Patented

# Revolutionizes Milling

## Patented Unequal Helix Geometry

**Chatter-Resistant Design:**
- Improves Surface Finish

**Optimum Material Removal:**
- Increases Cutting Depth
- Increases Feed Rates

**Increased Tool Life:**
- Ti-NAMITE-A®(AlTiN Coated)
- Corner Radius
- Special Gash Break Out Grind
- Eccentric Relief

**Minimum Tool Deflection:**
- Reduces Harmful Machine Vibration
- Improves Dimensional Control

**Material Applications Include:**
- Low Carbon Steels
- Tool Steels
- Cast Iron
- Stainless Steels
- Titanium/High Temp Alloys

### DESIGN BENEFITS

The Ƶ CARB end mill **maximizes stock removal** and **improves productivity** in most milling operations. Chatter is the most common problem associated with aggressive milling. The SGS Ƶ CARB design features reduce chatter, increase tool life and optimize performance. Ƶ CARB tools are coated with SGS Ti-NAMITE-A® coating that resists heat generated in aggressive cutting operations.

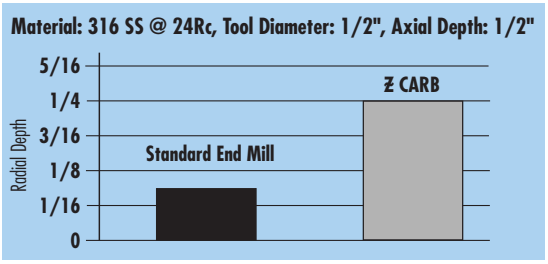
### CHATTER REDUCTION BY DESIGN

The unique patented design of the SGS Ƶ CARB decreases chatter, which improves work piece finish. Less tuning (manually adjusting speed and feed rates) increases operator confidence and productivity. Increases in axial depth of cut to 275% have been realized without chatter. SGS Ƶ CARB can achieve a 100% increase in radial width of cut over standard geometry end mills.

### APPLICATION TIPS

- Tool holders with adequate gripping pressure are required
- Stub length solid holders are recommended for heavy stock removal
- Avoid remilling chips
- Ramping or spiral plunging are the preferred entry methods into pockets (approximately 6° at 50 % normal feed)
- Regrind and recondition services are available from SGS
- Set-up rigidity critical during heavy roughing

### RADIAL CAPABILITY



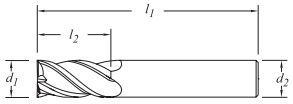

| $d_2$ TOLERANCES | |
|---|---|
| 1/8 - 3/8 | = -.0001/-.0003 |
| >3/8 - 1 | = -.0001/-.0004 |

| $d_1$ TOLERANCES | |
|---|---|
| 1/8 - 1/4 | = +.0000/-.0012 |
| >1/4 - 3/8 | = +.0000/-.0016 |
| >3/8 - 1 | = +.0000/-.002 |

| PATENT NUMBERS: |
|---|
| U.S.: 4,963,059 |
| Germany: 3,706,282 |
| Korea: 065,154 |
| Japan: 1513152 |

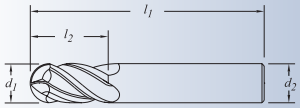
# Fractional

## Ƶ CARB™ Series Ƶ1 - 4 Flute - Square End



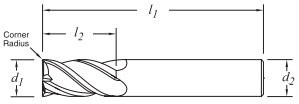

| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Ti-NAMITE-A (ALtiN) EDP No. | Ti-NAMITE-A (ALtiN) EDP No. w/ flat |
|---|---|---|---|---|---|
| 1/8 | 3/8 | 1-1/2 | 1/8 | 36404 | |
| 5/32 | 7/16 | 2 | 3/16 | 36406 | |
| 3/16 | 7/16 | 2 | 3/16 | 36408 | |
| 7/32 | 7/16 | 2-1/2 | 1/4 | 36410 | |
| 1/4 | 1/2 | 2-1/2 | 1/4 | 36416 | |
| 9/32 | 5/8 | 2-1/2 | 5/16 | 36418 | |
| 5/16 | 13/16 | 2-1/2 | 5/16 | 36420 | |
| 11/32 | 13/16 | 2-1/2 | 3/8 | 36422 | |
| 3/8 | 7/8 | 2-1/2 | 3/8 | 36424 | 36530 |
| 13/32 | 15/16 | 2-3/4 | 7/16 | 36426 | 36531 |
| 7/16 | 1 | 2-3/4 | 7/16 | 36428 | 36532 |
| 15/32 | 1 | 3 | 1/2 | 36430 | 36533 |
| 1/2 | 1 | 3 | 1/2 | 36432 | 36534 |
| 9/16 | 1-1/8 | 3-1/2 | 9/16 | 36436 | 36535 |
| 5/8 | 1-1/4 | 3-1/2 | 5/8 | 36440 | 36536 |
| 3/4 | 1-1/2 | 4 | 3/4 | 36442 | 36537 |
| 1 | 1-1/2 | 4 | 1 | 36444 | 36538 |

## Ƶ CARB™ Series Ƶ1B - 4 Flute - Ball End




| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Ti-NAMITE-A (ALtiN) EDP No. | Ti-NAMITE-A (ALtiN) EDP No. w/ flat |
|---|---|---|---|---|---|
| 1/8 | 3/8 | 1-1/2 | 1/8 | 36358 | |
| 5/32 | 7/16 | 2 | 3/16 | 36357 | |
| 3/16 | 7/16 | 2 | 3/16 | 36359 | |
| 7/32 | 7/16 | 2-1/2 | 1/4 | 36361 | |
| 1/4 | 1/2 | 2-1/2 | 1/4 | 36344 | |
| 9/32 | 5/8 | 2-1/2 | 5/16 | 36353 | |
| 5/16 | 13/16 | 2-1/2 | 5/16 | 36345 | |
| 11/32 | 13/16 | 2-1/2 | 3/8 | 36354 | |
| 3/8 | 7/8 | 2-1/2 | 3/8 | 36346 | 36539 |
| 13/32 | 15/16 | 2-3/4 | 7/16 | 36355 | 36540 |
| 7/16 | 1 | 2-3/4 | 7/16 | 36347 | 36541 |
| 15/32 | 1 | 3 | 1/2 | 36356 | 36542 |
| 1/2 | 1 | 3 | 1/2 | 36348 | 36543 |
| 9/16 | 1-1/8 | 3-1/2 | 9/16 | 36349 | 36544 |
| 5/8 | 1-1/4 | 3-1/2 | 5/8 | 36350 | 36545 |
| 3/4 | 1-1/2 | 4 | 3/4 | 36351 | 36546 |
| 1 | 1-1/2 | 4 | 1 | 36352 | 36547 |

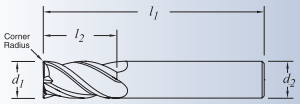
## Ƶ CARB™ - HTA Series ƵH1CR Fractional - Corner Radius





| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Corner Radius | Ti-NAMITE-A (AlTiN) EDP No. | Ti-NAMITE-A (AlTiN) EDP No. w/Flat |
|---|---|---|---|---|---|---|
| 1/4 | 1/2 | 2-1/2 | 1/4 | .015 - .020 | 36570 | |
| 5/16 | 13/16 | 2-1/2 | 5/16 | .015 - .020 | 36571 | |
| 3/8 | 7/8 | 2-1/2 | 3/8 | .015 - .020 | 36572 | 36555 |
| 7/16 | 1 | 2-3/4 | 7/16 | .015 - .020 | 36573 | 36556 |
| 1/2 | 1 | 3 | 1/2 | .025 - .030 | 36574 | 36557 |
| 9/16 | 1-1/8 | 3-1/2 | 9/16 | .025 - .030 | 36575 | 36558 |
| 5/8 | 1-1/4 | 3-1/2 | 5/8 | .035 - .040 | 36576 | 36559 |
| 3/4 | 1-1/2 | 4 | 3/4 | .035 - .040 | 36577 | 36560 |
| 1 | 1-1/2 | 4 | 1 | .035 - .040 | 36578 | 36561 |

## Ƶ CARB™ Series Ƶ1CR - 4 Flute - Corner Radius




| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Corner Radius | Ti-NAMITE-A (ALtiN) EDP No. | Ti-NAMITE-A (ALtiN) EDP No. w/ flat |
|---|---|---|---|---|---|---|
| 1/8 | 3/8 | 1-1/2 | 1/8 | .010 -.015 | 36333 | |
| 3/16 | 7/16 | 2 | 3/16 | .010 -.015 | 36334 | |
| 1/4 | 1/2 | 2-1/2 | 1/4 | .015 - .020 | 36335 | |
| 5/16 | 13/16 | 2-1/2 | 5/16 | .015 - .020 | 36336 | |
| 3/8 | 7/8 | 2-1/2 | 3/8 | .015 - .020 | 36337 | 36548 |
| 7/16 | 1 | 2-3/4 | 7/16 | .015 - .020 | 36338 | 36549 |
| 1/2 | 1 | 3 | 1/2 | .025 - .030 | 36339 | 36550 |
| 9/16 | 1-1/8 | 3-1/2 | 9/16 | .025 - .030 | 36340 | 36551 |
| 5/8 | 1-1/4 | 3-1/2 | 5/8 | .035 - .040 | 36341 | 36552 |
| 3/4 | 1-1/2 | 4 | 3/4 | .035 - .040 | 36342 | 36553 |
| 1 | 1-1/2 | 4 | 1 | .035 - .040 | 36343 | 36554 |

## Z-Carb HTA Fractional - Speed and Feed Recommendations

| High Temp Alloys | Bhn | CUTTING DIAMETER ($d_1$) 1/4 rpm | 1/4 in/min | 5/16 rpm | 5/16 in/min | 3/8 rpm | 3/8 in/min | 7/16 rpm | 7/16 in/min | 1/2 rpm | 1/2 in/min | 9/16 rpm | 9/16 in/min | 5/8 rpm | 5/8 in/min | 3/4 rpm | 3/4 in/min | 1 rpm | 1 in/min |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profile - Semi-Rough | <300 | 1,990 | 9.6 | 1,600 | 9.7 | 1,325 | 9.8 | 1,135 | 9.9 | 995 | 9.9 | 885 | 9.9 | 795 | 9.9 | 660 | 9.7 | 500 | 9.7 |
| Profile - Rough | <300 | 1,680 | 6.4 | 1,345 | 6.5 | 1,120 | 6.6 | 960 | 6.7 | 840 | 6.7 | 750 | 6.7 | 670 | 6.7 | 560 | 6.5 | 420 | 6.5 |
| Slotting | <300 | 1,380 | 3.9 | 1,100 | 4.0 | 920 | 4.1 | 785 | 4.2 | 690 | 4.2 | 610 | 4.2 | 550 | 4.2 | 460 | 4.0 | 345 | 4.0 |
| Profile - Semi-Rough | >300 | 1,840 | 7.1 | 1,470 | 7.2 | 1,220 | 7.3 | 1,050 | 7.4 | 920 | 7.4 | 815 | 7.4 | 735 | 7.4 | 610 | 7.2 | 460 | 7.2 |
| Profile - Rough | >300 | 1,530 | 4.0 | 1,225 | 4.1 | 1,020 | 4.2 | 875 | 4.3 | 765 | 4.3 | 680 | 4.3 | 610 | 4.3 | 510 | 4.1 | 380 | 4.1 |
| Slotting | >300 | 1,220 | 2.2 | 980 | 2.3 | 815 | 2.4 | 700 | 2.5 | 610 | 2.5 | 545 | 2.5 | 490 | 2.5 | 410 | 2.3 | 305 | 2.3 |

Profile - Semi-Rough Radial Width .125 x Diameter (max.) Axial Depth 1.5 x Diameter (max.)

Profile - Rough Radial Width .250 x Diameter (max.) Axial Depth 1.5 x Diameter (max.)

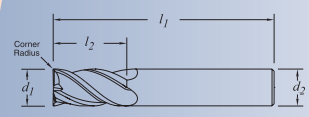
Slotting Axial Depth 1 x Diameter (max.)

Patented Z CARB SOLID CARBIDE END MILLS

SGS

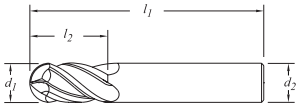
# Fractional

## Z CARB™ Series Z1LC - 4 Flute Long Reach with Corner Radius




| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Corner Radius | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|---|
| 1/4 | 1/2 | 4 | 1/4 | .015 - .020 | 36450 |
| 5/16 | 13/16 | 4 | 5/16 | .015 - .020 | 36452 |
| 3/8 | 7/8 | 5 | 3/8 | .015 - .020 | 36456 |
| 7/16 | 1 | 6 | 7/16 | .015 - .020 | 36460 |
| 1/2 | 1 | 6 | 1/2 | .025 - .030 | 36462 |
| 9/16 | 1-1/8 | 6 | 9/16 | .025 - .030 | 36466 |
| 5/8 | 1-1/4 | 6 | 5/8 | .035 - .040 | 36470 |
| 3/4 | 1-1/2 | 6 | 3/4 | .035 - .040 | 36472 |
| 1 | 1-1/2 | 6 | 1 | .035 - .040 | 36474 |

## Z CARB™ Series Z1LB - 4 Flute Long Reach Ball End




| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|
| 1/4 | 1/2 | 4 | 1/4 | 36480 |
| 5/16 | 13/16 | 4 | 5/16 | 36482 |
| 3/8 | 7/8 | 5 | 3/8 | 36486 |
| 7/16 | 1 | 6 | 7/16 | 38490 |
| 1/2 | 1 | 6 | 1/2 | 38492 |
| 9/16 | 1-1/8 | 6 | 9/16 | 38496 |
| 5/8 | 1-1/4 | 6 | 5/8 | 36500 |
| 3/4 | 1-1/2 | 6 | 3/4 | 36502 |
| 1 | 1-1/2 | 6 | 1 | 36504 |

## Z CARB™ Series Z16CR - 4 Flute Short Length with Corner Radius


| Cutting Diameter $d_1$ | Length of Cut $l_2$ | Overall Length $l_1$ | Shank Diameter $d_2$ | Corner Radius | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|---|
| 1/8 | 1/4 | 1-1/2 | 1/8 | .010 - .015 | 36505 |
| 5/32 | 5/16 | 2 | 3/16 | .010 - .015 | 36506 |
| 3/16 | 3/8 | 2 | 3/16 | .010 - .015 | 36507 |
| 7/32 | 3/8 | 2 | 1/4 | .015 - .020 | 36508 |
| 1/4 | 7/16 | 2 | 1/4 | .015 - .020 | 36509 |
| 5/16 | 1/2 | 2 | 5/16 | .015 - .020 | 36511 |
| 3/8 | 5/8 | 2 | 3/8 | .015 - .020 | 36513 |
| 7/16 | 5/8 | 2-1/2 | 7/16 | .015 - .020 | 36515 |
| 1/2 | 5/8 | 2-1/2 | 1/2 | .025 - .030 | 36517 |
| 5/8 | 3/4 | 3 | 5/8 | .035 - .040 | 36519 |
| 3/4 | 1 | 3 | 3/4 | .035 - .040 | 36520 |

| $d_1$ TOLERANCES |
|---|
| 1/8 - 1/4 = +.0000/-.0012 |
| >1/4 - 3/8 = +.0000/-.0016 |
| >3/8 - 1 = +.0000/-.002 |

| $d_2$ TOLERANCES |
|---|
| 1/8 - 3/8 = -.0001/-.0003 |
| >3/8 - 1 = -.0001/-.0004 |

## Z Carb Fractional - Speed and Feed Recommendations

| Material | Bhn | CUTTING DIAMETER ($d_1$) 1/8 | | 3/16 | | 1/4 | | 5/16 | | 3/8 | | 7/16 | | 1/2 | | 5/8 | | 3/4 | | 1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min | rpm | in/min |
| low carbon steels | ~175 | 15,585 | 12 | 10,362 | 20 | 7,793 | 24 | 6,234 | 29 | 5,195 | 39 | 4,453 | 38 | 3,896 | 37 | 3,117 | 33 | 2,598 | 31 | 1,948 | 25 |
| low carbon steels | ~275 | 12,835 | 10 | 8,148 | 17 | 6,418 | 20 | 5,134 | 24 | 4,278 | 32 | 3,667 | 31 | 3,209 | 30 | 2,567 | 7 | 2,139 | 25 | 1,604 | 21 |
| med alloy steels | ~275 | 10,696 | 8 | 6,790 | 14 | 5,348 | 17 | 4,278 | 20 | 3,565 | 27 | 3,056 | 26 | 2,674 | 25 | 2,139 | 23 | 1,783 | 21 | 1,337 | 17 |
| mold and die steels | ~275 | 5,500 | 4 | 3,492 | 8 | 2,750 | 8 | 2,200 | 10 | 1,834 | 13 | 1,572 | 13 | 1,375 | 13 | 1,100 | 11 | 917 | 11 | 688 | 9 |
| cast iron - gray | ~200 | 14,516 | 11 | 9,215 | 19 | 7,258 | 23 | 5,806 | 27 | 4,839 | 36 | 4,147 | 35 | 3,629 | 34 | 2,903 | 31 | 2,419 | 29 | 1,815 | 24 |
| cast iron - ductile | ~300 | 7,334 | 5 | 4,656 | 9 | 3,667 | 11 | 2,934 | 14 | 2,445 | 18 | 2,096 | 18 | 1,834 | 17 | 1,467 | 15 | 1,222 | 14 | 917 | 12 |
| cast iron - malleable | ~300 | 4,584 | 4 | 2,910 | 6 | 2,292 | 7 | 1,834 | 8 | 1,528 | 11 | 1,310 | 11 | 1,146 | 11 | 917 | 9 | 764 | 9 | 573 | 7 |
| stainless 300 series | ~275 | 9,168 | 7 | 5,820 | 12 | 4,584 | 14 | 3,667 | 16 | 3,056 | 16 | 2,619 | 16 | 2,292 | 16 | 1,834 | 6 | 1,528 | 15 | 1,146 | 15 |
| stainless 400 series | ~185 | 12,835 | 10 | 8,245 | 17 | 6,418 | 22 | 5,134 | 25 | 4,278 | 25 | 3,667 | 25 | 3,209 | 25 | 2,567 | 25 | 2,139 | 22 | 1,604 | 22 |
| stainless PH series | ~325 | 7,640 | 5 | 4,850 | 10 | 3,820 | 12 | 3,056 | 14 | 2,547 | 14 | 2,183 | 14 | 1,910 | 14 | 1,528 | 14 | 1,273 | 12 | 955 | 12 |
| titanium alloys | ~295 | 9,168 | 9 | 5,820 | 14 | 4,584 | 16 | 3,667 | 18 | 3,056 | 18 | 2,619 | 18 | 2,292 | 18 | 1,834 | 18 | 1,528 | 16 | 1,146 | 16 |
| high temp alloys | ~300 | 2,444 | 2 | 1,552 | 3 | 1,222 | 3 | 978 | 4 | 815 | 4 | 700 | 4 | 611 | 4 | 489 | 4 | 408 | 4 | 306 | 3 |

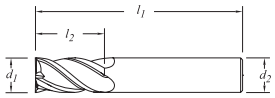
Profiling: Radial Width .5 x Diameter (max.)

Profiling: Axial Depth 1.5 x Diameter (max.)

Slotting: Axial Depth 1 x Diameter (max.)

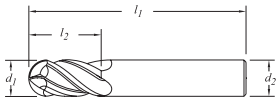
# Metric

## Z CARB™ Series Z1M - 4 Flute - Square End



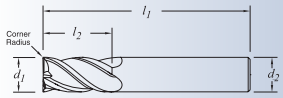

| Cutting Diameter $d_1$ mm | Length of Cut $l_2$ mm | Overall Length $l_1$ mm | Shank Diameter $d_2$ mm | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|
| 3 | 8 | 57 | 6 | 46357 |
| 4 | 11 | 57 | 6 | 46358 |
| 5 | 13 | 57 | 6 | 46359 |
| 6 | 13 | 57 | 6 | 46360 |
| 8 | 19 | 63 | 8 | 46362 |
| 10 | 22 | 72 | 10 | 46364 |
| 12 | 26 | 83 | 12 | 46366 |
| 14 | 26 | 83 | 14 | 46368 |
| 16 | 32 | 92 | 16 | 46370 |
| 18 | 32 | 92 | 18 | 46372 |
| 20 | 38 | 104 | 20 | 46374 |
| 25 | 38 | 104 | 25 | 46376 |

## Z CARB™ Series Z1MB - 4 Flute - Ball End




| Cutting Diameter $d_1$ mm | Length of Cut $l_2$ mm | Overall Length $l_1$ mm | Shank Diameter $d_2$ mm | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|
| 3 | 8 | 57 | 6 | 46354 |
| 4 | 11 | 57 | 6 | 46355 |
| 5 | 13 | 57 | 6 | 46356 |
| 6 | 13 | 57 | 6 | 46343 |
| 8 | 19 | 63 | 8 | 46344 |
| 10 | 22 | 72 | 10 | 46345 |
| 12 | 26 | 83 | 12 | 46346 |
| 14 | 26 | 83 | 14 | 46347 |
| 16 | 32 | 92 | 16 | 46348 |
| 18 | 32 | 92 | 18 | 46349 |
| 20 | 38 | 104 | 20 | 46350 |
| 25 | 38 | 104 | 25 | 46351 |

## Z CARB™ Series Z1MCR - 4 Flute - Corner Radius




| Cutting Diameter $d_1$ mm | Length of Cut $l_2$ mm | Overall Length $l_1$ mm | Shank Diameter $d_2$ mm | Corner Radius | Ti-NAMITE-A (ALtiN) EDP No. |
|---|---|---|---|---|---|
| 3 | 8 | 57 | 6 | 0,25-0,38 | 46377 |
| 4 | 11 | 57 | 6 | 0,25-0,38 | 46378 |
| 5 | 13 | 57 | 6 | 0,25-0,38 | 46379 |
| 6 | 13 | 57 | 6 | 0,38-0,51 | 46335 |
| 7 | 19 | 63 | 8 | 0,38-0,51 | 46380 |
| 8 | 19 | 63 | 8 | 0,38-0,51 | 46336 |
| 9 | 22 | 72 | 10 | 0,38-0,51 | 46381 |
| 10 | 22 | 72 | 10 | 0,38-0,51 | 46337 |
| 11 | 26 | 83 | 12 | 0,64-0,76 | 46382 |
| 12 | 26 | 83 | 12 | 0,64-0,76 | 46338 |
| 13 | 26 | 92 | 16 | 0,64-0,76 | 46383 |
| 14 | 26 | 83 | 14 | 0,64-0,76 | 46339 |
| 14 | 26 | 92 | 16 | 0,64-0,76 | 46384 |
| 15 | 32 | 92 | 16 | 0,89-1.02 | 46385 |
| 16 | 32 | 92 | 16 | 0,89-1,02 | 46340 |
| 18 | 32 | 92 | 18 | 0,89-1,02 | 46341 |
| 18 | 32 | 104 | 20 | 0,89-1.02 | 46386 |
| 20 | 38 | 104 | 20 | 0,89-1,02 | 46342 |
| 25 | 38 | 104 | 25 | 0,89-1,02 | 46334 |

| $d_1$ TOLERANCES (mm) | |
|---|---|
| 3 - 6 | = +0,0000/-0,030 |
| >6 - 10 | = +0,0000/-0,040 |
| >10 - 25 | = +0,0000/-0,050 |

| $d_2$ TOLERANCES (mm) | |
|---|---|
| 6 - 10 | = -0,0025/-0,0075 |
| >10 - 25 | = -0,0025/-0,010 |

## Z Carb Metric - Speed and Feed Recommendations

| Material | Bhn | CUTTING DIAMETER ($d_1$) 3 | | 5 | | 6 | | 8 | | 10 | | 12 | | 14 | | 16 | | 18 | | 20 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min | rpm | mm/min |
| low carbon steels | ~175 | 16,500 | 335 | 9,894 | 502 | 8,248 | 586 | 6,185 | 754 | 4,948 | 955 | 4,124 | 963 | 3,535 | 890 | 3,093 | 817 | 2,749 | 809 | 2,474 | 804 |
| low carbon steels | ~275 | 13,585 | 276 | 8,148 | 413 | 6,793 | 483 | 5,093 | 620 | 4,075 | 786 | 3,396 | 793 | 2,911 | 733 | 2,547 | 672 | 2,264 | 667 | 2,038 | 662 |
| med alloy steels | ~275 | 11,320 | 230 | 6,790 | 345 | 5,661 | 403 | 4,244 | 517 | 3,396 | 656 | 2,830 | 661 | 2,425 | 592 | 2,123 | 561 | 1,887 | 556 | 1,698 | 552 |
| mold and die steels | ~275 | 5,822 | 118 | 3,492 | 177 | 2,911 | 207 | 2,183 | 266 | 1,747 | 337 | 1,456 | 340 | 1,248 | 314 | 1,092 | 288 | 970 | 285 | 873 | 283 |
| cast iron - gray | ~200 | 15,364 | 300 | 9,215 | 468 | 7,682 | 546 | 5,760 | 702 | 4,609 | 889 | 3,841 | 897 | 3,292 | 829 | 2,881 | 761 | 2,560 | 754 | 2,304 | 749 |
| cast iron - ductile | ~300 | 7,763 | 158 | 4,656 | 236 | 3,882 | 276 | 2,911 | 354 | 2,329 | 449 | 1,941 | 453 | 1,663 | 419 | 1,456 | 384 | 1,294 | 381 | 1,164 | 378 |
| cast iron - malleable | ~300 | 4,852 | 98 | 2,911 | 147 | 2,426 | 173 | 1,819 | 221 | 1,455 | 280 | 1,213 | 283 | 1,040 | 262 | 910 | 240 | 809 | 238 | 728 | 236 |
| stainless 300 series | ~275 | 9,704 | 175 | 5,820 | 300 | 4,852 | 355 | 3,638 | 405 | 2,911 | 405 | 2,426 | 405 | 2,079 | 405 | 1,819 | 405 | 1,617 | 380 | 1,455 | 380 |
| stainless 400 series | ~185 | 13,585 | 250 | 8,245 | 430 | 6,793 | 560 | 5,093 | 635 | 4,075 | 635 | 3,396 | 635 | 2,911 | 635 | 2,547 | 635 | 2,264 | 560 | 2,038 | 560 |
| stainless PH series | ~325 | 8,086 | 125 | 4,850 | 250 | 4,043 | 300 | 3,032 | 355 | 2,426 | 355 | 2,022 | 355 | 1,733 | 355 | 1,516 | 355 | 1,348 | 300 | 1,213 | 300 |
| titanium alloys | ~295 | 9,704 | 225 | 5,820 | 355 | 4,852 | 405 | 3,638 | 455 | 2,911 | 455 | 2,426 | 455 | 2,079 | 455 | 1,819 | 455 | 1,617 | 405 | 1,455 | 405 |
| high temp alloys | ~300 | 2,588 | 50 | 1,552 | 75 | 1,294 | 75 | 970 | 100 | 776 | 100 | 647 | 100 | 554 | 100 | 485 | 100 | 431 | 100 | 388 | 100 |

Profiling: Radial Width .5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Profiling: Axial Depth 1.5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Slotting: Axial Depth 1 x Diameter (max.)