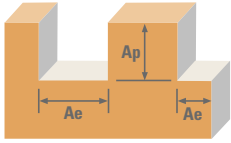


# Speeds and Feeds

**Instructions:**

- rpm = use speed from INCH or METRIC Baseline chart
- ipm = INCH Baseline Feed (ipm) x Feed Multiplier [from selected chart below]
- mm/min = METRIC Baseline Feed (mm/min) x Feed Multiplier [from selected chart below]
- Reduce speed and feed 30 percent when using uncoated tools
- Find Width of Cut (Ae) and Depth of Cut (Ap) recommendations on chart below
- refer to the KYOCERA SGS Tool Wizard® or sgsmicrotools.com for detailed technical charts by series



| INCH<br>2-Flute, Square,<br>Corner Radius<br>& Ball<br>Without Reach | Flute Length    | 1.5 x DC |         | 3 x DC  |         |      |      |
|--|-----------------|----------|---------|---------|---------|------|------|
|  | Feed Multiplier | 1        |         | 0.9     |         |      |      |
|  | Width/Depth     | Ae x DC  | Ap x DC | Ae x DC | Ap x DC |      |      |
|  | Diameter (DC)   | ≤0.0312  | >0.0312 | ≤0.0312 | >0.0312 |      |      |
| P<br>H<br>K<br>M<br>S<br>N<br>ALL                                    | Profile         | ≤.30     | ≤.50    | ≤1      | ≤.10    | ≤.25 | ≤2   |
|  | Slot            | 1        | ≤.20    | ≤.50    | 1       | ≤.15 | ≤.35 |

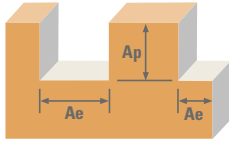
| INCH<br>4-Flute, Square,<br>Corner Radius<br>& Ball<br>Without Reach | Flute Length    | 1.5 x DC |         | 3 x DC  |         | 5 x DC  |         | 8 x DC  |         | 12 x DC |         |      |    |      |      |    |
|--|-----------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|----|------|------|----|
|  | Feed Multiplier | 1.57     |         | 1.41    |         | 0.59    |         | 0.59    |         | 0.36    |         |      |    |      |      |    |
|  | Width/Depth     | Ae x DC  | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC |      |    |      |      |    |
|  | Diameter (DC)   | ≤0.0312  | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 |      |    |      |      |    |
| P<br>H<br>K<br>M<br>S<br>N<br>ALL                                    | Profile         | ≤.30     | ≤.50    | ≤1      | ≤.10    | ≤.25    | ≤2      | ≤.10    | ≤.25    | ≤3      | ≤.05    | ≤.10 | ≤4 | ≤.03 | ≤.06 | ≤6 |
|  | Slot            | 1        | ≤.20    | ≤.50    | 1       | ≤.15    | ≤.35    | 1       | ≤.10    | ≤.20    |         |      |    |      |      |    |

| METRIC<br>2-Flute<br>Square & Ball<br>Without Reach | Flute Length    | 1.5 x DC |         | 3 x DC  |         |      |      |
|---|-----------------|----------|---------|---------|---------|------|------|
|   | Feed Multiplier | 1        |         | 0.9     |         |      |      |
|   | Width/Depth     | Ae x DC  | Ap x DC | Ae x DC | Ap x DC |      |      |
|   | Diameter (DC)   | ≤0.0312  | >0.0312 | ≤0.0312 | >0.0312 |      |      |
| P<br>H<br>K<br>M<br>S<br>N<br>ALL                   | Profile         | ≤.30     | ≤.50    | ≤1      | ≤.10    | ≤.25 | ≤2   |
|   | Slot            | 1        | ≤.20    | ≤.50    | 1       | ≤.15 | ≤.35 |

| METRIC<br>4-Flute<br>Square & Ball<br>Without Reach | Flute Length    | 1.5 x DC |         | 3 x DC  |         |      |      |
|---|-----------------|----------|---------|---------|---------|------|------|
|   | Feed Multiplier | 1.57     |         | 1.41    |         |      |      |
|   | Width/Depth     | Ae x DC  | Ap x DC | Ae x DC | Ap x DC |      |      |
|   | Diameter (DC)   | ≤0.0312  | >0.0312 | ≤0.0312 | >0.0312 |      |      |
| P<br>H<br>K<br>M<br>S<br>N<br>ALL                   | Profile         | ≤.30     | ≤.50    | ≤1      | ≤.10    | ≤.25 | ≤2   |
|   | Slot            | 1        | ≤.20    | ≤.50    | 1       | ≤.15 | ≤.35 |

**Instructions:**

- rpm = use speed from INCH or METRIC Baseline chart
- ipm = INCH Baseline Feed (ipm) x Feed Multiplier [from selected chart below]
- mm/min = METRIC Baseline Feed (mm/min) x Feed Multiplier [from selected chart below]
- Reduce speed and feed 30 percent when using uncoated tools
- Find Width of Cut (Ae) and Depth of Cut (Ap) recommendations on chart below
- refer to the KYOCERA SGS Tool Wizard® or sgsmicrotools.com for detailed technical charts by series



| INCH<br>2-Flute<br>Square & Ball<br>With Reach | Flute Length    | 8 x DC  |         | 12 x DC |         |      |      |      |
|--|-----------------|---------|---------|---------|---------|------|------|------|
|  | Feed Multiplier | 0.6     |         | 0.5     |         |      |      |      |
|  | Width/Depth     | Ae x DC | Ap x DC | Ae x DC | Ap x DC |      |      |      |
|  | Diameter (DC)   | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 |      |      |      |
| P  | Profile         | ≤.25    | ≤.50    | ≤.30    | ≤.22    | ≤.45 | ≤.25 |      |
| H  |                 |         |         |         |         |      |      |      |
| K  | ALL             | 1       |         | ≤.07    | ≤.17    | 1    | ≤.06 | ≤.15 |
| M  |                 |         |         |         |         |      |      |      |
| S  |                 |         |         |         |         |      |      |      |
| N  |                 |         |         |         |         |      |      |      |

| INCH<br>3-Flute<br>Square, Corner<br>Radius & Ball<br>With Reach | Flute Length    | 3 x DC  |         | 5 x DC  |         | 8 x DC  |         | 12 x DC |         | 15 x DC |         | 20 x DC |         | 25 x DC |         |      |      |      |      |      |      |      |      |
|--|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|------|------|------|------|------|------|------|
|  | Feed Multiplier | 1.4     |         | 1.15    |         | 0.9     |         | 0.7     |         | 0.6     |         | 0.45    |         | 0.35    |         |      |      |      |      |      |      |      |      |
|  | Width/Depth     | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC | Ae x DC | Ap x DC |      |      |      |      |      |      |      |      |
|  | Diameter (DC)   | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 |      |      |      |      |      |      |      |      |
| P  | Profile         | ≤.30    | ≤.60    | ≤.5     | ≤.30    | ≤.60    | ≤.35    | ≤.25    | ≤.50    | ≤.30    | ≤.22    | ≤.45    | ≤.25    | ≤.15    | ≤.30    | ≤.25 | ≤.12 | ≤.25 | ≤.20 | ≤.12 | ≤.25 | ≤.20 |      |
| H  |                 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |      |
| K  | ALL             | 1       |         | ≤.15    | ≤.30    | 1       | ≤.08    | ≤.20    | 1       | ≤.07    | ≤.17    | 1       | ≤.06    | ≤.15    | 1       | ≤.06 | ≤.15 | 1    | ≤.04 | ≤.10 | 1    | ≤.04 | ≤.10 |
| M  |                 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |      |
| S  |                 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |      |
| N  |                 |         |         |         |         |         |         |         |         |         |         |         |         |         |         |      |      |      |      |      |      |      |      |

















| INCH<br>4-Flute<br>Square & Ball<br>With Reach | Flute Length    | 8 x DC  |         | 12 x DC |         |      |      |      |
|--|-----------------|---------|---------|---------|---------|------|------|------|
|  | Feed Multiplier | 0.95    |         | 0.75    |         |      |      |      |
|  | Width/Depth     | Ae x DC | Ap x DC | Ae x DC | Ap x DC |      |      |      |
|  | Diameter (DC)   | ≤0.0312 | >0.0312 | ≤0.0312 | >0.0312 |      |      |      |
| P  | Profile         | ≤.25    | ≤.50    | ≤.30    | ≤.22    | ≤.45 | ≤.25 |      |
| H  |                 |         |         |         |         |      |      |      |
| K  | ALL             | 1       |         | ≤.07    | ≤.17    | 1    | ≤.06 | ≤.15 |
| M  |                 |         |         |         |         |      |      |      |
| S  |                 |         |         |         |         |      |      |      |
| N  |                 |         |         |         |         |      |      |      |

**Note:**













- Bhn (Brinell)      HRc (Rockwell C)
- reduce speed and feed 30 percent when using uncoated tools
- Fz x No. of Flutes x max available rpm when recommendation exceeds machine limit
- helical ramp at 1 degrees or less, using slotting speed and feed rates (plunging is not recommended)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x DC maximum)
- refer to the KYOCERA SGS Tool Wizard® or sgsmicrotools.com for detailed technical charts by series

# FRACTIONAL Baseline

INCH Baseline  
Speed and Feed  
Square, Corner Radius  
& Ball End  
With and Without Reach

| Material   | Hardness                    | Vc (sfm)   | RPM        | DC • in    |          |         |         |         |         |         |
|--|-----------------------------|--|------------|------------|----------|---------|---------|---------|---------|---------|
|  |                             |  |            | 0.0050     | 0.0156   | 0.0312  | 0.0625  | 0.0938  | 0.1200  |         |
| P<br>CARBON STEELS<br>1018, 1040, 1080, 1090,<br>10L50, 1140, 1212,<br>12L15, 1525, 1536 | ≤ 275 Bhn<br>or<br>≤ 28 HRc | Profile<br>   | 365        | RPM        | 278860   | 89378   | 44689   | 22309   | 14865   | 11619   |
|  |                             |  | (292-438)  | Fz         | 0.000022 | 0.00007 | 0.00013 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 12.05    | 12.05   | 12.05   | 12.05   | 12.05   | 12.05   |
|  |                             | Slot<br>      | 290        | RPM        | 221560   | 71013   | 35506   | 17725   | 11810   | 9232    |
|  |                             |  | (232-348)  | Fz         | 0.000022 | 0.00007 | 0.00013 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 9.57     | 9.57    | 9.57    | 9.57    | 9.57    | 9.57    |
| P<br>ALLOY STEELS<br>4140, 4150, 4320, 5120,<br>5150, 8630, 86L20,<br>50100              | ≤ 375 Bhn<br>or<br>≤ 40 HRc | Profile<br>   | 210        | RPM        | 160440   | 51423   | 25712   | 12835   | 8552    | 6685    |
|  |                             |  | (168-252)  | Fz         | 0.000019 | 0.00006 | 0.00012 | 0.00024 | 0.00036 | 0.00046 |
|  |                             |  |            | Feed (ipm) | 6.16     | 6.16    | 6.16    | 6.16    | 6.16    | 6.16    |
|  |                             | Slot<br>      | 165        | RPM        | 126060   | 40404   | 20202   | 10085   | 6720    | 5253    |
|  |                             |  | (132-198)  | Fz         | 0.000019 | 0.00006 | 0.00012 | 0.00024 | 0.00036 | 0.00046 |
|  |                             |  |            | Feed (ipm) | 4.84     | 4.84    | 4.84    | 4.84    | 4.84    | 4.84    |
| M<br>STAINLESS STEELS<br>(FREE MACHINING)<br>303, 416, 420F, 430F,<br>440F               | ≤ 275 Bhn<br>or<br>≤ 28 HRc | Profile<br>   | 340        | RPM        | 259760   | 83256   | 41628   | 20781   | 13846   | 10823   |
|  |                             |  | (272-408)  | Fz         | 0.000022 | 0.00007 | 0.00013 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 11.22    | 11.22   | 11.22   | 11.22   | 11.22   | 11.22   |
|  |                             | Slot<br>      | 270        | RPM        | 206280   | 66115   | 33058   | 16502   | 10996   | 8595    |
|  |                             |  | (216-324)  | Fz         | 0.000022 | 0.00007 | 0.00013 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 8.91     | 8.91    | 8.91    | 8.91    | 8.91    | 8.91    |
| M<br>STAINLESS STEELS<br>(DIFFICULT)<br>304, 304L, 316, 316L                             | ≤ 275 Bhn<br>or<br>≤ 28 HRc | Profile<br>   | 235        | RPM        | 179540   | 57545   | 28772   | 14363   | 9570    | 7481    |
|  |                             |  | (188-282)  | Fz         | 0.000019 | 0.00006 | 0.00012 | 0.00024 | 0.00036 | 0.00046 |
|  |                             |  |            | Feed (ipm) | 6.90     | 6.90    | 6.90    | 6.90    | 6.90    | 6.90    |
|  |                             | Slot<br>    | 185        | RPM        | 141340   | 45301   | 22651   | 11307   | 7534    | 5889    |
|  |                             |  | (148-222)  | Fz         | 0.000019 | 0.00006 | 0.00012 | 0.00024 | 0.00036 | 0.00046 |
|  |                             |  |            | Feed (ipm) | 5.43     | 5.43    | 5.43    | 5.43    | 5.43    | 5.43    |
| M<br>STAINLESS STEELS<br>(PH)<br>13-8 PH, 15-5PH,<br>17-4 PH, CUSTOM 450                 | ≤ 325 Bhn<br>or<br>≤ 35 HRc | Profile<br> | 215        | RPM        | 164260   | 52647   | 26324   | 13141   | 8756    | 6844    |
|  |                             |  | (172-258)  | Fz         | 0.000014 | 0.00004 | 0.00008 | 0.00017 | 0.00025 | 0.00033 |
|  |                             |  |            | Feed (ipm) | 4.46     | 4.46    | 4.46    | 4.46    | 4.46    | 4.46    |
|  |                             | Slot<br>    | 170        | RPM        | 129880   | 41628   | 20814   | 10390   | 6923    | 5412    |
|  |                             |  | (136-204)  | Fz         | 0.000014 | 0.00004 | 0.00008 | 0.00017 | 0.00025 | 0.00033 |
|  |                             |  |            | Feed (ipm) | 3.53     | 3.53    | 3.53    | 3.53    | 3.53    | 3.53    |
| K<br>CAST IRONS<br>(LOW & MEDIUM<br>ALLOY)<br>Gray, Malleable,<br>Ductile                | ≤ 220 Bhn<br>or<br>≤ 19 HRc | Profile<br> | 305        | RPM        | 233020   | 74686   | 37343   | 18642   | 12421   | 9709    |
|  |                             |  | (244-366)  | Fz         | 0.000022 | 0.00007 | 0.00014 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 10.08    | 10.08   | 10.08   | 10.08   | 10.08   | 10.08   |
|  |                             | Slot<br>    | 245        | RPM        | 187180   | 59994   | 29997   | 14974   | 9978    | 7799    |
|  |                             |  | (196-294)  | Fz         | 0.000022 | 0.00007 | 0.00014 | 0.00027 | 0.00041 | 0.00052 |
|  |                             |  |            | Feed (ipm) | 8.10     | 8.10    | 8.10    | 8.10    | 8.10    | 8.10    |
| N<br>ALUMINUM ALLOYS<br>2017, 2024, 356, 6061,<br>7075                                   | ≤ 150 Bhn<br>or<br>≤ 7 HRc  | Profile<br> | 1000       | RPM        | 764000   | 244872  | 122436  | 61120   | 40725   | 31833   |
|  |                             |  | (800-1200) | Fz         | 0.000064 | 0.00020 | 0.00040 | 0.00080 | 0.00120 | 0.00153 |
|  |                             |  |            | Feed (ipm) | 97.50    | 97.50   | 97.50   | 97.50   | 97.50   | 97.50   |
|  |                             | Slot<br>    | 800        | RPM        | 611200   | 195897  | 97949   | 48896   | 32580   | 25467   |
|  |                             |  | (640-960)  | Fz         | 0.000064 | 0.00020 | 0.00040 | 0.00080 | 0.00120 | 0.00153 |
|  |                             |  |            | Feed (ipm) | 78.00    | 78.00   | 78.00   | 78.00   | 78.00   | 78.00   |
| N<br>COPPER ALLOYS<br>Alum Bronze, C110,<br>Muntz Brass                                  | ≤ 140 Bhn<br>or<br>≤ 3 HRc  | Profile<br> | 515        | RPM        | 393460   | 126109  | 63054   | 31477   | 20973   | 16394   |
|  |                             |  | (412-618)  | Fz         | 0.000048 | 0.00015 | 0.00030 | 0.00060 | 0.00090 | 0.00115 |
|  |                             |  |            | Feed (ipm) | 37.68    | 37.68   | 37.68   | 37.68   | 37.68   | 37.68   |
|  |                             | Slot<br>    | 410        | RPM        | 313240   | 100397  | 50199   | 25059   | 16697   | 13052   |
|  |                             |  | (328-492)  | Fz         | 0.000048 | 0.00015 | 0.00030 | 0.00060 | 0.00090 | 0.00115 |
|  |                             |  |            | Feed (ipm) | 30.00    | 30.00   | 30.00   | 30.00   | 30.00   | 30.00   |

















continued on next page

| INCH Baseline<br>Speed and Feed<br>Square, Corner Radius<br>& Ball End<br>With and Without Reach |   |  | DC • in    |            |          |         |         |         |         |         |
|--|---|--|------------|------------|----------|---------|---------|---------|---------|---------|
|  | Hardness  | Vc<br>(sfm)  |            | 0.0050     | 0.0156   | 0.0312  | 0.0625  | 0.0938  | 0.1200  |         |
| N  | PLASTICS<br>Polycarbonate, PVC,<br>Polypropylene  | Profile<br>   | 1000       | RPM        | 764000   | 244872  | 122436  | 61120   | 40725   | 31833   |
|  |   |  | (800-1200) | Fz         | 0.000064 | 0.00020 | 0.00040 | 0.00080 | 0.00120 | 0.00153 |
|  |   |  |            | Feed (ipm) | 97.50    | 97.50   | 97.50   | 97.50   | 97.50   | 97.50   |
|  |   | Slot<br>      | 800        | RPM        | 611200   | 195897  | 97949   | 48896   | 32580   | 25467   |
|  |   |  | (640-960)  | Fz         | 0.000064 | 0.00020 | 0.00040 | 0.00080 | 0.00120 | 0.00153 |
|  |   |  |            | Feed (ipm) | 78.00    | 78.00   | 78.00   | 78.00   | 78.00   | 78.00   |
| S  | SUPER ALLOYS<br>(NICKEL, COBALT,<br>IRON BASE)<br>Inconel 601, 617, 625,<br>Incoloy, Monel 400  | Profile<br>   | 60         | RPM        | 45840    | 14692   | 7346    | 3667    | 2443    | 1910    |
|  |   |  | (48-72)    | Fz         | 0.000012 | 0.00004 | 0.00008 | 0.00015 | 0.00023 | 0.00029 |
|  |   |  |            | Feed (ipm) | 1.11     | 1.11    | 1.11    | 1.11    | 1.11    | 1.11    |
|  |   | Slot<br>      | 45         | RPM        | 34380    | 11019   | 5510    | 2750    | 1833    | 1433    |
|  |   |  | (36-54)    | Fz         | 0.000012 | 0.00004 | 0.00008 | 0.00015 | 0.00023 | 0.00029 |
|  |   |  |            | Feed (ipm) | 0.83     | 0.83    | 0.83    | 0.83    | 0.83    | 0.83    |
| S  | SUPER ALLOYS<br>(NICKEL, COBALT,<br>IRON BASE)<br>Inconel 718, X-750,<br>Incoloy, Waspaloy,<br>Hastelloy, Rene                        | Profile<br>   | 45         | RPM        | 34380    | 11019   | 5510    | 2750    | 1833    | 1433    |
|  |   |  | (36-54)    | Fz         | 0.000008 | 0.00003 | 0.00005 | 0.00010 | 0.00015 | 0.00019 |
|  |   |  |            | Feed (ipm) | 0.55     | 0.55    | 0.55    | 0.55    | 0.55    | 0.55    |
|  |   | Slot<br>      | 35         | RPM        | 26740    | 8571    | 4285    | 2139    | 1425    | 1114    |
|  |   |  | (28-42)    | Fz         | 0.000008 | 0.00003 | 0.00005 | 0.00010 | 0.00015 | 0.00019 |
|  |   |  |            | Feed (ipm) | 0.43     | 0.43    | 0.43    | 0.43    | 0.43    | 0.43    |
| S  | TITANIUM ALLOYS<br>Pure Titanium,<br>Ti6Al4V,<br>Ti6Al2Sn4Zr2Mo,<br>Ti4Al4Mo2Sn0.5Si  | Profile<br>   | 160        | RPM        | 122240   | 39179   | 19590   | 9779    | 6516    | 5093    |
|  |   |  | (128-192)  | Fz         | 0.000014 | 0.00004 | 0.00008 | 0.00017 | 0.00025 | 0.00033 |
|  |   |  |            | Feed (ipm) | 3.32     | 3.32    | 3.32    | 3.32    | 3.32    | 3.32    |
|  |   | Slot<br>    | 130        | RPM        | 99320    | 31833   | 15917   | 7946    | 5294    | 4138    |
|  |   |  | (104-156)  | Fz         | 0.000014 | 0.00004 | 0.00008 | 0.00017 | 0.00025 | 0.00033 |
|  |   |  |            | Feed (ipm) | 2.70     | 2.70    | 2.70    | 2.70    | 2.70    | 2.70    |
| S  | TITANIUM ALLOYS<br>(DIFFICULT)<br>Ti10Al2Fe3Al,<br>Ti5Al5V5Mo3Cr,<br>Ti7Al4Mo,<br>Ti3Al8V6Cr4Zr4Mo,<br>Ti6Al6V6Sn,<br>Ti15V3 Cr3Sn3Al | Profile<br> | 60         | RPM        | 45840    | 14692   | 7346    | 3667    | 2443    | 1910    |
|  |   |  | (48-72)    | Fz         | 0.000010 | 0.00003 | 0.00006 | 0.00012 | 0.00018 | 0.00023 |
|  |   |  |            | Feed (ipm) | 0.88     | 0.88    | 0.88    | 0.88    | 0.88    | 0.88    |
|  |   | Slot<br>    | 45         | RPM        | 34380    | 11019   | 5510    | 2750    | 1833    | 1433    |
|  |   |  | (36-54)    | Fz         | 0.000010 | 0.00003 | 0.00006 | 0.00012 | 0.00018 | 0.00023 |
|  |   |  |            | Feed (ipm) | 0.66     | 0.66    | 0.66    | 0.66    | 0.66    | 0.66    |
| H  | TOOL STEELS<br>A2, D2, H13, L2, M2,<br>P20, S7, T15, W2   | Profile<br> | 175        | RPM        | 133700   | 42853   | 21426   | 10696   | 7127    | 5571    |
|  |   |  | (140-210)  | Fz         | 0.000016 | 0.00005 | 0.00010 | 0.00020 | 0.00030 | 0.00038 |
|  |   |  |            | Feed (ipm) | 4.28     | 4.28    | 4.28    | 4.28    | 4.28    | 4.28    |
|  |   | Slot<br>    | 140        | RPM        | 106960   | 34282   | 17141   | 8557    | 5701    | 4457    |
|  |   |  | (112-168)  | Fz         | 0.000016 | 0.00005 | 0.00010 | 0.00020 | 0.00030 | 0.00038 |
|  |   |  |            | Feed (ipm) | 3.42     | 3.42    | 3.42    | 3.42    | 3.42    | 3.42    |







**Note:**

- Bhn (Brinell)      Hrc (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate ipm
- rpm = Vc x 3.82 / DC
- ipm = Fz x No. of flutes x rpm
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D<sub>1</sub> maximum)
- refer to the KYOCERA SGS Tool Wizard® or sgsmicrotools.com for detailed technical charts by series

# METRIC Baseline

| METRIC Baseline<br>Speed and Feed<br>Square & Ball End<br>With and Without Reach          |  |  | Hardness      | Vc<br>(m/min)   | DC • (mm)  |         |         |         |         |         |         |
|---|--|--|---------------|---|--|---------|---------|---------|---------|---------|---------|
| P   | Material   | Profile/Slot   |               |   | 0.1  | 0.5     | 1       | 1.5     | 2       | 2.5     | 3       |
|   |  |  | P             | CARBON STEELS<br>1018, 1040, 1080, 1090,<br>10L50, 1140, 1212,<br>12L15, 1525, 1536 | Profile<br> | 111     | RPM     | 353837  | 70767   | 35384   | 23589   |
| (89-134)  | Fz   | 0.00043  |               |   |  | 0.00216 | 0.00432 | 0.00648 | 0.00865 | 0.01081 | 0.01297 |
| Feed (mm/min)   | 306  | 306  |               |   |  | 306     | 306     | 306     | 306     | 306     |         |
| Slot<br> | 88   | RPM  |               |   | 281131   | 56226   | 28113   | 18742   | 14057   | 11245   | 9371    |
|   | (71-106)   | Fz   |               |   | 0.00043  | 0.00216 | 0.00432 | 0.00648 | 0.00865 | 0.01081 | 0.01297 |
|   | Feed (mm/min)  | 243  |               |   | 243  | 243     | 243     | 243     | 243     | 243     | 243     |
| P   | ALLOY STEELS<br>4140, 4150, 4320, 5120,<br>5150, 8630, 86L20,<br>50100 | Profile<br>   | 64            | RPM   | 203577   | 40715   | 20358   | 13572   | 10179   | 8143    | 6786    |
|   |  |  | (51-77)       | Fz  | 0.00038  | 0.00192 | 0.00384 | 0.00576 | 0.00769 | 0.00961 | 0.01153 |
|   |  |  | Feed (mm/min) | 156   | 156  | 156     | 156     | 156     | 156     | 156     | 156     |
|   |  | Slot<br>      | 50            | RPM   | 159954   | 31991   | 15995   | 10664   | 7998    | 6398    | 5332    |
|   |  |  | (40-60)       | Fz  | 0.00038  | 0.00192 | 0.00384 | 0.00576 | 0.00769 | 0.00961 | 0.01153 |
|   |  |  | Feed (mm/min) | 123   | 123  | 123     | 123     | 123     | 123     | 123     | 123     |
| M   | STAINLESS STEELS<br>(FREE MACHINING)<br>303, 416, 420F, 430F,<br>440F  | Profile<br>   | 104           | RPM   | 329602   | 65920   | 32960   | 21973   | 16480   | 13184   | 10987   |
|   |  |  | (83-124)      | Fz  | 0.00043  | 0.00216 | 0.00432 | 0.00648 | 0.00865 | 0.01081 | 0.01295 |
|   |  |  | Feed (mm/min) | 285   | 285  | 285     | 285     | 285     | 285     | 285     | 285     |
|   |  | Slot<br>      | 82            | RPM   | 261742   | 52348   | 26174   | 17449   | 13087   | 10470   | 8725    |
|   |  |  | (66-99)       | Fz  | 0.00043  | 0.00216 | 0.00432 | 0.00648 | 0.00865 | 0.01081 | 0.01295 |
|   |  |  | Feed (mm/min) | 226   | 226  | 226     | 226     | 226     | 226     | 226     | 226     |
| M   | STAINLESS STEELS<br>(DIFFICULT)<br>304, 304L, 316, 316L                | Profile<br>   | 72            | RPM   | 227813   | 45563   | 22781   | 15188   | 11391   | 9113    | 7594    |
|   |  |  | (57-86)       | Fz  | 0.00038  | 0.00192 | 0.00385 | 0.00577 | 0.00769 | 0.00961 | 0.01154 |
|   |  |  | Feed (mm/min) | 175   | 175  | 175     | 175     | 175     | 175     | 175     | 175     |
|   |  | Slot<br>    | 56            | RPM   | 179342   | 35868   | 17934   | 11956   | 8967    | 7174    | 5978    |
|   |  |  | (45-68)       | Fz  | 0.00038  | 0.00192 | 0.00385 | 0.00577 | 0.00769 | 0.00961 | 0.01154 |
|   |  |  | Feed (mm/min) | 138   | 138  | 138     | 138     | 138     | 138     | 138     | 138     |
| M   | STAINLESS STEELS<br>(PH)<br>13-8 PH, 15-5PH,<br>17-4 PH, CUSTOM 450    | Profile<br> | 66            | RPM   | 208425   | 41685   | 20842   | 13895   | 10421   | 8337    | 6947    |
|   |  |  | (52-79)       | Fz  | 0.00027  | 0.00136 | 0.00272 | 0.00408 | 0.00544 | 0.00680 | 0.00819 |
|   |  |  | Feed (mm/min) | 113   | 113  | 113     | 113     | 113     | 113     | 113     | 113     |
|   |  | Slot<br>    | 52            | RPM   | 164801   | 32960   | 16480   | 10987   | 8240    | 6592    | 5493    |
|   |  |  | (41-62)       | Fz  | 0.00027  | 0.00136 | 0.00272 | 0.00408 | 0.00544 | 0.00680 | 0.00819 |
|   |  |  | Feed (mm/min) | 90  | 90   | 90      | 90      | 90      | 90      | 90      | 90      |
| K   | CAST IRONS<br>(LOW & MEDIUM<br>ALLOY)<br>Gray, Malleable,<br>Ductile   | Profile<br> | 93            | RPM   | 295672   | 59134   | 29567   | 19711   | 14784   | 11827   | 9856    |
|   |  |  | (74-112)      | Fz  | 0.00043  | 0.00217 | 0.00433 | 0.00650 | 0.00866 | 0.01083 | 0.01301 |
|   |  |  | Feed (mm/min) | 256   | 256  | 256     | 256     | 256     | 256     | 256     | 256     |
|   |  | Slot<br>    | 75            | RPM   | 237507   | 47501   | 23751   | 15834   | 11875   | 9500    | 7917    |
|   |  |  | (60-90)       | Fz  | 0.00043  | 0.00217 | 0.00433 | 0.00650 | 0.00866 | 0.01083 | 0.01301 |
|   |  |  | Feed (mm/min) | 206   | 206  | 206     | 206     | 206     | 206     | 206     | 206     |
| N   | ALUMINUM ALLOYS<br>2017, 2024, 356, 6061,<br>7075                      | Profile<br> | 305           | RPM   | 969416   | 193883  | 96942   | 64628   | 48471   | 38777   | 32314   |
|   |  |  | (244-366)     | Fz  | 0.00128  | 0.00639 | 0.01277 | 0.01916 | 0.02555 | 0.03193 | 0.03832 |
|   |  |  | Feed (mm/min) | 2477  | 2477   | 2477    | 2477    | 2477    | 2477    | 2477    | 2477    |
|   |  | Slot<br>    | 244           | RPM   | 775533   | 155107  | 77553   | 51702   | 38777   | 31021   | 25851   |
|   |  |  | (195-293)     | Fz  | 0.00128  | 0.00639 | 0.01277 | 0.01916 | 0.02555 | 0.03193 | 0.03832 |
|   |  |  | Feed (mm/min) | 1981  | 1981   | 1981    | 1981    | 1981    | 1981    | 1981    | 1981    |
| N   | COPPER ALLOYS<br>Alum Bronze, C110,<br>Muntz Brass                     | Profile<br> | 157           | RPM   | 499249   | 99850   | 49925   | 33283   | 24962   | 19970   | 16642   |
|   |  |  | (126-188)     | Fz  | 0.00096  | 0.00479 | 0.00959 | 0.01438 | 0.01917 | 0.02396 | 0.02876 |
|   |  |  | Feed (mm/min) | 957   | 957  | 957     | 957     | 957     | 957     | 957     | 957     |
|   |  | Slot<br>    | 125           | RPM   | 397461   | 79492   | 39746   | 26497   | 19873   | 15898   | 13249   |
|   |  |  | (100-150)     | Fz  | 0.00096  | 0.00479 | 0.00959 | 0.01438 | 0.01917 | 0.02396 | 0.02876 |
|   |  |  | Feed (mm/min) | 762   | 762  | 762     | 762     | 762     | 762     | 762     | 762     |

continued on next page

| METRIC Baseline<br>Speed and Feed<br>Square & Ball End<br>With and Without Reach |   | Hardness                    | Vc<br>(m/min)  | RPM       | DC • (mm)     |         |         |         |         |         |         |         |
|--|---|-----------------------------|--|-----------|---------------|---------|---------|---------|---------|---------|---------|---------|
|  |   |                             |  |           | 0.1           | 0.5     | 1       | 1.5     | 2       | 2.5     | 3       |         |
| N  | PLASTICS<br>Polycarbonate, PVC,<br>Polypropylene  |                             | Profile<br>   | 305       |               | 969416  | 193883  | 96942   | 64628   | 48471   | 38777   | 32314   |
|  |   |                             |  | (244-366) | Fz            | 0.00128 | 0.00639 | 0.01277 | 0.01916 | 0.02555 | 0.03193 | 0.03832 |
|  |   |                             |  |           | Feed (mm/min) | 2477    | 2477    | 2477    | 2477    | 2477    | 2477    | 2477    |
|  |   |                             |  | 244       |               | 775533  | 155107  | 77553   | 51702   | 38777   | 31021   | 25851   |
|  |   |                             |  | (195-293) | Fz            | 0.00128 | 0.00639 | 0.01277 | 0.01916 | 0.02555 | 0.03193 | 0.03832 |
|  |   |                             |  |           | Feed (mm/min) | 1981    | 1981    | 1981    | 1981    | 1981    | 1981    | 1981    |
| S  | SUPER ALLOYS<br>(NICKEL, COBALT,<br>IRON BASE)<br>Inconel 601, 617, 625,<br>Incoloy, Monel 400  | ≤ 300 Bhn<br>or<br>≤ 32 HRc | Profile<br>   | 18        |               | 58165   | 11633   | 5816    | 3878    | 2908    | 2327    | 1939    |
|  |   |                             |  | (15-22)   | Fz            | 0.00024 | 0.00121 | 0.00242 | 0.00362 | 0.00483 | 0.00604 | 0.00722 |
|  |   |                             |  |           | Feed (mm/min) | 28      | 28      | 28      | 28      | 28      | 28      | 28      |
|  |   |                             |  | 14        |               | 43624   | 8725    | 4362    | 2908    | 2181    | 1745    | 1454    |
|  |   |                             |  | (11-16)   | Fz            | 0.00024 | 0.00121 | 0.00242 | 0.00362 | 0.00483 | 0.00604 | 0.00722 |
|  |   |                             |  |           | Feed (mm/min) | 21      | 21      | 21      | 21      | 21      | 21      | 21      |
| S  | SUPER ALLOYS<br>(NICKEL, COBALT,<br>IRON BASE)<br>Inconel 718, X-750,<br>Incoloy, Waspaloy,<br>Hastelloy, Rene                        | ≤ 400 Bhn<br>or<br>≤ 43 HRc | Profile<br>   | 14        |               | 43624   | 8725    | 4362    | 2908    | 2181    | 1745    | 1454    |
|  |   |                             |  | (11-16)   | Fz            | 0.00016 | 0.00080 | 0.00161 | 0.00241 | 0.00322 | 0.00402 | 0.00486 |
|  |   |                             |  |           | Feed (mm/min) | 14      | 14      | 14      | 14      | 14      | 14      | 14      |
|  |   |                             |  | 11        |               | 33930   | 6786    | 3393    | 2262    | 1696    | 1357    | 1131    |
|  |   |                             |  | (9-13)    | Fz            | 0.00016 | 0.00080 | 0.00161 | 0.00241 | 0.00322 | 0.00402 | 0.00486 |
|  |   |                             |  |           | Feed (mm/min) | 11      | 11      | 11      | 11      | 11      | 11      | 11      |
| S  | TITANIUM ALLOYS<br>Pure Titanium,<br>Ti6Al4V,<br>Ti6Al2Sn4Zr2Mo,<br>Ti4Al4Mo2Sn0.5Si  | ≤ 350 Bhn<br>or<br>≤ 38 HRc | Profile<br>   | 49        |               | 155107  | 31021   | 15511   | 10340   | 7755    | 6204    | 5170    |
|  |   |                             |  | (39-59)   | Fz            | 0.00027 | 0.00136 | 0.00272 | 0.00408 | 0.00544 | 0.00680 | 0.00821 |
|  |   |                             |  |           | Feed (mm/min) | 84      | 84      | 84      | 84      | 84      | 84      | 84      |
|  |   |                             |  | 40        |               | 126024  | 25205   | 12602   | 8402    | 6301    | 5041    | 4201    |
|  |   |                             |  | (32-48)   | Fz            | 0.00027 | 0.00136 | 0.00272 | 0.00408 | 0.00544 | 0.00680 | 0.00821 |
|  |   |                             |  |           | Feed (mm/min) | 69      | 69      | 69      | 69      | 69      | 69      | 69      |
| S  | TITANIUM ALLOYS<br>(DIFFICULT)<br>Ti10Al2Fe3Al,<br>Ti5Al5V5Mo3Cr,<br>Ti7Al4Mo,<br>Ti3Al8V6Cr4Zr4Mo,<br>Ti6Al6V6Sn,<br>Ti15V3 Cr3Sn3Al | ≤ 440 Bhn<br>or<br>≤ 47 HRc | Profile<br> | 18        |               | 58165   | 11633   | 5816    | 3878    | 2908    | 2327    | 1939    |
|  |   |                             |  | (15-22)   | Fz            | 0.00019 | 0.00096 | 0.00192 | 0.00288 | 0.00384 | 0.00480 | 0.00585 |
|  |   |                             |  |           | Feed (mm/min) | 22      | 22      | 22      | 22      | 22      | 22      | 22      |
|  |   |                             |  | 14        |               | 43624   | 8725    | 4362    | 2908    | 2181    | 1745    | 1454    |
|  |   |                             |  | (11-16)   | Fz            | 0.00019 | 0.00096 | 0.00192 | 0.00288 | 0.00384 | 0.00480 | 0.00585 |
|  |   |                             |  |           | Feed (mm/min) | 17      | 17      | 17      | 17      | 17      | 17      | 17      |
| H  | TOOL STEELS<br>A2, D2, H13, L2, M2,<br>P20, S7, T15, W2   | ≤ 375 Bhn<br>or<br>≤ 40 HRc | Profile<br> | 53        |               | 169648  | 33930   | 16965   | 11310   | 8482    | 6786    | 5655    |
|  |   |                             |  | (43-64)   | Fz            | 0.00032 | 0.00160 | 0.00320 | 0.00480 | 0.00640 | 0.00800 | 0.00962 |
|  |   |                             |  |           | Feed (mm/min) | 109     | 109     | 109     | 109     | 109     | 109     | 109     |
|  |   |                             |  | 43        |               | 135718  | 27144   | 13572   | 9048    | 6786    | 5429    | 4524    |
|  |   |                             |  | (34-51)   | Fz            | 0.00032 | 0.00160 | 0.00320 | 0.00480 | 0.00640 | 0.00800 | 0.00962 |
|  |   |                             |  |           | Feed (mm/min) | 87      | 87      | 87      | 87      | 87      | 87      | 87      |

Note:

- Bhn (Brinell)      HRc (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate mm/min
- rpm = (Vc x 1000) / (DC x 3.14)
- mm/min = Fz x No. of flutes x rpm
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D<sub>1</sub> maximum)
- refer to the KYOCERA SGS Tool Wizard® or sgsmicrotools.com for detailed technical charts by series