All speed and feed recommendations should be considered only as a starting point. Start with conservative speeds and feeds while analyzing the rigidity of the process. Then cautiously progress incrementally to achieve optimum performance. Contact Fullerton Tool directly for any additional support.

### General Recommendations

The above suggested parameters are recommended for uncoated tools only. When various coatings are applied, SFM may be increased accordingly. These general percentages are as follows under optimal conditions:

- TiN = +15%
- TiCN = +25%
- TiAlN = +40%

### Rigidity

Maximize rigidity to reduce chatter and increase tool life. Ways to improve rigidity include, choosing the largest diameter possible to perform your milling task, using the shortest LOC (Length of Cut) available, and always use the tool holder which offers the shortest gage line (Shortest Tool Holder Length).

### Chatter

If chatter is present increase feed or reduce speed.

### Extra Long End Mills

For extra long end mills the SFM should be reduced by 25%.

### Cutter Direction

Cutter direction should be in a climb milling direction whenever possible. Conventional tool paths may be employed when the tool is in use on older manual equipment to minimize backlash or to remove scale to reach the softer parent material underneath.

### TIR or Total Indicator Runout

This condition should be held to a minimum at all times. As this value increases, the effectiveness of the tool’s performance decreases thus reducing tool life.

### Recutting Chips

Use a coolant or air blast to evacuate chips to avoid premature damage to your carbide cutting tool, which may occur if chips are recut.

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### END MILL SPEED AND FEED RECOMMENDATIONS

**Maximizing Performance and Tool Life**

**Materials**

| Materials                        | Speed | 1/8" | 1/4" | 1/2" | 1"  
|----------------------------------|-------|------|------|------|-----
| Non-Ferrous                     |       |      |      |      |     
| Aluminum / Aluminum Alloy       | 1000-2000 | 0.001 | 0.002 | 0.004 | 0.006 |
| Aluminum Alloy +10%             | 700-1200 | 0.001 | 0.002 | 0.004 | 0.006 |
| Brass                           | 300-450 | 0.001 | 0.002 | 0.003 | 0.004 |
| Bronze                          | 250-350 | 0.001 | 0.002 | 0.003 | 0.004 |
| Copper / Copper Alloys          | 500-900 | 0.001 | 0.002 | 0.003 | 0.004 |
| Composites: FiberGlass          | 200-600 | 0.001 | 0.002 | 0.003 | 0.004 |
| Graphites                       | 200-400 | 0.001 | 0.006 | 0.010 | 0.015 |
| Graphite / Epoxy                | 200-400 | 0.001 | 0.002 | 0.003 | 0.004 |
| Magnesium                       | 1000 min | 0.001 | 0.002 | 0.004 | 0.006 |
| Stainless Steel                 | Free Machine | 300-400 | 0.0005 | 0.001  | 0.002 | 0.004 | 0.006 |
| Work Hardening                  | 150-300 | 0.0005 | 0.0005 | 0.001  | 0.003 | 0.005 |
| High Temp Alloys                | Nickel Base | 200-300 | 0.0005 | 0.001  | 0.002 | 0.003 | 0.004 |
| Cast Iron                       | Ductile | 250-400 | 0.0005 | 0.0015 | 0.002  | 0.004 | 0.006 |
| Gray                            | 350-500 | 0.0005 | 0.002  | 0.004  | 0.006 |
| Malleable                       | 200-350 | 0.0005 | 0.002  | 0.004  | 0.006 |
| Steels                          | Low Alloy | 350-600 | 0.0005 | 0.001  | 0.002 | 0.004 | 0.006 |
| Medium Alloy                    | 200-400 | 0.0005 | 0.001  | 0.002 | 0.004 |
| High Alloy Mold-Die             | 175-250 | 0.0005 | 0.001  | 0.002 | 0.004 |
| High Strength                   | 75-150 | 0.0005 | 0.0005 | 0.001  | 0.003 | 0.004 |
| Titanium                        | Soft  | 150-300 | 0.0005 | 0.001 | 0.002 | 0.004 |
| Hard                            | 50-150 | 0.0005 | 0.0005 | 0.001  | 0.002 | 0.004 |

Formulas to determine speed, feed & chip load after the type and diameter of the cutting tool is determined.

**US Customary Units**

- D = cutter diameter (in)
- T = tooth count (flute)
- IPT chip load (in/flute) = IPM ÷ RPM ÷ T
- IPR feed per revolution (in/rev) = IPM ÷ RPM
- SFM surface speed (ft/min) = 0.2618 x RPM x D
- RPM spindle speed (rev/min) = 3.82 x SFM ÷ D
- IPM feed rate (in/min) = RPM x IPT x T

**SI Units**

- D = cutter diameter (mm)
- T = tooth count (flute)
- MMPT chip load (mm/flute)
- MMPR feed per revolution (mm/rev) = MMPM ÷ RPM
- SMPM surface speed (m/min) = 0.00314 x RPM x D
- RPM spindle speed (rev/min) = 318.3 x SMPM ÷ D
- MMPM feed rate (mm/min) = RPM x MMPT x T

**Feed Rate Conversion**

- MNPM (mm/min) = IPM (in/min) x 25.4 (mm/in)
- IPM (in/min) = MNPM (mm/min) x 0.0394 (in/mm)

**Surface Speed Conversion**

- SNPM (m/min) = SFM (ft/min) x 0.3048 (m/ft)
- SFM (ft/min) = SNPM (m/min) x 3.2808 (ft/m)

**Unit Conversion**

- 1 in = 25.4 mm
- 1 ft = 304.8 mm = 0.3048 m
- 1 mm = .03937 in
- 1 m = 3.2808 ft = 39.370 in

For the very best selection of an end mill and how to apply it for your particular application, we suggest that you call our technical support staff. They will advise you in what end mill to use, the correct speeds and feeds and if a particular coating would be beneficial. You may also visit our web site (http://www.fullertontool.com) for the latest information regarding particular tools.

Call 1-800-248-8315

Mark Donze - Ext. 204 • Steve Oszust - Ext. 232

Tom McKimmy - Ext. 218