

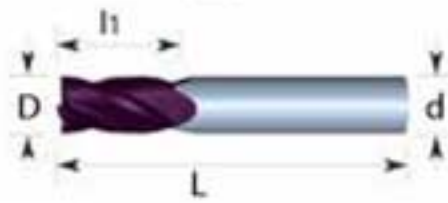
P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High Temp. Alloys
H	Hardened Steel

● BEST ◐ OK ○ NOT OPTIMAL

ULTRA HIGH PERFORMANCE

- Special Helix Design with honed edges
- Variable Pitch to reduce chatter with special core design

- 10% Ultra High Performance Micro Grain Carbide
- Diameter Tolerances: +0.0000"/-0.0015"



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Stub Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	Corner Radius	TiAlN Coated		TiAlN Coated	
					4 Flute - ROUND Shank Part#	Price	4 Flute - WELDON Shank Part#	Price
3/16	3/16	3/8	2	SQ	180-188-4	\$15.70	--	--
3/16	3/16	3/8	2	.015CR	180-188-4-015R	\$15.70	--	--
1/4	1/4	3/8	2	SQ	180-250-4	\$19.44	--	--
1/4	1/4	3/8	2	.015CR	180-250-4-015R	\$19.44	--	--
5/16	5/16	3/8	2	SQ	180-312-4	\$26.86	--	--
5/16	5/16	3/8	2	.020CR	180-312-4-020R	\$26.86	--	--
3/8	3/8	1/2	2	SQ	180-375-4	\$33.57	--	--
3/8	3/8	1/2	2	.020CR	180-375-4-020R	\$33.57	--	--
1/2	1/2	5/8	2-1/2	SQ	180-500-4	\$54.72	181-500-4	\$54.72
1/2	1/2	5/8	2-1/2	.030CR	180-500-4-030R	\$54.72	181-500-4-030R	\$54.72
5/8	5/8	3/4	3	SQ	180-625-4	\$100.88	181-625-4	\$100.88
5/8	5/8	3/4	3	.030CR	180-625-4-030R	\$100.88	181-625-4-030R	\$100.88
3/4	3/4	1	3	SQ	180-750-4	\$147.44	181-750-4	\$147.44
3/4	3/4	1	3	.030CR	180-750-4-030R	\$147.44	181-750-4-030R	\$147.44



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Regular Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	Corner Radius	TiAlN Coated		TiAlN Coated		TiAlN Coated	
					4 Flute - ROUND Shank Part#	Price	4 Flute - WELDON Shank Part#	Price	5 Flute - ROUND Shank Part#	Price
1/8	1/8	1/2	1-1/2	.010CR	080-125-4-010R	\$14.88	--	--	--	--
3/16	3/16	5/8	2	SQ	080-188-4	\$17.44	--	--	--	--
3/16	3/16	5/8	2	.015CR	080-188-4-015R	\$17.44	--	--	--	--
1/4	1/4	3/4	2-1/2	SQ	080-250-4	\$21.60	081-250-4	\$21.60	080-250-5	\$21.60
1/4	1/4	3/4	2-1/2	.020CR	080-250-4-020R	\$21.60	081-250-4-020R	\$21.60	080-250-5-020R	\$21.60
5/16	5/16	13/16	2-1/2	SQ	080-312-4	\$29.84	081-312-4	\$29.84	080-312-5	\$29.84
5/16	5/16	13/16	2-1/2	.020CR	080-312-4-020R	\$29.84	081-312-4-020R	\$29.84	080-312-5-020R	\$29.84
3/8	3/8	7/8	2-1/2	SQ	080-375-4	\$36.48	081-375-4	\$36.48	080-375-5	\$36.48
3/8	3/8	7/8	2-1/2	.020CR	080-375-4-020R	\$36.48	081-375-4-020R	\$36.48	080-375-5-020R	\$36.48
3/8	3/8	7/8	2-1/2	.030CR	080-375-4-030R	\$36.48	081-375-4-030R	\$36.48	080-375-5-030R	\$36.48
7/16	7/16	1	2-3/4	SQ	080-437-4	\$52.80	081-437-4	\$52.80	--	--
1/2	1/2	1-1/4	3	SQ	080-500-4	\$60.80	081-500-4	\$60.80	080-500-5	\$60.80
1/2	1/2	1-1/4	3	.015CR	080-500-4-015R	\$60.80	081-500-4-015R	\$60.80	--	--
1/2	1/2	1-1/4	3	.030CR	080-500-4-030R	\$60.80	081-500-4-030R	\$60.80	080-500-5-030R	\$60.80
1/2	1/2	1-1/4	3	.060CR	080-500-4-060R	\$60.80	081-500-4-060R	\$60.80	--	--
5/8	5/8	1-1/4	3-1/2	SQ	080-625-4	\$104.00	081-625-4	\$104.00	080-625-5	\$104.00
5/8	5/8	1-1/4	3-1/2	.030CR	080-625-4-030R	\$104.00	081-625-4-030R	\$104.00	080-625-5-030R	\$104.00
5/8	5/8	1-1/4	3-1/2	.060CR	080-625-4-060R	\$104.00	081-625-4-060R	\$104.00	--	--
5/8	5/8	1-1/4	3-1/2	.125CR	080-625-4-125R	\$104.00	081-625-4-125R	\$104.00	--	--
3/4	3/4	1-1/2	4	SQ	080-750-4	\$151.99	081-750-4	\$151.99	080-750-5	\$151.99
3/4	3/4	1-1/2	4	.030CR	080-750-4-030R	\$151.99	081-750-4-030R	\$151.99	080-750-5-030R	\$151.99
3/4	3/4	1-1/2	4	.060CR	080-750-4-060R	\$151.99	081-750-4-060R	\$151.99	--	--
3/4	3/4	1-1/2	4	.125CR	080-750-4-125R	\$151.99	081-750-4-125R	\$151.99	--	--
1	1	1-1/2	4	SQ	080-100-4	\$260.31	081-100-4	\$260.31	080-100-5	\$260.31
1	1	1-1/2	4	.030CR	080-100-4-030R	\$260.31	081-100-4-030R	\$260.31	080-100-5-030R	\$260.31
1	1	1-1/2	4	.060CR	080-100-4-060R	\$260.31	081-100-4-060R	\$260.31	--	--
1	1	1-1/2	4	.125CR	080-100-4-125R	\$260.31	081-100-4-125R	\$260.31	--	--

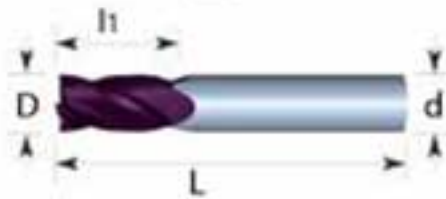
P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High Temp. Alloys
H	Hardened Steel

● BEST ◐ OK ○ NOT OPTIMAL

ULTRA HIGH PERFORMANCE

- Special Helix Design with honed edges
- Variable Pitch to reduce chatter with special core design

- 10% Ultra High Performance Micro Grain Carbide
- Diameter Tolerances: +0.0000"/-0.0015"



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Long Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	Corner Radius	TiALN Coated		TiALN Coated	
					4 Flute - ROUND Shank		4 Flute - WELDON Shank	
					Part#	Price	Part#	Price
3/16	3/16	3/4	2-1/2	SQ	082-188-4	\$34.67	--	
3/16	3/16	3/4	2-1/2	.015CR	082-188-4-015R	\$34.67	--	
1/4	1/4	1-1/8	3	SQ	082-250-4	\$36.54	083-250-4	\$36.54
1/4	1/4	1-1/8	3	.020CR	082-250-4-020R	\$36.54	083-250-4-020R	\$36.54
5/16	5/16	1-1/8	3	SQ	082-312-4	\$50.84	083-312-4	\$50.84
5/16	5/16	1-1/8	3	.020CR	082-312-4-020R	\$50.84	083-312-4-020R	\$50.84
3/8	3/8	1-1/8	3	SQ	082-375-4	\$61.45	083-375-4	\$61.45
3/8	3/8	1-1/8	3	.020CR	082-375-4-020R	\$61.45	083-375-4-020R	\$61.45
7/16	7/16	2	4	SQ	082-437-4	\$79.65	083-437-4	\$79.65
1/2	1/2	2	4	SQ	082-500-4	\$92.80	083-500-4	\$92.80
1/2	1/2	2	4	.015CR	082-500-4-015R	\$92.80	083-500-4-015R	\$92.80
1/2	1/2	2	4	.030CR	082-500-4-030R	\$92.80	083-500-4-030R	\$92.80
1/2	1/2	2	4	.060CR	082-500-4-060R	\$92.80	083-500-4-060R	\$92.80
5/8	5/8	2-1/4	5	SQ	082-625-4	\$142.39	083-625-4	\$142.39
5/8	5/8	2-1/4	5	.030CR	082-625-4-030R	\$142.39	083-625-4-030R	\$142.39
5/8	5/8	2-1/4	5	.060CR	082-625-4-060R	\$142.39	083-625-4-060R	\$142.39
5/8	5/8	2-1/4	5	.125CR	082-625-4-125R	\$142.39	083-625-4-125R	\$142.39
3/4	3/4	2-1/4	5	SQ	082-750-4	\$193.59	083-750-4	\$193.59
3/4	3/4	2-1/4	5	.030CR	082-750-4-030R	\$193.59	083-750-4-030R	\$193.59
3/4	3/4	2-1/4	5	.060CR	082-750-4-060R	\$193.59	083-750-4-060R	\$193.59
3/4	3/4	2-1/4	5	.125CR	082-750-4-125R	\$193.59	083-750-4-125R	\$193.59
1	1	2-1/4	5	SQ	082-100-4	\$311.99	083-100-4	\$311.99
1	1	2-1/4	5	.030CR	082-100-4-030R	\$311.99	083-100-4-030R	\$311.99
1	1	2-1/4	5	.060CR	082-100-4-060R	\$311.99	083-100-4-060R	\$311.99
1	1	2-1/4	5	.125CR	082-100-4-125R	\$311.99	083-100-4-125R	\$311.99



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Extra Long Length, Single End

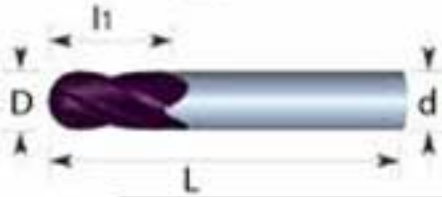
Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	Corner Radius	TiALN Coated		TiALN Coated	
					4 Flute - ROUND Shank		4 Flute - WELDON Shank	
					Part#	Price	Part#	Price
3/16	3/16	1-1/8	3	SQ	088-188-4	\$38.14	--	
1/4	1/4	1-1/2	4	SQ	088-250-4	\$43.48	--	
5/16	5/16	1-5/8	4	SQ	088-312-4	\$58.47	--	
3/8	3/8	1-3/4	4	SQ	088-375-4	\$67.59	--	
1/2	1/2	3	6	SQ	088-500-4	\$141.05	--	
5/8	5/8	3	6	SQ	088-625-4	\$165.53	--	
3/4	3/4	3	6	SQ	088-750-4	\$220.30	--	
1	1	3	6	SQ	088-100-4	\$417.21	--	

P	●	Steel
M	○	Stainless Steel
K	●	Cast Iron
N	○	Non-Ferrous
S	○	High Temp. Alloys
H	○	Hardened Steel
●		BEST
○		OK
○		NOT OPTIMAL

ULTRA HIGH PERFORMANCE

- Special Helix Design with honed edges
- Variable Pitch to reduce chatter with special core design

- 10% Ultra High Performance Micro Grain Carbide
- Diameter Tolerances: +0.0000"/-0.0015"



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Ball Regular Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	TiALN Coated		TiALN Coated	
				4 Flute - ROUND Shank Part#	Price	4 Flute - WELDON Shank Part#	Price
3/16	3/16	5/8	2	084-188-4	\$20.92	--	
1/4	1/4	3/4	2-1/2	084-250-4	\$25.92	085-250-4	\$25.92
5/16	5/16	13/16	2-1/2	084-312-4	\$35.80	085-312-4	\$35.80
3/8	3/8	7/8	2-1/2	084-375-4	\$43.78	085-375-4	\$43.78
7/16	7/16	1	2-3/4	084-437-4	\$63.36	085-437-4	\$63.36
1/2	1/2	1	3	084-500-4	\$72.96	085-500-4	\$72.96
5/8	5/8	1-1/4	3-1/2	084-625-4	\$124.80	085-625-4	\$124.80
3/4	3/4	1-1/2	4	084-750-4	\$182.39	085-750-4	\$182.39
1	1	1-1/2	4	084-100-4	\$297.59	085-100-4	\$297.59



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Ball Long Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	TiALN Coated		TiALN Coated	
				4 Flute - ROUND Shank Part#	Price	4 Flute - WELDON Shank Part#	Price
3/16	3/16	3/4	2-1/2	086-188-4	\$41.61	--	
1/4	1/4	1-1/8	3	086-250-4	\$43.85	087-250-4	\$43.85
5/16	5/16	1-1/8	3	086-312-4	\$61.01	087-312-4	\$61.01
3/8	3/8	1-1/8	3	086-375-4	\$73.73	087-375-4	\$73.73
7/16	7/16	2	4	086-437-4	\$95.58	087-437-4	\$95.58
1/2	1/2	2	4	086-500-4	\$111.36	087-500-4	\$112.59
5/8	5/8	2-1/4	5	086-625-4	\$170.87	087-625-4	\$170.87
3/4	3/4	2-1/4	5	086-750-4	\$232.31	087-750-4	\$232.31
1	1	2-1/4	5	086-100-4	\$374.39	087-100-4	\$374.39



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Ball Extra Long Length, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	TiALN Coated		TiALN Coated	
				4 Flute - ROUND Shank Part#	Price	4 Flute - WELDON Shank Part#	Price
3/16	3/16	1-1/8	3	089-188-4	\$47.75	--	
1/4	1/4	1-1/2	4	089-250-4	\$50.87	--	
5/16	5/16	1-5/8	4	089-312-4	\$69.55	--	
3/8	3/8	1-3/4	4	089-375-4	\$103.10	--	
1/2	1/2	3	6	089-500-4	\$169.26	--	
5/8	5/8	3	6	089-625-4	\$190.37	--	
3/4	3/4	3	6	089-750-4	\$264.36	--	
1	1	3	6	089-100-4	\$500.66	--	

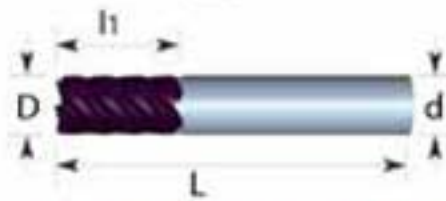
P	Steel
M	Stainless Steel
K	Cast Iron
N	Non-Ferrous
S	High Temp. Alloys
H	Hardened Steel

● BEST ◐ OK ○ NOT OPTIMAL

ULTRA HIGH PERFORMANCE

- Special Helix Design with honed edges
- Variable Pitch to reduce chatter with special core design

- 10% Ultra High Performance Micro Grain Carbide
- Diameter Tolerances: +0.0000"/-0.0015"



6 & 7 Flute High Performance End Mills

- Full edge finishing with low radial engagement at high speeds & feeds
- Excellent for Trochoidal Milling
- Take advantage of Radial Chip Thinning Factor compensation (RCTF), to move at high velocities



ULTRA HIGH PERFORMANCE Variable Pitch Carbide, Finishers, Single End

Cutter Diam. D	Shank Diam. d	Length Of Cut L1	O.A.L. L	Corner Radius	TiAlN Coated		TiAlN Coated	
					6 Flute - ROUND Shank Part#	Price	7 Flute - ROUND Shank Part#	Price
1/4	1/4	3/4	2-1/2	SQ	380-250-6	\$21.60	--	
1/4	1/4	3/4	2-1/2	.030CR	380-250-6-030R	\$21.60	--	
3/8	3/8	7/8	2-1/2	SQ	380-375-6	\$36.48	--	
3/8	3/8	7/8	2-1/2	.030CR	380-375-6-030R	\$36.48	--	
1/2	1/2	1-1/4	3	SQ	380-500-6	\$60.80	--	
1/2	1/2	1-1/4	3	.030CR	380-500-6-030R	\$60.80	380-500-7-030R	\$66.88
5/8	5/8	1-1/4	3-1/2	SQ	380-625-6	\$104.00	--	
5/8	5/8	1-1/4	3-1/2	.030CR	380-625-6-030R	\$104.00	380-625-7-030R	\$114.40
3/4	3/4	1-1/2	4	SQ	380-750-6	\$152.00	--	
3/4	3/4	1-1/2	4	.030CR	380-750-6-030R	\$152.00	380-750-7-030R	\$167.20
1	1	1-1/2	4	SQ	380-100-6	\$248.00	--	
1	1	1-1/2	4	.030CR	380-100-6-030R	\$248.00	380-100-7-030R	\$272.80



ULTRA HIGH PERFORMANCE

Material	TiAlN Coated	Feed Per Tooth By End Mill Diameter								
		1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	1"	
Aluminum & Aluminum Alloys	N	900-1800	.0025	.0030	.0035	.0040	.0045	.0055	.0065	.0085
Copper & Copper Alloys		525-1275	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0065
Brass & Bronze		375-600	.0025	.0030	.0030	.0035	.0035	.0040	.0045	.0055
Graphite		--	--	--	--	--	--	--	--	--
Plastics		--	--	--	--	--	--	--	--	--
Iron, Cast (soft)	K	375-650	.0030	.0032	.0035	.0037	.0040	.0045	.0070	.0090
Iron, Cast (hard)		100-375	.0018	.0020	.0025	.0027	.0030	.0035	.0040	.0050
Iron, Ductile		100-600	.0020	.0022	.0025	.0027	.0030	.0040	.0050	.0070
Iron, Malleable		225-650	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080
Carbon Steels, Low	P	300-600	.0020	.0025	.0030	.0035	.0040	.0050	.0060	.0080
Carbon Steels, Medium		150-375	.0025	.0026	.0027	.0028	.0030	.0040	.0050	.0060
Carbon Steels Hardened to 35 Rc		130-345	.0020	.0021	.0022	.0023	.0025	.0027	.0030	.0040
Carbon Steels Hardened to 50 Rc		70-160	.0012	.0012	.0013	.0014	.0015	.0026	.0030	.0035
Carbon Steels Hardened to 60 Rc		--	--	--	--	--	--	--	--	--
Steels, Mold	M	300-525	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Steels, Tool		150-375	.0020	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Stainless Steels, Soft	S	300-450	.0020	.0022	.0025	.0022	.0030	.0040	.0050	.0070
Stainless Steels, Hard		150-300	.0015	.0016	.0017	.0018	.0020	.0030	.0040	.0060
Monel & High Nickel Steel	S	75-200	.0015	.0022	.0025	.0027	.0030	.0035	.0040	.0050
Titanium, Soft		125-375	.0015	.0022	.0025	.0027	.0030	.0040	.0050	.0070
Titanium, Hard		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

- 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 1.5 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.
- Climb Milling is preferred to Conventional Milling

$$RPM = \frac{SFM}{(3.146 * \text{Cutter Diam.}) / 12}$$

$$IPM = RPM * \text{Feed Per Tooth} * \# \text{ of Teeth}$$

