## Speeds & Feeds

**Product Table:** Miniature End Mills - Square - Extra Long Length
**Characteristics:** 4 Flutes
**Series:** 9605xx, 9919xx

### Product Notes:

Posted values reflect tools with a reach equal to 5x Diameter. For tools with a greater reach multiple, use the table below to adjust Chip Load and Depths of Cut.

| Reach Multiple | Slotting | | | Roughing | | | Finishing | | |
|---|---|---|---|---|---|---|---|---|---|
| | Chip Load | Depth of Cut | | Chip Load | Depth of Cut | | Chip Load | Depth of Cut | |
| | | Radial | Axial | | Radial | Axial | | Radial | Axial |
| 5x | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 8x | 75% | 100% | 90% | 75% | 92% | 86% | 83% | 100% | 100% |
| 12x | 60% | 100% | 75% | 60% | 75% | 71% | 75% | 67% | 100% |
| 15x | 50% | 100% | 75% | 50% | 50% | 71% | 67% | 53% | 100% |
| 20x | 40% | 100% | 50% | 40% | 42% | 57% | 58% | 33% | 100% |
| 25x | 30% | 100% | 50% | 30% | 42% | 57% | 50% | 33% | 100% |

### General Notes:

All posted speed and feed parameters are suggested starting values that may be increased given optimal setup conditions. Chip loads reflect uncoated cutters and may be increased 10%-20% if coated. For ferrous materials with hardness ≤ 28 Rc, chip loads can be increased 10%-20%.

If you require additional information, Harvey Tool has a team of technical experts available to assist you through even the most challenging applications. Please contact us at **800-645-5609** or **Harveytech@harveyperformance.com**.

WARNING: Cutting tools may shatter under improper use. Government regulations require use of safety glasses and other appropriate safety equipment in the vicinity of use.

### Hardness: ≤ 28 Rc (≤ 271 HBn)

| MATERIAL | SFM | Chip Load (IPT) By Cutter Diameter | | | | | | | | | | Depth of Cut | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | .125 | .187 | .250 | .312 | .375 | .500 | .625 | .750 | 1.000 | Radial | Axial |
| **ALUMINUM ALLOYS** | | Slotting | .00110 | .00165 | .00220 | .00275 | .00330 | .00440 | .00550 | .00660 | .00880 | 1.00 x Dia | .20 x Dia |
| Casting (2xx, 5xx, 7xx, 8xx) | 750 | Roughing | .00138 | .00206 | .00275 | .00343 | .00413 | .00550 | .00688 | .00825 | .01100 | .60 x Dia | .35 x Dia |
| Wrought (1xxx, 2xxx, 3xxx, 5xxx, 6xxx, 7xxx, 8xxx) | 1000 | Finishing | .00174 | .00260 | .00348 | .00434 | .00521 | .00695 | .00869 | .01043 | .01390 | .15 x Dia | 1.50 x Dia |
| Casting - 3%-5% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 750 | Slotting | .00099 | .00148 | .00198 | .00247 | .00297 | .00396 | .00495 | .00594 | .00792 | 1.00 x Dia | .20 x Dia |
| Casting - 5%-8% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 700 | | | | | | | | | | | | |
| Casting - 8%-12% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 650 | Roughing | .00124 | .00185 | .00248 | .00309 | .00371 | .00495 | .00619 | .00743 | .00990 | .60 x Dia | .35 x Dia |
| Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 475 | | | | | | | | | | | | |
| Wrought - 5%-8% Si (4xxx) | 1000 | Finishing | .00156 | .00234 | .00313 | .00390 | .00469 | .00626 | .00782 | .00939 | .01251 | .15 x Dia | 1.50 x Dia |
| Wrought - 8%-12% Si (4xxx) | 800 | | | | | | | | | | | | |
| **MAGNESIUM ALLOYS** | 1500 | Slotting | .00110 | .00165 | .00220 | .00275 | .00330 | .00440 | .00550 | .00660 | .00880 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00138 | .00206 | .00275 | .00343 | .00413 | .00550 | .00688 | .00825 | .01100 | .60 x Dia | .35 x Dia |
| **ZINC ALLOYS** | 800 | Finishing | .00174 | .00260 | .00348 | .00434 | .00521 | .00695 | .00869 | .01043 | .01390 | .15 x Dia | 1.50 x Dia |
| **COPPER ALLOYS** | | | | | | | | | | | | | |
| High Coppers - 90%+ (C1xxxx) | 225 | | | | | | | | | | | | |
| Brass (Copper Zinc alloys, C2xxxx, C3xxxx, C4xxxx, C66400-C69800) | 500 | Slotting | .00088 | .00132 | .00176 | .00220 | .00264 | .00352 | .00440 | .00528 | .00704 | 1.00 x Dia | .20 x Dia |
| Phosphor Bronzes (Copper Tin alloys, C5xxxx) | 225 | | | | | | | | | | | | |
| Aluminum Bronzes (Copper Aluminum alloys, C60600-C64200) | 500 | | | | | | | | | | | | |
| Silicon Bronzes (Copper Silicon alloys, C64700-C66100) | 500 | Roughing | .00110 | .00165 | .00220 | .00275 | .00330 | .00440 | .00550 | .00660 | .00880 | .60 x Dia | .35 x Dia |
| Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxxx) | 225 | | | | | | | | | | | | |
| Cast Copper Alloys (C83300-C86200, C86400-C87900, C92200-C95800, C97300-C97800, C99400-C99700) | 550 | Finishing | .00139 | .00208 | .00278 | .00347 | .00417 | .00556 | .00695 | .00834 | .01112 | .15 x Dia | 1.50 x Dia |

### Hardness: 29-37 Rc (279-344 HBn)

| MATERIAL | SFM | Chip Load (IPT) By Cutter Diameter | | | | | | | | | | Depth of Cut | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | .125 | .187 | .250 | .312 | .375 | .500 | .625 | .750 | 1.000 | Radial | Axial |
| **CARBON STEELS** | | Slotting | .00038 | .00057 | .00076 | .00094 | .00113 | .00151 | .00189 | .00227 | .00302 | 1.00 x Dia | .20 x Dia |
| Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx | 600 | Roughing | .00043 | .00064 | .00085 | .00106 | .00128 | .00170 | .00213 | .00255 | .00340 | .60 x Dia | .35 x Dia |
| | | Finishing | .00054 | .00081 | .00109 | .00136 | .00163 | .00217 | .00272 | .00326 | .00435 | .15 x Dia | 1.50 x Dia |
| 1030 - 1095, 1140 - 1151, 13xx, 15xx, 2xxx, 3xxx, 4xxx & 4xLxx, 5xxx & 5xLxx, 50xxx & 50Lxxx, 51xxx & 51Lxxx, 52xxx & 52Lxxx, 6xxx, 8xxx, 9xxx | 200 | Slotting | .00035 | .00052 | .00069 | .00086 | .00104 | .00138 | .00173 | .00207 | .00276 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00039 | .00058 | .00078 | .00097 | .00117 | .00156 | .00194 | .00233 | .00311 | .60 x Dia | .35 x Dia |
| | | Finishing | .00050 | .00074 | .00099 | .00124 | .00149 | .00199 | .00248 | .00298 | .00397 | .15 x Dia | 1.50 x Dia |
| **STAINLESS STEELS** | | Slotting | .00038 | .00057 | .00076 | .00094 | .00113 | .00151 | .00189 | .00227 | .00302 | 1.00 x Dia | .20 x Dia |
| 203 EZ, 303 (all types), 416, 416Se, 416 Plus X, 420F, 420FSe, 430F, 430FSe, 440F, 440FSe | 450 | Roughing | .00043 | .00064 | .00085 | .00106 | .00128 | .00170 | .00213 | .00255 | .00340 | .60 x Dia | .35 x Dia |
| | | Finishing | .00054 | .00081 | .00109 | .00136 | .00163 | .00217 | .00272 | .00326 | .00435 | .15 x Dia | 1.50 x Dia |
| 201, 202, 203, 205, 301, 302, 304, 304L, 308, 309, 310, 314, 316, 316L, 317, 321, 329, 330, 347, 348, 385, 403, 405, 409, 410, 413, 420, 429, 430, 434, 436, 442, 446, 501, 502 | 200 | Slotting | .00035 | .00052 | .00069 | .00086 | .00104 | .00138 | .00173 | .00207 | .00276 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00039 | .00058 | .00078 | .00097 | .00117 | .00156 | .00194 | .00233 | .00311 | .60 x Dia | .35 x Dia |
| | | Finishing | .00050 | .00074 | .00099 | .00124 | .00149 | .00199 | .00248 | .00298 | .00397 | .15 x Dia | 1.50 x Dia |
| 414, 431, 440A, 440B, 440C, 13-8, 15-5, 15-7, 17-4, 17-7 | 150 | Slotting | .00022 | .00032 | .00043 | .00054 | .00065 | .00086 | .00108 | .00130 | .00173 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00024 | .00036 | .00049 | .00061 | .00073 | .00097 | .00122 | .00146 | .00194 | .60 x Dia | .35 x Dia |
| | | Finishing | .00031 | .00046 | .00062 | .00078 | .00093 | .00124 | .00155 | .00186 | .00248 | .15 x Dia | 1.50 x Dia |
| **TOOL STEELS** | | Slotting | .00035 | .00052 | .00069 | .00086 | .00104 | .00138 | .00173 | .00207 | .00276 | 1.00 x Dia | .20 x Dia |
| A, L, O, P, W series | 200 | Roughing | .00039 | .00058 | .00078 | .00097 | .00117 | .00156 | .00194 | .00233 | .00311 | .60 x Dia | .35 x Dia |
| | | Finishing | .00050 | .00074 | .00099 | .00124 | .00149 | .00199 | .00248 | .00298 | .00397 | .15 x Dia | 1.50 x Dia |
| D, H, M, T, S series | 150 | Slotting | .00022 | .00032 | .00043 | .00054 | .00065 | .00086 | .00108 | .00130 | .00173 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00024 | .00036 | .00049 | .00061 | .00073 | .00097 | .00122 | .00146 | .00194 | .60 x Dia | .35 x Dia |
| | | Finishing | .00031 | .00046 | .00062 | .00078 | .00093 | .00124 | .00155 | .00186 | .00248 | .15 x Dia | 1.50 x Dia |
| **TITANIUM ALLOYS** | 150 | Slotting | .00022 | .00032 | .00043 | .00054 | .00065 | .00086 | .00108 | .00130 | .00173 | 1.00 x Dia | .20 x Dia |
| | | Roughing | .00024 | .00036 | .00049 | .00061 | .00073 | .00097 | .00122 | .00146 | .00194 | .60 x Dia | .35 x Dia |
| | | Finishing | .00031 | .00046 | .00062 | .00078 | .00093 | .00124 | .00155 | .00186 | .00248 | .15 x Dia | 1.50 x Dia |
| **HIGH TEMP ALLOYS** | | Slotting | .00022 | .00032 | .00043 | .00054 | .00065 | .00086 | .00108 | .00130 | .00173 | 1.00 x Dia | .20 x Dia |
| Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, Incoloy | 70 | Roughing | .00024 | .00036 | .00049 | .00061 | .00073 | .00097 | .00122 | .00146 | .00194 | .60 x Dia | .35 x Dia |
| | | Finishing | .00031 | .00046 | .00062 | .00078 | .00093 | .00124 | .00155 | .00186 | .00248 | .15 x Dia | 1.50 x Dia |

### Hardness: 38-45 Rc (353-421 HBn)

| SFM | | Chip Load (IPT) By Cutter Diameter | | | | | | | | | Depth of Cut | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | .125 | .187 | .250 | .312 | .375 | .500 | .625 | .750 | 1.000 | Radial | Axial |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - |
| 100 | Slotting | .00017 | .00026 | .00035 | .00043 | .00052 | .00069 | .00086 | .00104 | .00138 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00019 | .00029 | .00039 | .00049 | .00058 | .00078 | .00097 | .00117 | .00156 | .60 x Dia | .35 x Dia |
| | Finishing | .00025 | .00037 | .00050 | .00063 | .00075 | .00100 | .00125 | .00150 | .00200 | .15 x Dia | 1.50 x Dia |
| 90 | Slotting | .00011 | .00016 | .00022 | .00027 | .00032 | .00043 | .00054 | .00065 | .00086 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00012 | .00018 | .00024 | .00030 | .00036 | .00049 | .00061 | .00073 | .00097 | .60 x Dia | .35 x Dia |
| | Finishing | .00016 | .00023 | .00031 | .00039 | .00047 | .00063 | .00078 | .00094 | .00125 | .15 x Dia | 1.50 x Dia |
| 100 | Slotting | .00017 | .00026 | .00035 | .00043 | .00052 | .00069 | .00086 | .00104 | .00138 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00019 | .00029 | .00039 | .00049 | .00058 | .00078 | .00097 | .00117 | .00156 | .60 x Dia | .35 x Dia |
| | Finishing | .00025 | .00037 | .00050 | .00063 | .00075 | .00100 | .00125 | .00150 | .00200 | .15 x Dia | 1.50 x Dia |
| 90 | Slotting | .00011 | .00016 | .00022 | .00027 | .00032 | .00043 | .00054 | .00065 | .00086 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00012 | .00018 | .00024 | .00030 | .00036 | .00049 | .00061 | .00073 | .00097 | .60 x Dia | .35 x Dia |
| | Finishing | .00016 | .00023 | .00031 | .00039 | .00047 | .00063 | .00078 | .00094 | .00125 | .15 x Dia | 1.50 x Dia |
| 75 | Slotting | .00011 | .00016 | .00022 | .00027 | .00032 | .00043 | .00054 | .00065 | .00086 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00012 | .00018 | .00024 | .00030 | .00036 | .00049 | .00061 | .00073 | .00097 | .60 x Dia | .35 x Dia |
| | Finishing | .00016 | .00023 | .00031 | .00039 | .00047 | .00063 | .00078 | .00094 | .00125 | .15 x Dia | 1.50 x Dia |
| 50 | Slotting | .00011 | .00016 | .00022 | .00027 | .00032 | .00043 | .00054 | .00065 | .00086 | 1.00 x Dia | .20 x Dia |
| | Roughing | .00012 | .00018 | .00024 | .00030 | .00036 | .00049 | .00061 | .00073 | .00097 | .60 x Dia | .35 x Dia |
| | Finishing | .00016 | .00023 | .00031 | .00039 | .00047 | .00063 | .00078 | .00094 | .00125 | .15 x Dia | 1.50 x Dia |