

| GROUP # | MATERIAL CARBON STEEL                               | MATERIAL EXAMPLES   | HARDNESS | LOW SFM | HIGH SFM | RECOMMENDED MAX% STEPOVER 2@ XD IA LOC | 0.2500 | 0.3750 | 0.5000 | 0.6250 | 0.7500 | 1.0000 |
|---------|---|---|----------|---------|----------|--|--------|--------|--------|--------|--------|--------|
| P2      | Medium & High CARBON STEELS                         | 1000-1200 SERIES  | >285     | 225     | 385      | Slotting                               | 0.0011 | 0.0018 | 0.0024 | 0.0028 | 0.0032 | 0.0040 |
|         |   |   |          | 375     | 700      | Roughing                               | 0.0012 | 0.0020 | 0.0030 | 0.0040 | 0.0050 | 0.0060 |
|         |   |   |          | 400     | 900      | Finishing - HEM                        | 0.0015 | 0.0025 | 0.0031 | 0.0038 | 0.0047 | 0.0065 |
| P3      | Alloy Steel   | 4130, 4140, 5140, 6150, 8620,                                 | >300     | 225     | 300      | Slotting                               | 0.0010 | 0.0016 | 0.0023 | 0.0026 | 0.0029 | 0.0032 |
|         |   |   |          | 225     | 500      | Roughing                               | 0.0012 | 0.0019 | 0.0027 | 0.0037 | 0.0047 | 0.0055 |
|         |   |   |          | 400     | 875      | Finishing - HEM                        | 0.0014 | 0.0019 | 0.0026 | 0.0030 | 0.0037 | 0.0049 |
| P4      | Tool Steel  | A2, P20, S7, H13, L6  | >300     | 125     | 270      | Slotting                               | 0.0009 | 0.0012 | 0.0015 | 0.0020 | 0.0025 | 0.0030 |
|         |   |   |          | 150     | 500      | Roughing                               | 0.0011 | 0.0018 | 0.0025 | 0.0035 | 0.0046 | 0.0055 |
|         |   |   |          | 450     | 650      | Finishing - HEM                        | 0.0012 | 0.0018 | 0.0024 | 0.0028 | 0.0032 | 0.0041 |
| P5      | Ferritic, Martensitic & PH Stainless Steels         | 400's, 15-5, 17-4 Custom 400's                                | >300     | 125     | 225      | Slotting                               | 0.0009 | 0.0013 | 0.0018 | 0.0023 | 0.0028 | 0.0033 |
|         |   |   |          | 150     | 400      | Roughing                               | 0.0010 | 0.0016 | 0.0023 | 0.0033 | 0.0043 | 0.0052 |
|         |   |   |          | 300     | 500      | Finishing - HEM                        | 0.0011 | 0.0018 | 0.0022 | 0.0027 | 0.0032 | 0.0041 |
| M2      | Austenitic Stainless Steels & Cast Stainless Steels | 310, 314, 316   | <300     | 200     | 275      | Slotting                               | 0.0008 | 0.0010 | 0.0012 | 0.0024 | 0.0037 | 0.0045 |
|         |   |   |          | 200     | 325      | Roughing                               | 0.0008 | 0.0010 | 0.0012 | 0.0035 | 0.0060 | 0.0075 |
|         |   |   |          | 350     | 500      | Finishing - HEM                        | 0.0013 | 0.0019 | 0.0027 | 0.0031 | 0.0040 | 0.0048 |
| M3      | Duplex Steels (austenitic & Ferritic)               | 255, 323, 329, 2202, 2205, 2304                               | <310     | 125     | 270      | Slotting                               | 0.0007 | 0.0009 | 0.0011 | 0.0020 | 0.0030 | 0.0041 |
|         |   |   |          | 180     | 325      | Roughing                               | 0.0009 | 0.0011 | 0.0012 | 0.0030 | 0.0050 | 0.0065 |
|         |   |   |          | 350     | 450      | Finishing - HEM                        | 0.0013 | 0.0019 | 0.0025 | 0.0032 | 0.0038 | 0.0052 |
| K3      | Cast Iron - Nodular High Strength                   | 32510, 40010, 5005, 70003, 90001                              | >300     | 150     | 300      | Slotting                               | 0.0006 | 0.0009 | 0.0012 | 0.0021 | 0.0032 | 0.0040 |
|         |   |   |          | 200     | 325      | Roughing                               | 0.0006 | 0.0009 | 0.0012 | 0.0024 | 0.0035 | 0.0045 |
|         |   |   |          | 300     | 500      | Finishing - HEM                        | 0.0006 | 0.0008 | 0.0011 | 0.0014 | 0.0020 | 0.0024 |
| S1      | Iron-Based, Heat-Resistant Alloys                   | A-286, INVAR, Discaloy, INCOLOY 800-802, Nitronic 50          | >200     | 60      | 175      | Slotting                               | 0.0006 | 0.0009 | 0.0012 | 0.0018 | 0.0024 | 0.0029 |
|         |   |   |          | 70      | 180      | Roughing                               | 0.0008 | 0.0011 | 0.0014 | 0.0017 | 0.0020 | 0.0023 |
|         |   |   |          | 90      | 225      | Finishing - HEM                        | 0.0012 | 0.0016 | 0.0021 | 0.0027 | 0.0030 | 0.0035 |
| S2      | Cobalt-Based, Heat-Resistant Alloys                 | Haynes 25, Haynes 188, Stellite, MAR-M302                     | >180     | 70      | 170      | Slotting                               | 0.0007 | 0.0010 | 0.0013 | 0.0026 | 0.0039 | 0.0051 |
|         |   |   |          | 70      | 225      | Roughing                               | 0.0009 | 0.0012 | 0.0015 | 0.0029 | 0.0040 | 0.0050 |
|         |   |   |          | 100     | 225      | Finishing - HEM                        | 0.0013 | 0.0018 | 0.0023 | 0.0028 | 0.0032 | 0.0043 |
| S3      | Nickel-Based, Heat-Resistant Alloys                 | HAST-C, Rene 41, Waspalloy, Monel, Ni-monic, UDIMET, Inco 718 | >180     | 70      | 100      | Slotting                               | 0.0007 | 0.0010 | 0.0013 | 0.0019 | 0.0025 | 0.0034 |
|         |   |   |          | 70      | 150      | Roughing                               | 0.0008 | 0.0012 | 0.0014 | 0.0027 | 0.0041 | 0.0052 |
|         |   |   |          | 90      | 225      | Finishing - HEM                        | 0.0009 | 0.0012 | 0.0017 | 0.0022 | 0.0027 | 0.0035 |
| S4      | TITANIUM  | Ti6AL4V   | >270     | 125     | 185      | Slotting                               | 0.0010 | 0.0015 | 0.0021 | 0.0028 | 0.0035 | 0.0043 |
|         |   |   |          | 150     | 300      | Roughing                               | 0.0012 | 0.0018 | 0.0024 | 0.0036 | 0.0051 | 0.0062 |
|         |   |   |          | 300     | 425      | Finishing - HEM                        | 0.0015 | 0.0018 | 0.0024 | 0.0029 | 0.0033 | 0.0042 |
| S4.2    | TITANIUM  | TITANIUM 10-2-3   | <390     | 115     | 175      | Slotting                               | 0.0010 | 0.0015 | 0.0020 | 0.0026 | 0.0032 | 0.0038 |
|         |   |   |          | 125     | 300      | Roughing                               | 0.0011 | 0.0016 | 0.0022 | 0.0033 | 0.0045 | 0.0056 |
|         |   |   |          | 250     | 400      | Finishing - HEM                        | 0.0013 | 0.0016 | 0.0023 | 0.0028 | 0.0033 | 0.0044 |
| H1      | Hardened Tool Steels                                | D2, H13, S7   | >360     | 125     | 275      | Slotting                               | 0.0011 | 0.0015 | 0.0018 | 0.0022 | 0.0025 | 0.0034 |
|         |   |   |          | 125     | 350      | Roughing                               | 0.0011 | 0.0018 | 0.0025 | 0.0030 | 0.0035 | 0.0040 |
|         |   |   |          | 250     | 500      | Finishing - HEM                        | 0.0010 | 0.0015 | 0.0021 | 0.0023 | 0.0026 | 0.0029 |
| H2      | Hardened Tool Steels                                | D2, H13, S7   | >420     | 100     | 225      | Slotting                               | 0.0010 | 0.0014 | 0.0015 | 0.0019 | 0.0023 | 0.0030 |
|         |   |   |          | 100     | 325      | Roughing                               | 0.0011 | 0.0016 | 0.0022 | 0.0028 | 0.0033 | 0.0038 |
|         |   |   |          | 200     | 450      | Finishing - HEM                        | 0.0010 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0026 |
| H2      | Hardened Tool Steels                                | D2, H13, S7   | >485     | 100     | 175      | Slotting                               | 0.0008 | 0.0011 | 0.0013 | 0.0017 | 0.0020 | 0.0028 |
|         |   |   |          | 100     | 275      | Roughing                               | 0.0009 | 0.0013 | 0.0018 | 0.0024 | 0.0030 | 0.0035 |
|         |   |   |          | 200     | 400      | Finishing - HEM                        | 0.0008 | 0.0010 | 0.0014 | 0.0017 | 0.0020 | 0.0022 |

We recommend using air blast to cool the tool anytime you are running over 500 SFM

| MILL PROCESS         | ADOC                | RDOC   |
|----------------------|---------------------|--------|
| <b>SLOTING</b>       | 25%-75% Diameter    | 100%   |
| <b>ROUGHING</b>      | Up to 200% Diameter | 16-40% |
| <b>FINISH OR HEM</b> | Up to 225% Diameter | 2-15%  |

Must use chip thinning calculations when developing feedrates for FINISH OR HEM toolpaths  
Cut feedrate up to 40% for finishing if surface finish shows feed lines