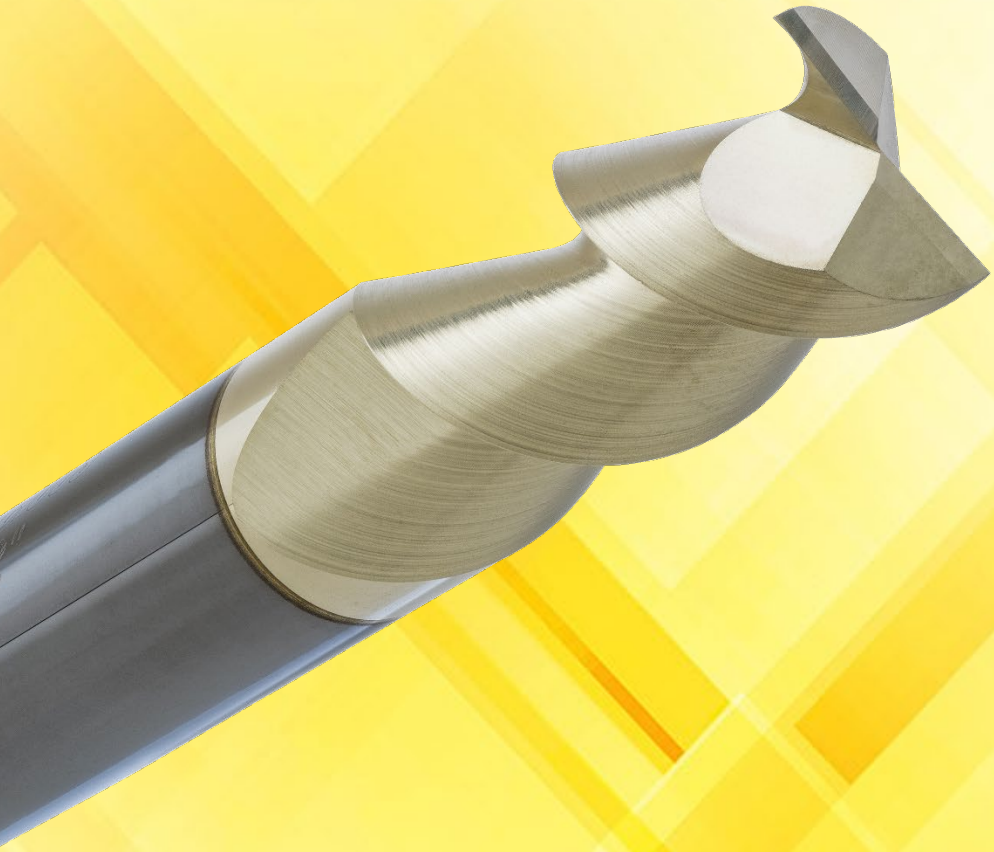
FEROCIOUS

Milling Aluminum & Non-Ferrous Materials at Ferocious Rates



CGS

High-Performance
High-Quality
Precision

FEROCIOUS

2000 SERIES

- ✓ 2-Flute 55° HI-Helix
- ✓ Manufactured from premium sub micro grain carbide for high transverse rupture strength
- ✓ Ground with micro polished cylindrical land for improved surface finishes
- ✓ Stub, Standard, long and extra-long lengths
- ✓ Extended reach for deep pockets

Available With

- *Reduced Shank Undercut*
- *Set Screw Flats*
- *Zirconium Nitride*

For coated tool, add "S" to part number (2001-S)

2 Flute

Solid Carbide

PROFILE

ROUGHING

SLOTTING

CONTOUR

55°

Bright

ZrN

FEROCIOUS

2000 SERIES | 2-FLUTE | 55° Helix | SQUARE END					
EDP#	DIA	SHANK	LOC	OAL	FLUTES
2001	1/8	1/8	1/2	1-1/2	2
2501	1/8	1/8	3/16	1-1/2	2
2502	1/8	1/8	1/4	2	2
2002	5/32	5/32	3/4	2	2
2003	3/16	3/16	5/8	2	2
2004	3/16	3/16	1	3	2
2503	3/16	3/16	1/4	2	2
2504	3/16	3/16	3/8	3	2
2006	1/4	1/4	3/4	2-1/2	2
2009	1/4	1/4	1-1/4	3	2
2506	1/4	1/4	3/8	2	2
2509	1/4	1/4	1/2	3	2
2012	5/16	5/16	1	2-1/2	2
2015	5/16	5/16	1-3/8	3	2
2512	5/16	5/16	1/2	2	2
2515	5/16	5/16	1/2	3	2
2018	3/8	3/8	1	2-1/2	2
2024	3/8	3/8	2-1/2	4	2
2518	3/8	3/8	5/8	2	2
2524	3/8	3/8	5/8	4	2
2021	3/8	3/8	1-1/2	3	2
2027	7/16	7/16	1	3	2
2030	1/2	1/2	1	3	2
2036	1/2	1/2	1-1/2	3-1/2	2
2530	1/2	1/2	5/8	2-1/2	2
2536	1/2	1/2	5/8	4	2
2033	1/2	1/2	1-1/4	3	2
2039	1/2	1/2	2	4	2
2042	1/2	1/2	3	5	2
2045	9/16	9/16	1-1/4	3-1/2	2
2048	5/8	5/8	1-1/4	3-1/2	2
2548	5/8	5/8	3/4	3	2
2051	5/8	5/8	1-3/4	4	2
2054	5/8	5/8	2-1/2	5	2
2057	3/4	3/4	1-1/2	4	2
2063	3/4	3/4	3-1/2	6	2
2557	3/4	3/4	1	3	2
2563	3/4	3/4	1	6	2
2060	3/4	3/4	2-1/2	5	2
2066	1	1	1-1/2	4	2
2069	1	1	4	7	2
2566	1	1	1	3	2
2569	1	1	1	7	2
2067	1	1	2-1/2	5	2
2068	1	1	3	6	2

2100 SERIES | 2-FLUTE | 55° Helix | SQUARE END					
EDP#	DIA	SHANK	LOC	OAL	FLUTES
2101	3	3	10	38	2
2102	4	4	16	50	2
2103	5	5	16	50	2
2106	6	6	19	63	2
2112	8	8	22	63	2
2118	10	10	25	63	2
2130	12	12	25	75	2
2145	14	14	32	88	2
2148	16	16	32	88	2
2155	18	18	38	100	2
2157	20	20	38	100	2
2166	25	25	38	100	2

Long and Extra Long Lengths					
EDP#	DIA	SHANK	LOC	OAL	FLUTES
2206	6	6	32	75	2
2212	8	8	35	75	2
2218	10	10	38	75	2
2220	10	10	63	100	2
2230	12	12	38	90	2
2232	12	12	50	100	2
2234	12	12	75	125	2
2248	16	16	44	100	2
2250	16	16	63	125	2
2257	20	20	63	125	2
2259	20	20	90	150	2
2266	25	25	63	125	2
2268	25	25	102	165	2

BN2000 SERIES | 2-FLUTE | BALLNOSE					
EDP#	DIA	SHANK	LOC	OAL	FLUTES
BN2001	1/8	1/8	1/2	1-1/2	2
BN2003	3/16	3/16	5/8	2	2
BN2006	1/4	1/4	3/4	2-1/2	2
BN2009	1/4	1/4	1-1/4	3	2
BN2012	5/16	5/16	1	2-1/2	2
BN2018	3/8	3/8	1	2-1/2	2
BN2021	3/8	3/8	1-1/2	3	2
BN2030	1/2	1/2	1	3	2
BN2033	1/2	1/2	1-1/4	3	2
BN2036	1/2	1/2	1-1/2	3-1/2	2
BN2039	1/2	1/2	2	4	2
BN2048	5/8	5/8	1-1/4	3-1/2	2

TOLERANCES:	*Shank Diameter*	*Shank Diameter*
	+0/-.0125mm	+0/-.0125mm
	Cutting Diameter	*Cutting Diameter*
	+.000"/-.0005"	+0/-.0125mm

FEROCIOUS

2000 SERIES

- ✓ Available with Corner Radius and Ball Nose end
- ✓ High performance in roughing, slotting, contour, peripheral and finish milling
- ✓ High helix for vertical shear action and chip evacuation
- ✓ Industry's highest attainable speeds and feeds when milling aluminum, non-ferrous materials and plastics.

With Corner Radius

CR2000 SERIES | 2-FLUTE | CORNER RADIUS (CR)									
EDP#	DIA	SHANK	LOC	OAL	.015	.030	.060	.090	.125
CR2001	1/8	1/8	1/2	1-1/2	.015	.030	-	-	-
CR2003	3/16	3/16	5/8	2	.015	.030	-	-	-
CR2006	1/4	1/4	3/4	2-1/2	.015	.030	.060	-	-
CR2018	3/8	3/8	1	2-1/2	.015	.030	.060	-	-
CR2030	1/2	1/2	1	3	.015	.030	.060	.090	.125
CR2033	1/2	1/2	1-1/4	3	.015	.030	.060	.090	.125
CR2036	1/2	1/2	1-1/2	3-1/2	.015	.030	.060	.090	.125
CR2039	1/2	1/2	2	4	.015	.030	.060	.090	.125
CR2048	5/8	5/8	1-1/4	3-1/2	.015	.030	.060	.090	.125
CR2057	3/4	3/4	1-1/2	4	.015	.030	.060	.090	.125
CR2060	3/4	3/4	2-1/2	5	.015	.030	.060	.090	.125
CR2066	1	1	1-1/2	4	.015	.030	.060	.090	.125
CR2067	1	1	2-1/2	5	.015	.030	.060	.090	.125
CR2069	1	1	4	7	.015	.030	.060	.090	.125

Cutting Diameter Tolerances

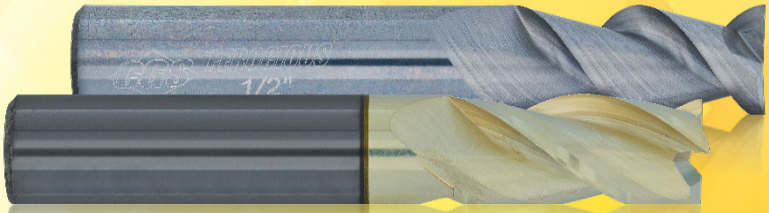
+.000"/-.0005"

Shank Diameter Tolerances

+.000"/-.0005"

SPEEDS & FEEDS

2000 SERIES



SPEEDS AND FEEDS		
TOOL DIAMETER	I.P.T (INCH PER TOOTH)	STARTING RPM
1/8	.001	12,000
3/16	.002	10,000
1/4	.003	10,000
5/16	.004	8,000
3/8	.005	8,000
1/2	.006	8,000
5/8	.007	6,000
3/4	.008	4,000
1	.010	4,000

- THE IPT VALUES BELOW ARE MINIMUM STARTING POINTS – REDUCING IPT VALUES CAN CAUSE THE TOOL TO DEFLECT
- IF SFM CANNOT BE ACHIEVED DUE TO RPM LIMITS, PLEASE RUN AT MAXIMUM SAFE RPM AND MAINTAIN IPT RECOMMENDATION

MATERIAL	CUT TYPE		Starting SFM Range	Target SFM	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
					ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt
Aluminum Alloys	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0009	0.0016	0.0024	0.0038	0.0046	0.0062	0.0070	0.0077	0.0088
	≤ 0.5xD	Profile			0.0012	0.0021	0.0031	0.0049	0.0059	0.0079	0.0090	0.0099	0.0113
	≤ 0.05xD	Finish Pass			0.0016	0.0028	0.0043	0.0068	0.0082	0.0110	0.0125	0.0137	0.0157
MATERIAL	**CUT TYPE**		**Starting SFM Range**	**Target SFM**	**1/8**	**3/16**	**1/4**	**5/16**	**3/8**	**1/2**	**5/8**	**3/4**	**1**
					ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt
Cast Aluminum	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0008	0.0014	0.0022	0.0034	0.0041	0.0056	0.0063	0.0069	0.0079
(High Silicon)	≤ 0.5xD	Profile			0.0010	0.0018	0.0028	0.0044	0.0053	0.0072	0.0081	0.0089	0.0102
	≤ 0.05xD	Finish Pass			0.0014	0.0026	0.0038	0.0061	0.0074	0.0099	0.0112	0.0123	0.0141
MATERIAL	**CUT TYPE**		**Starting SFM Range**	**Target SFM**	**1/8**	**3/16**	**1/4**	**5/16**	**3/8**	**1/2**	**5/8**	**3/4**	**1**
					ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt
Copper Alloys / Brass	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0008	0.0014	0.0022	0.0034	0.0041	0.0056	0.0063	0.0069	0.0079
	≤ 0.5xD	Profile			0.0010	0.0018	0.0028	0.0044	0.0053	0.0072	0.0081	0.0089	0.0102
	≤ 0.05xD	Finish Pass			0.0014	0.0026	0.0038	0.0061	0.0074	0.0099	0.0112	0.0123	0.0141
MATERIAL	**CUT TYPE**		**Starting SFM Range**	**Target SFM**	**1/8**	**3/16**	**1/4**	**5/16**	**3/8**	**1/2**	**5/8**	**3/4**	**1**
					ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt	ipt
Plastics	≥ 0.5xD to 1xD	Full Slot	395-786	590-1572	0.0017	0.0031	0.0046	0.0073	0.0088	0.0119	0.0135	0.0148	0.0169
	≤ 0.5xD	Profile			0.0022	0.0039	0.0059	0.0094	0.0113	0.0153	0.0173	0.0190	0.0217
	≤ 0.05xD	Finish Pass			0.0031	0.0055	0.0082	0.0130	0.0158	0.0212	0.0240	0.0264	0.0301

✓ Max spindle speeds possible ✓ Vertical chip ejection ✓ Longer tool life
✓ Dramatic feed rate increase ✓ Quiet operation

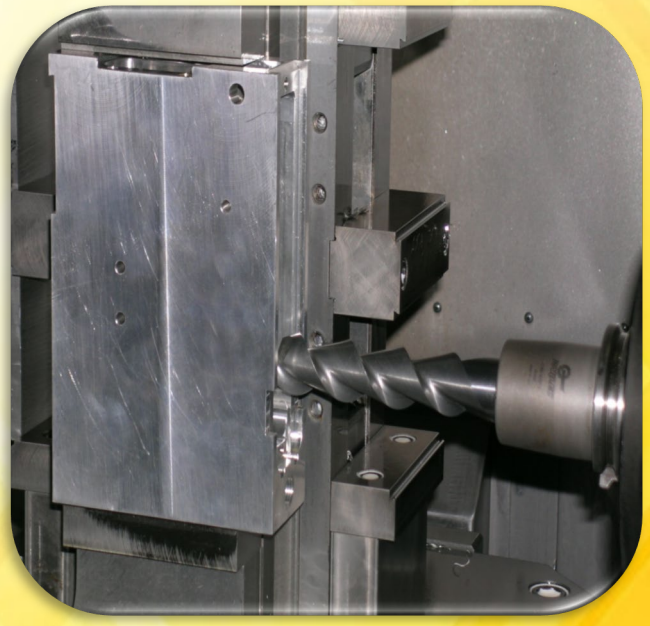
WARNING: TOO LOW OF AN RPM COUPLED WITH TOO MUCH FEED MIGHT CAUSE THE TOOL TO SHATTER

FOR BEST RESULTS:

1. DIRECT MULTIPLE COOLANT NOZZLES AT THE END MILL TO ASSURE CONSTANT COOLING OF THE TOOL AND TO FLUSH CHIPS.
2. THESE TOOLS ARE SPECIALLY DESIGNED FOR HI-SPEED MILLING OF ALUMINUM.
3. THE FEEDS LISTED ARE STARTING POINTS. VARIATIONS OF THESE WILL DEPEND ON THE RADIAL & AXIAL DEPTH-OF-CUT & WORK PIECE CONDITIONS
1. REDUCE FEED BY 50% ON LONG AND LONG REACH TOOLS OR WHEN AXIAL DEPTH OF CUT EXCEEDS 1.5XD
2. RADIAL RUNOUT OF TOOL TIP UNDER (.0005") WHEN RUNNING TO ACHIEVE OPTIMUM FEEDS
3. *CGS* RECOMMENDS STARTING AT LOWER END OF SFM VALUES AND INCREASING AT CONTROLLED LEVELS TO ACHIEVE OPTIMUM FEEDS & SURFACE FINISHES

DON'T JUST TAKE OUR WORD FOR IT!

Hear What Our Customers Have To Say!



Just as an "overnight success" is generally the result of years of effort, a "breakthrough" in part machining productivity usually is the sum of a number of carefully engineered individual improvements. Zaytran, Inc. used several improvements to reduce machining time from more than 45 minutes to less than 20 for a 6061 aluminum component that measured 6" x 5" x 2". Zaytran, located in Elyria, Ohio, is a leading producer of precision grippers, actuators and locating pins focusing on producing high-performance products. The component featured a 4.8" deep cavity. The depth of the feature made it difficult to evacuate chips, which resulted in surface finish problems. Machining time was 45 to 48 minutes.

Seeking to speed production, Jerry Williams, Zaytran process engineer, consulted with CGS.

As a solution, CGS produced special versions of its Ferocious 2-flute, 55* high-helix, solid-carbide end mill by adding through-coolant capability. The designs allowed coolant flow through the 3/4" dia. and 1" dia. tools with flute lengths up to 5", to effectively push chips out of the cavity. "There was no other way to get coolant down where the tool was actually cutting," said Steve Maxwell, Zaytran production team leader and programmer.

Zaytran was able to square the parts using just the CGS end mills, while other suppliers' end mills, with profiling lengths of 3" to 4", were unsuccessful, thus causing Zaytran to have to apply face mills on two sides. Face milling proved unnecessary when applying CGS end mills in shrink-fit holders. "We could do profile milling, 3-1/2" or 4" deep, and maintain 0.001" or 0.0015" taper over the whole length of the part, eliminating the need for the face mills," Maxwell said.

A large contributor to the decrease in machining time was the end mills' capability to run at high speeds and feeds. The micro grain-carbide tools feature a circular land that facilitates maximum feed rates and cutting speeds, and the tool geometry is engineered to produce efficient sharing action and vertical chip ejection. Williams said the shop typically runs the end mills at feeds of 100 ipm or faster, in contrast to the 40-to-50 ipm feeds employed with previously used end mills.

AVAILABLE IN THE FOLLOWING		
END TYPE	**LENGTHS**	**MEASUREMENT SYSTEM**
SQUARE	STUB	IMPERIAL (INCH)
BALLNOSE	STANDARD	METRIC (MILLIMETERS)
CORNER RADIUS	LONG	
	EXTRA LONG	
	EXTENDED REACH	

High-Performance,
Precision & Quality Are
Crafted Into Every End Mill

A World Leader in Solid Carbide End Mill Manufacturing

Division *of*
Commercial Grinding Services, Inc.

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