-3/4	BN	542403	542411		
		2	4	BN	542420	542428		
		3	6	BN	542445	--		
1/2	1/2	1	3	BN	542404	542412		
		2	4	BN	542421	542429		
		3	6	BN	542445	--		
5/8	5/8	1-1/4	3-1/2	BN	542405	542413		
		2-1/4	5	BN	542422	542430		
		3	6	BN	542446	--		
3/4	3/4	1-1/2	4	BN	542406	542414		
		2-1/4	5	BN	542423	542431		
		3	6	BN	542447	--		
1	1	1-1/2	4	BN	542398	542407		
		2-1/4	5	BN	542415	542424		
		3	6	BN	542440	--		

Long Reach Neck Relief - Fractional								
Cutter D	Shank d	Neck d2	LOC l1	L.B.S l2	Overall L	End Face	TiAlN	
							4 Flute Round Shank	
3/16	3/16	.1775	3/8	2-1/2	4	SQ		542474
		.1775	3/8	2-1/2	4	.015"R		542475
		.1775	3/8	2-1/2	4	BN		542499
1/4	1/4	.2400	3/8	2-1/2	4	SQ		542476
		.2400	3/8	2-1/2	4	.015"R		542477
		.2400	3/8	2-1/2	4	BN		542500

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

- Long Reach & Neck Relieved
- Same design features as all ICEPICK HP End Mills
- Square, Corner Radius & Ball Nose
- 4 Flute TiAlN Coated
- Center Cutting, Fractional Sizes
- Long Reach with side wall clearance



Long Reach Neck Relief - Fractional							
Cutter D	Shank d	Neck d2	LOC l1	L.B.S l2	Overall L	End Face	TiAlN 4 Flute Round Shank
5/16	5/16	.3025	7/16	2-1/2	4	SQ	542478
		.3025	7/16	2-1/2	4	.015"R	542479
		.3025	7/16	2-1/2	4	BN	542501
3/8	3/8	.3650	1/2	2-1/2	4	SQ	542480
		.3650	1/2	2-1/2	4	.015"R	542481
		.3650	1/2	2-1/2	4	BN	542502
1/2	1/2	.4800	5/8	3	5	SQ	542482
		.4800	5/8	3	5	.020"R	542483
		.4800	5/8	3	5	BN	542503
		.4800	5/8	4	6	SQ	542485
		.4800	5/8	4	6	.020"R	542484
		.4800	5/8	4	6	BN	542504
5/8	5/8	.6050	3/4	3	5	SQ	542486
		.6050	3/4	3	5	.020"R	542487
		.6050	3/4	3	5	BN	542505
		.6050	3/4	4	6	SQ	542489
		.6050	3/4	4	6	.020"R	542488
		.6050	3/4	4	6	BN	542506
3/4	3/4	.7300	1	3	5	SQ	542490
		.7300	1	3	5	.020"R	542491
		.7300	1	3	5	BN	542507
		.7300	1	4	6	SQ	542494
		.7300	1	4	6	.020"R	542492
		.7300	1	4	6	BN	542508
		.7300	1	5	7	SQ	542495
		.7300	1	5	7	.020"R	542493
		.7300	1	5	7	BN	542509
1	1	.9800	1-1/4	3	5	SQ	542468
		.9800	1-1/4	3	5	.020"R	542469
		.9800	1-1/4	3	5	BN	542496
		.9800	1-1/4	4	6	SQ	542472
		.9800	1-1/4	4	6	.020"R	542470
		.9800	1-1/4	4	6	BN	542497
		.9800	1-1/4	5	7	SQ	542473
		.9800	1-1/4	5	7	.020"R	542471
		.9800	1-1/4	5	7	BN	542498



ULTRA HIGH PERFORMANCE

Speeds & Feeds

Material Classification	Speed	Feed Per Tooth By End Mill Diameter (IPT)								
	SFM	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"	
Aluminum Alloys & Aluminum	900-1800	.0025	.0030	.0035	.0040	.0045	.0055	.0065	.0085	
Copper Alloys & Copper	525-1275	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0065	
Bronze & Brass	375-600	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0055	
Graphite	--	--	--	--	--	--	--	--	--	
Plastics	--	--	--	--	--	--	--	--	--	
Softer Cast Iron	375-650	.0030	.0032	.0035	.0037	.0040	.0045	.0070	.0090	
Harder Cast Iron	100-375	.0018	.0020	.0025	.0027	.0030	.0035	.0040	.0050	
Ductile Iron	100-600	.0020	.0022	.0025	.0027	.0030	.0040	.0050	.0070	
Malleable Iron	225-650	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080	
Low Carbon Steels (1020 & Under)	300-600	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080	
Medium Carbon Steels (1030-1060)	150-375	.0025	.0026	.0027	.0028	.0030	.0040	.0050	.0060	
Alloy Steels Hardened to 35 Rc	130-345	.0020	.0021	.0022	.0023	.0025	.0027	.0030	.0040	
Alloy Steels Hardened to 40-50 Rc	70-160	.0012	.0012	.0013	.0014	.0015	.0026	.0030	.0035	
Die Steels Hardened to 51-60 Rc	--	--	--	--	--	--	--	--	--	
Tool Steels	150-375	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050	
Mold Steels	300-525	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050	
Softer Stainless Steels	300-450	.0020	.0022	.0025	.0022	.0030	.0040	.0050	.0070	
Harder Stainless Steels	150-300	.0015	.0016	.0017	.0018	.0020	.0030	.0040	.0060	
Monel & High Nickel Steel	75-200	.0015	.0022	.0025	.0027	.0030	.0035	.0040	.0050	
Softer Titanium	125-375	.0015	.0022	.0025	.0027	.0030	.0040	.0050	.0070	
Harder Titanium	50-175	.0010	.0016	.0017	.0018	.0020	.0022	.0026	.0030	
Nickel Based High Temp Alloys	50-125	.0014	.0014	.0015	.0016	.0017	.0018	.0020	.0023	

Note: These are guidelines only & the following points are important to consider:

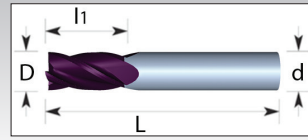
- Higher Feed Per Tooth should be used to start for radial depths of cut less than 25% of the tool diameter.
- The above recommendations are for axial lengths of cut not to exceed 1.5 times the tool diameter for profiling and 1 times the diameter for full slotting.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Light Radial Depths of cut, make certain to increase the feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.



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

● BEST ○ OK ○ NOT OPTIMAL

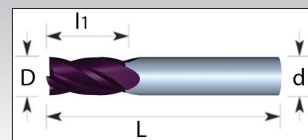
- Square & Corner Radius End
- 4 & 5 Flute TiALN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- Extreme Production
- Unique Polishing Process
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
- Ultra Premium Micrograin Carbide



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

● BEST ○ OK ○ NOT OPTIMAL

- Square & Corner Radius End
- 4 & 5 Flute TiALN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- Extreme Production
- Unique Polishing Process
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
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Square & Corner Radius End - Fractional

Cutter D	Shank d	LOC li	Overall L	End Face	TiALN		
					4 Flute Round Shank	4 Flute Weldon Shank	5 Flute Round Shank
1/8	1/8	1/2	1-1/2	SQ	540006	--	--
		1/2	1-1/2	.010"R	540007	--	--
3/16	3/16	3/8	2	SQ	540177	--	--
		3/8	2	.015"R	540178	--	--
		5/8	2	SQ	540009	--	--
		5/8	2	.015"R	540010	--	--
		3/4	2-1/2	SQ	540081	--	--
		3/4	2-1/2	.015"R	540082	--	--
		1-1/8	3	SQ	540161	--	--
		1-1/8	3	.015"R	542531	--	--
		3/8	2	SQ	540179	--	--
		3/8	2	.015"R	540180	--	--
1/4	1/4	3/4	2-1/2	SQ	540012	540053	540015
		3/4	2-1/2	.020"R	540014	540055	540016
		1-1/8	3	SQ	540083	540106	542582
		1-1/8	3	.020"R	540084	540107	542583
		1-1/2	4	SQ	540162	--	542596
		1-1/2	4	.020"R	542532	--	542597
		3/8	2	SQ	540181	--	--
		3/8	2	.020"R	540182	--	--
5/16	5/16	13/16	2-1/2	SQ	540017	540056	540019
		13/16	2-1/2	.020"R	540018	540057	540020
		1-1/8	3	SQ	540085	540108	542584
		1-1/8	3	.020"R	540086	540109	542585
		1-5/8	4	SQ	540163	--	542598
		1-5/8	4	.020"R	542533	--	542599
		1/2	2	SQ	540183	--	--
1/2	2	.020"R	540184	--	--		
3/8	3/8	7/8	2-1/2	SQ	540021	540058	540025
		7/8	2-1/2	.020"R	540023	540060	540026
		7/8	2-1/2	.030"R	540024	540061	--
		1-1/8	3	SQ	540087	540110	542586
		1-1/8	3	.020"R	540088	540111	542587
		1-3/4	4	SQ	540164	--	542600
		1-3/4	4	.020"R	542534	--	542601
		7/16	7/16	1	2-3/4	SQ	540028
7/16	7/16	2	4	SQ	540089	540112	
1/2	1/2	5/8	2-1/2	SQ	540185	540191	--
		5/8	2-1/2	.030"R	540186	540192	--
		1-1/4	3	SQ	540029	540063	540033
		1-1/4	3	.015"R	540030	540064	--
		1-1/4	3	.030"R	540031	540065	540034
		1-1/4	3	.060"R	540032	540066	--

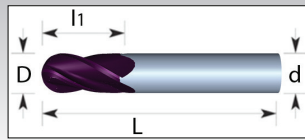
Square & Corner Radius End - Fractional

Cutter D	Shank d	LOC li	Overall L	End Face	TiALN		
					4 Flute Round Shank	4 Flute Weldon Shank	5 Flute Round Shank
1/2	1/2	2	4	SQ	540090	540113	542588
		2	4	.015"R	540091	540114	--
		2	4	.030"R	540092	540115	542589
		2	4	.060"R	540093	540116	--
		3	6	SQ	540165	--	542602
		3	6	.030"R	542535	--	542603
		3/4	3	SQ	540187	540193	--
		3/4	3	.030"R	540188	540194	--
		1-1/4	3-1/2	SQ	540035	540067	540039
		1-1/4	3-1/2	.030"R	540036	540068	540040
5/8	5/8	1-1/4	3-1/2	.060"R	540037	540069	--
		1-1/4	3-1/2	.125"R	540038	540070	--
		2-1/4	5	SQ	540094	540117	542590
		2-1/4	5	.030"R	540095	540118	542591
		2-1/4	5	.060"R	540096	540119	--
		2-1/4	5	.125"R	540097	540120	--
		3	6	SQ	540166	--	542604
		3	6	.030"R	542536	--	542605
		1	3	SQ	540189	540195	--
		1	3	.030"R	540190	540196	--
3/4	3/4	1-1/2	4	SQ	540041	540071	540045
		1-1/2	4	.030"R	540042	540073	540046
		1-1/2	4	.060"R	540043	540074	--
		1-1/2	4	.125"R	540044	540075	--
		2-1/4	5	SQ	540098	540121	542592
		2-1/4	5	.030"R	540099	540122	542593
		2-1/4	5	.060"R	540100	540123	--
		2-1/4	5	.125"R	540101	540124	--
		3	6	SQ	540167	--	542606
		3	6	.030"R	542537	--	542607
1	1	1-1/2	4	SQ	540000	540047	540004
		1-1/2	4	.030"R	540001	540048	540005
		1-1/2	4	.060"R	540002	540049	--
		1-1/2	4	.125"R	540003	540050	--
		2-1/4	5	SQ	540076	540102	542580
		2-1/4	5	.030"R	540077	540103	542581
		2-1/4	5	.060"R	540078	540104	--
		2-1/4	5	.125"R	540079	540105	--
		3	6	SQ	540160	--	542594
		3	6	.030"R	542530	--	542595

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

● BEST ○ OK ○ NOT OPTIMAL

- Ball Nose End
- 4 Flute TiALN Coated
- Variable Pitch, Reduces Chatter
- Round & Weldon Shanks
- Center Cutting
- Fractional Sizes
- Extreme Production
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Ball Nose - Fractional						
Cutter D	Shank d	LOC l1	Overall L	End Face	TiALN	
					4 Flute Round Shank	4 Flute Weldon Shank
3/16	3/16	5/8	2	BN	540127	--
		3/4	2-1/2	BN	540144	--
		1-1/8	3	BN	540170	--
1/4	1/4	3/4	2-1/2	BN	540128	540136
		1-1/8	3	BN	540145	540153
		1-1/2	4	BN	540171	--
5/16	5/16	13/16	2-1/2	BN	540129	540137
		1-1/8	3	BN	540146	540154
		1-5/8	4	BN	540172	--
3/8	3/8	7/8	2-1/2	BN	540130	540138
		1-1/8	3	BN	540147	540155
		1-3/4	4	BN	540173	--
7/16	7/16	1	2-3/4	BN	540131	540139
		2	4	BN	540148	540156
1/2	1/2	1	3	BN	540132	540140
		2	4	BN	540149	540157
		3	6	BN	540174	--
5/8	5/8	1-1/4	3-1/2	BN	540133	540141
		2-1/4	5	BN	540150	540158
		3	6	BN	540175	--
3/4	3/4	1-1/2	4	BN	540134	540142
		2-1/4	5	BN	540151	540159
		3	6	BN	540176	--
1	1	1-1/2	4	BN	540125	540135
		2-1/4	5	BN	540143	540152
		3	6	BN	540168	--

A Complete Range Of Tools For High Efficiency Milling (HEM), Dynamic And Trochoidal Milling

- Square & Corner Radius End
- 5, 6 & 7 Flute ALL4 Coated
- Variable Pitch, Reduces Chatter
- Round Shanks
- Center Cutting, Fractional Sizes
- Trochoidal & Dynamic Milling

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

● BEST ○ OK ○ NOT OPTIMAL

- HEM (High Efficiency Milling)
- Chipbreakers Available
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
- Ultra Premium Micrograin Carbide

Finisher



Chipbreaker



NEW!

Use On-Size Hydraulic Holders, Precision Collet Chucks, Milling chucks, or Shrink Fit Holders for best tool performance!

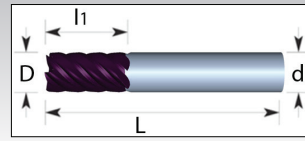
ULTRA HIGH PERFORMANCE

TALON

P	●	Steel
M	●	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S	●	High Temp. Alloys
H	⊖	Hardened Steel

● BEST ○ OK ○ NOT OPTIMAL

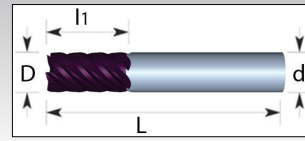
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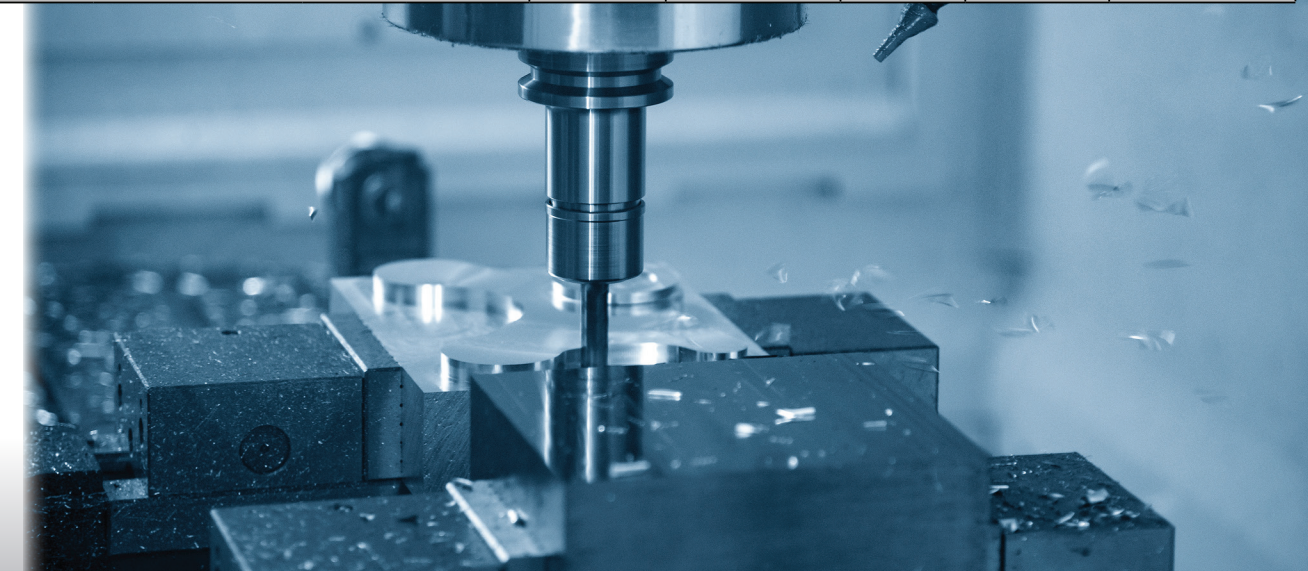
● BEST ○ OK ○ NOT OPTIMAL

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HEM Square & Corner Radius End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	End Face	ALL4				
					5 Flute	5 Flute Chipbreaker	6 Flute	7 Flute	7 Flute Chipbreaker
1/4	1/4	3/4	2-1/2	SQ	542608	--	540199	--	--
		3/4	2-1/2	.015CR	542609	--	--	--	--
		3/4	2-1/2	.030CR	542610	--	540200	--	--
		1-1/8	3	SQ	542611	--	--	--	--
		1-1/8	3	.015CR	542612	--	--	--	--
		1-1/8	3	.030CR	542613	--	--	--	--
5/16	5/16	13/16	2-1/2	SQ	542614	--	--	--	--
		13/16	2-1/2	.015CR	542615	--	--	--	--
		13/16	2-1/2	.030CR	542616	--	--	--	--
		1-1/4	3	SQ	542617	--	--	--	--
		1-1/4	3	.015CR	542618	--	--	--	--
		1-1/4	3	.030CR	542619	--	--	--	--
		2-1/8	4	SQ	542620	--	--	--	--
		2-1/8	4	.015CR	542621	--	--	--	--
3/8	3/8	1	2-1/2	SQ	542623	542638	540201	542632	542647
		1	2-1/2	.015CR	542624	542639	--	542633	542648
		1	2-1/2	.030CR	542625	542640	540202	542634	542649
		1-1/4	3	SQ	542626	542641	--	542635	542650
		1-1/4	3	.015CR	542627	542642	--	542636	542651
		1-1/4	3	.030CR	542628	542643	--	542637	542652
		2-1/8	4	SQ	542629	542644	--	--	--
		2-1/8	4	.015CR	542630	542645	--	--	--
		2-1/8	4	.030CR	542631	542646	--	--	--
		1/2	1/2	1-1/4	3	SQ	542653	542685	540203
1-1/4	3			.015CR	542654	542686	--	542670	542702
1-1/4	3			.030CR	542655	542687	540204	542671	542703
1-1/4	3			.060CR	542656	542688	--	542672	--
2-1/8	4			SQ	542657	542689	--	542673	542704
2-1/8	4			.015CR	542658	542690	--	542674	542705
2-1/8	4			.030CR	542659	542691	--	542675	542706
2-1/8	4			.060CR	542660	542692	--	542676	--
2-5/8	5			SQ	542661	542693	--	542677	542707
2-5/8	5			.015CR	542662	542694	--	542678	542708
2-5/8	5			.030CR	542663	542695	--	542679	542709
2-5/8	5			.060CR	542664	542696	--	542680	--
3-1/4	6			SQ	542665	542697	--	542681	542710
3-1/4	6			.015CR	542666	542698	--	542682	542711
3-1/4	6			.030CR	542667	542699	--	542683	542712
3-1/4	6			.060CR	542668	542700	--	542684	--

HEM Square & Corner Radius End - Fractional									
Cutter D	Shank d	LOC l1	Overall L	End Face	ALL4				
					5 Flute	5 Flute Chipbreaker	6 Flute	7 Flute	7 Flute Chipbreaker
5/8	5/8	1-1/2	3-1/2	SQ	542713	542731	540205	542722	542740
		1-1/2	3-1/2	.030CR	542714	542732	540206	542723	542741
		1-1/2	3-1/2	.060CR	542715	542733	--	542724	--
		2-1/2	5	SQ	542716	542734	--	542725	542742
		2-1/2	5	.030CR	542717	542735	--	542726	542743
		2-1/2	5	.060CR	542718	542736	--	542727	--
		3-1/4	6	SQ	542719	542737	--	542728	542744
		3-1/4	6	.030CR	542720	542738	--	542729	542745
		3-1/4	6	.060CR	542721	542739	--	542730	--
		3/4	3/4	1-1/2	4	SQ	542746	542764	540207
1-1/2	4			.030CR	542747	542765	540208	542756	542771
1-1/2	4			.060CR	542748	--	--	542757	--
2-1/2	5			SQ	542749	542766	--	542758	542772
2-1/2	5			.030CR	542750	542767	--	542759	542773
2-1/2	5			.060CR	542751	--	--	542760	--
3-1/4	6			SQ	542752	542768	--	542761	542774
3-1/4	6			.030CR	542753	542769	--	542762	542775
3-1/4	6			.060CR	542754	--	--	542763	--
1	1			1-1/2	4	SQ	542776	542794	540197
		1-1/2	4	.030CR	542777	542795	540198	542786	542801
		1-1/2	4	.060CR	542778	--	--	542787	--
		2-5/8	5	SQ	542779	542796	--	542788	542802
		2-5/8	5	.030CR	542780	542797	--	542789	542803
		2-5/8	5	.060CR	542781	--	--	542790	--
		3-1/4	6	SQ	542782	542798	--	542791	542804
		3-1/4	6	.030CR	542783	542799	--	542792	542805
		3-1/4	6	.060CR	542784	--	--	542793	--



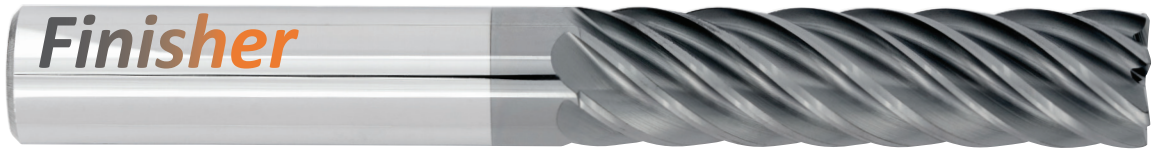
ULTRA HIGH PERFORMANCE

HEM Speeds & Feeds

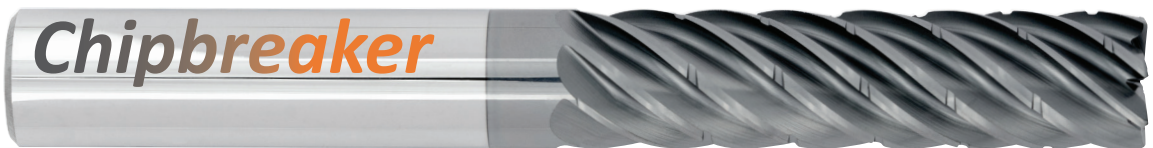
Material Classification	Speed SFM	Feed Per Tooth By End Mill Diameter (IPT)							
		1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
Softer Cast Iron	375-950	.0030	.0032	.0035	.0037	.0040	.0045	.0070	.0090
Harder Cast Iron	150-475	.0018	.0020	.0025	.0027	.0030	.0035	.0040	.0050
Ductile Iron	200-900	.0020	.0022	.0025	.0027	.0030	.0040	.0050	.0070
Malleable Iron	275-850	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080
Low Carbon Steels (1020 & Under)	350-900	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080
Medium Carbon Steels (1030-1060)	200-675	.0025	.0026	.0027	.0028	.0030	.0040	.0050	.0060
Alloy Steels Hardened to 35 Rc	190-545	.0020	.0021	.0022	.0023	.0025	.0027	.0030	.0040
Alloy Steels Hardened to 40-50 Rc	90-275	.0012	.0012	.0013	.0014	.0015	.0026	.0030	.0035
Die Steels Hardened to 51-60 Rc	--	--	--	--	--	--	--	--	--
Tool Steels	175-525	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Mold Steels	300-725	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Softer Stainless Steels	300-520	.0020	.0022	.0025	.0022	.0030	.0040	.0050	.0070
Harder Stainless Steels	150-475	.0015	.0016	.0017	.0018	.0020	.0030	.0040	.0060
Monel & High Nickel Steel	75-250	.0015	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Softer Titanium	125-425	.0015	.0022	.0025	.0027	.0030	.0040	.0050	.0070
Harder Titanium	50-195	.0010	.0016	.0017	.0018	.0020	.0022	.0026	.0030
Nickel Based High Temp Alloys	50-175	.0014	.0014	.0015	.0016	.0017	.0018	.0020	.0023

Note: These are guidelines only & the following points are important to consider:

- High Efficiency Milling (HEM) utilizes high axial depths of cut with low radial depths of cut. Make certain to increase the programmed feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.



- Finisher design provides the best surface finish
- Use when chip management isn't an issue such as periphery milling applications



- Chipbreaker design allows for chip size management
- With managed chip sizes, chip augers and conveyors are kept clean
- Chips are easily flushed or blown away from being re-cut & damaging the tool
- Excellent for slotting & pocketing applications



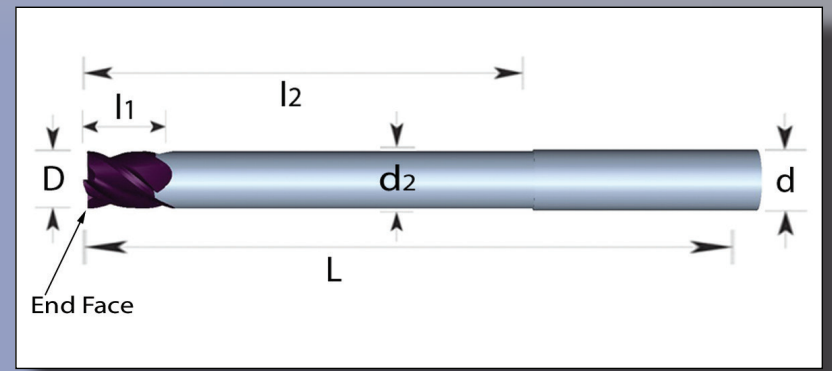
Premium Carbide Custom Order

End Face:

- Square
- Ball Nose
- Corner Radius Size: _____
- Chamfer Size: _____

Dimensions:

- L - Overall Length (OAL): _____
- d - Shank Diameter: _____
- l1 - Length of Cut (LOC): _____
- D - Tool Diameter: _____
- Number of Flutes: _____



Shank:

- Round
- Weldon Flat

Coating:

- Uncoated
- TiALN (Titanium Aluminum Nitride)
- ZrN (Zirconium Nitride)
- DLC (Diamond Like Carbon)

Neck Relief: Optional

- No
- Yes
- d2 - Neck Relief Diameter: _____
- l2 - Length below Shank (LBS): _____

Tapered:

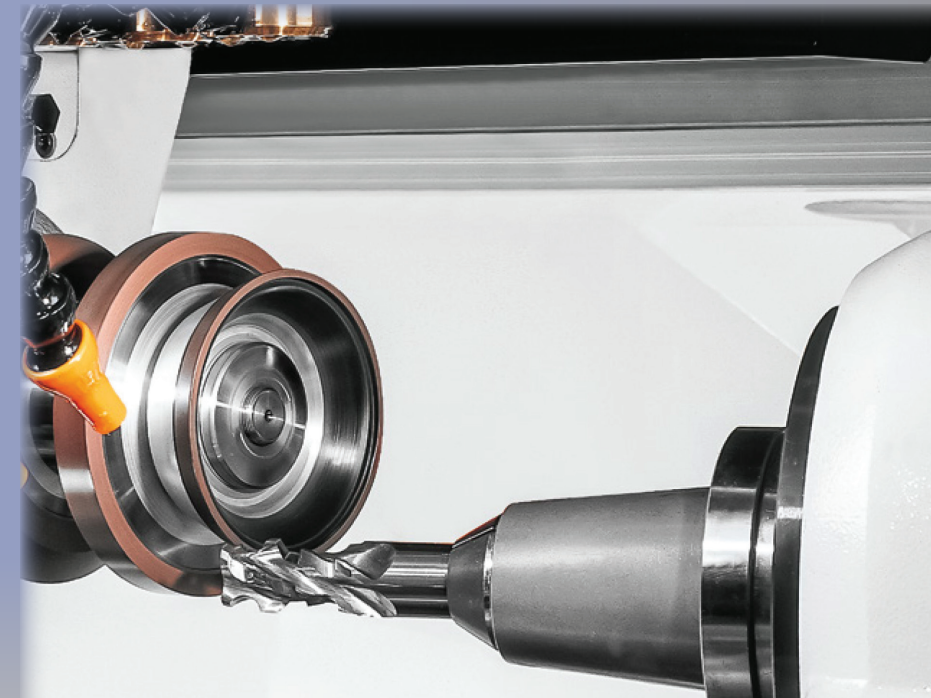
- No
- Yes
- Taper Angle Per Side: _____
- D - Tip Diameter: _____

Special Minimum Order Quantities

Tool Diameter Range	Minimum Order Qty.
Under 3/16" (4mm)	Not Available
3/16"-1/4" (4mm-6mm)	20
5/16"-3/8" (7mm-10mm)	15
7/16"-1/2" (11mm-12mm)	10
9/16"-3/4" (13mm-20mm)	5
7/8"-1" (25mm)	3

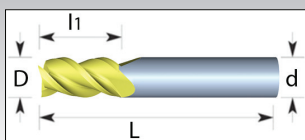
Series:

- GENERAL PURPOSE
- HIGH PERFORMANCE
- ULTRA HIGH PERFORMANCE
- ALUMINUM



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

- Square & Corner Radius End
- 3 Flute Uncoated & ZrN
- Variable Pitch, Reduces Chatter
- Round Shanks, Center Cutting
- With or Without Chipbreakers
- Fractional Sizes
- 36 Degree Helix
- Unique Polishing Process
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
- Ultra Premium Micrograin Carbide

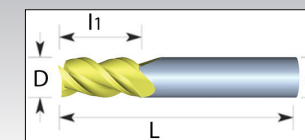


Square & Corner Radius - 3 Flute Medium/Roughing

Cutter D	Shank d	LOC l1	Overall L	End Face	Uncoated		ZrN	
					3 Flute	Chipbreaker	3 Flute	Chipbreaker
1/4	1/4	3/4	2-1/2	SQ	542214	--	542265	--
		3/4	2-1/2	.015CR	542215	--	542266	--
		3/4	2-1/2	.030CR	542217	--	--	--
		3/4	2-1/2	.060CR	542218	--	--	--
5/16	5/16	13/16	2-1/2	SQ	542220	--	542269	--
		13/16	2-1/2	.030CR	542221	--	542270	--
		13/16	2-1/2	.060CR	542222	--	--	--
3/8	3/8	1	2-1/2	SQ	542223	--	542271	--
		1	2-1/2	.030CR	542224	542226	542272	542273
		1	2-1/2	.060CR	542225	--	--	--
		1-1/8	3	SQ	542227	--	542274	--
		1-1/8	3	.030CR	542228	542229	542275	542276
1/2	1/2	1-1/4	3	SQ	542230	--	542277	--
		1-1/4	3	.030CR	542231	542235	542278	542279
		1-1/4	3	.060CR	542232	--	--	--
		1-1/4	3	.090CR	542233	--	--	--
		1-1/4	3	.120CR	542234	--	--	--
		2	4	SQ	542236	--	542280	--
		2	4	.030CR	542237	542238	542281	542282
5/8	5/8	1-1/4	3-1/2	SQ	542239	--	542283	--
		1-1/4	3-1/2	.030CR	542240	542244	542284	542285
		1-1/4	3-1/2	.060CR	542241	--	--	--
		1-1/4	3-1/2	.090CR	542242	--	--	--
		1-1/4	3-1/2	.120CR	542243	--	--	--
		2-1/4	5	SQ	542245	--	542286	--
		2-1/4	5	.030CR	542246	542247	542287	542288
3/4	3/4	1-5/8	4	SQ	542248	--	542289	--
		1-5/8	4	.030CR	542249	542253	542290	542291
		1-5/8	4	.060CR	542250	--	--	--
		1-5/8	4	.090CR	542251	--	--	--
		1-5/8	4	.120CR	542252	--	--	--
		2-1/4	5	SQ	542254	--	542292	--
1	1	2-1/4	5	.030CR	542255	542256	542293	542294
		1-1/2	4	SQ	542257	--	542295	--
		1-1/2	4	.030CR	542258	542261	542296	542297
		1-1/2	4	.060CR	542259	--	--	--
		1-1/2	4	.120CR	542260	--	--	--
		2-1/4	5	SQ	542262	--	542298	--
		2-1/4	5	.030CR	542263	542264	542299	542300

P	Steel
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S	High Temp. Alloys
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- Square & Corner Radius End
- 2 & 3 Flute Uncoated, ZrN & DLC
- Variable Pitch, Reduces Chatter
- Round Shanks
- Center Cutting
- Fractional Sizes
- 45 Degree Helix
- Unique Polishing Process
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
- Ultra Premium Micrograin Carbide



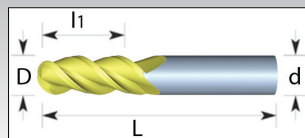
Square & Corner Radius - 2 & 3 Flute Medium/Finishing

Cutter D	Shank d	LOC l1	Overall L	End Face	Uncoated		ZrN		DLC	
					2 Flute	3 Flute	2 Flute	3 Flute	2 Flute	3 Flute
1/8	1/8	1/2	1-1/2	SQ	542072	542073	--	--	--	--
3/16	3/16	5/8	2	SQ	542074	542076	541958	541960	542188	542189
		3/4	2-1/2	SQ	542106	542107	541990	541991	--	--
1/4	1/4	1-1/8	3	SQ	542154	542155	542038	542039	--	--
		3/4	2-1/2	SQ	542077	542079	541961	541963	542190	542192
		3/4	2-1/2	.020"R	542078	542080	541962	541964	542191	542193
		1-1/8	3	SQ	542108	542109	541992	541993	--	--
5/16	5/16	1-1/2	4	SQ	542156	542157	542040	542041	--	--
		13/16	2-1/2	SQ	542082	542084	541966	541968	542194	542196
		13/16	2-1/2	.020"R	542083	542086	541967	541970	542195	542197
		1-1/8	3	SQ	542110	542111	541994	541995	--	--
		1-5/8	4	SQ	542158	542159	542042	542043	--	--
3/8	3/8	1	2-1/2	SQ	542088	542090	541972	541974	542198	542200
		1	2-1/2	.020"R	542089	542091	541973	541975	542199	542201
		1-1/8	3	SQ	542112	542113	541996	541997	--	--
1/2	1/2	1-3/4	4	SQ	542160	542161	542044	542045	--	--
		1-1/4	3	SQ	542092	542094	541976	541978	542202	542204
		1-1/4	3	.030"R	542093	542095	541977	541979	542203	542205
		2	4	SQ	542114	542115	541998	541999	--	--
5/8	5/8	3	6	SQ	542162	542163	542046	542047	--	--
		1-1/4	3-1/2	SQ	542096	542098	541980	541982	542206	542208
		1-1/4	3-1/2	.030"R	542097	542099	541981	541983	542207	542209
		2-1/4	5	SQ	542116	542117	542000	542001	--	--
3/4	3/4	3	6	SQ	542164	542165	542048	542049	--	--
		1-1/2	4	SQ	542100	542102	541984	541986	542210	542212
		1-1/2	4	.030"R	542101	542103	541985	541987	542211	542213
1	1	2-1/4	5	SQ	542118	542119	542002	542003	--	--
		3	6	SQ	542166	542167	542050	542051	--	--
		1-1/2	4	SQ	542068	542070	541954	541956	542184	542186
		1-1/2	4	.030"R	542069	542071	541955	541957	542185	542187
		2-1/4	5	SQ	542104	542105	541988	541989	--	--
		3	6	SQ	542152	542153	542036	542037	--	--



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S	High Temp. Alloys
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- Ball Nose End
- 2 & 3 Flute Uncoated & ZrN
- Variable Pitch, Reduces Chatter
- Round Shanks
- Center Cutting
- Fractional Sizes
- Extreme Production
- Unique Polishing Process
- Unique Honing Process
- Plunging, Pocketing
- Slotting, Ramping, Profiling
- Ultra Premium Micrograin Carbide



Ball Nose - Fractional									
Cutter D	Shank d	LOC l1	Overall L	End Face	Uncoated		ZrN		
					2 Flute	3 Flute	2 Flute	3 Flute	
3/16	3/16	5/8	2	BN	542122	542123	542006	542007	
		3/4	2-1/2	BN	542138	542139	542022	542023	
		1-1/8	3	BN	542170	542171	542054	542055	
1/4	1/4	3/4	2-1/2	BN	542124	542125	542008	542009	
		1-1/8	3	BN	542140	542141	542024	542025	
		1-1/2	4	BN	542172	542173	542056	542057	
5/16	5/16	13/16	2-1/2	BN	542126	542127	542010	542011	
		1-1/8	3	BN	542142	542143	542026	542027	
		1-5/8	4	BN	542174	542175	542058	542059	
3/8	3/8	1	2-1/2	BN	542128	542129	542012	542013	
		1-1/8	3	BN	542144	542145	542028	542029	
		1-3/4	4	BN	542176	542177	542060	542061	
1/2	1/2	1-1/4	3	BN	542130	542131	542014	542015	
		2	4	BN	542146	542147	542030	542031	
		3	6	BN	542178	542179	542062	542063	
5/8	5/8	1-1/4	3-1/2	BN	542132	542133	542016	542017	
		2-1/4	5	BN	542148	542149	542032	542033	
		3	6	BN	542180	542181	542064	542065	
3/4	3/4	1-1/2	4	BN	542134	542135	542018	542019	
		2-1/4	5	BN	542150	542151	542034	542035	
		3	6	BN	542182	542183	542066	542067	
1	1	1-1/2	4	BN	542120	542121	542004	542005	
		2-1/4	5	BN	542136	542137	542020	542021	
		3	6	BN	542168	542169	542052	542053	



ALUMINUM

Speeds & Feeds

Material Classification	Speed	Feed Per Tooth By End Mill Diameter (IPT)							
	SFM	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"
Aluminum Alloys & Aluminum	900-1800	.0030	.0035	.0040	.0045	.0050	.0060	.0070	.0090
Copper Alloys & Copper	525-1275	.0030	.0035	.0035	.0040	.0040	.0045	.0050	.0070
Bronze & Brass	375-600	.0030	.0035	.0035	.0040	.0040	.0045	.0050	.0060
Graphite	500-1200	.0040	.0045	.0045	.0045	.0045	.0050	.0060	.0080
Plastics	600-1650	.0040	.0045	.0050	.0060	.0070	.0090	.0110	.0160
Softer Cast Iron	--	--	--	--	--	--	--	--	--
Harder Cast Iron	--	--	--	--	--	--	--	--	--
Ductile Iron	--	--	--	--	--	--	--	--	--
Malleable Iron	--	--	--	--	--	--	--	--	--
Low Carbon Steels (1020 & Under)	--	--	--	--	--	--	--	--	--
Medium Carbon Steels (1030-1060)	--	--	--	--	--	--	--	--	--
Alloy Steels Hardened to 35 Rc	--	--	--	--	--	--	--	--	--
Alloy Steels Hardened to 50 Rc	--	--	--	--	--	--	--	--	--
Die Steels Hardened to 60 Rc	--	--	--	--	--	--	--	--	--
Tool Steels	--	--	--	--	--	--	--	--	--
Mold Steels	--	--	--	--	--	--	--	--	--
Softer Stainless Steels	--	--	--	--	--	--	--	--	--
Harder Stainless Steels	--	--	--	--	--	--	--	--	--
Monel & High Nickel Steel	--	--	--	--	--	--	--	--	--
Softer Titanium	--	--	--	--	--	--	--	--	--
Harder Titanium	--	--	--	--	--	--	--	--	--
Nickel Based High Temp Alloys	--	--	--	--	--	--	--	--	--

Note: These are guidelines only & the following points are important to consider:

- Higher Feed Per Tooth should be used to start for radial depths of cut less than 25% of the tool diameter.
- The above recommendations are for axial lengths of cut not to exceed 1.5 times the tool diameter for profiling and 1 times the diameter for full slotting.
- The above parameters are recommended starting points only. If the tool is working well, without vibrations or significant noise, increase the SFM and/or Feed Per Tooth in 5-10% increments.
- Optimum speeds & feeds will depend upon material, setup, machine conditions & tool deflection. Higher or lower parameters may be required to achieve optimum machining conditions.
- For Light Radial Depths of cut, make certain to increase the feed rate to compensate for Radial Chip Thinning Factor (RCTF). Consult a formula or app to calculate.
- For Plunging or Ramping the feed rate should be reduced by about 50%.
- Climb Milling is preferred to Conventional Milling.





Available Exclusively From



📍 12550 Robin Lane
Brookfield, WI 53005

☎ 262-783-4900

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Green Bay, WI 54304

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