

# IPC9 Series Application Guide – Speed & Feed (metric)

| ISO Classification | Work Material  | Type of Cut       | Axial DOC    | Radial DOC | Number of Flutes | Speed (M/Min) | Feed (MM per Tooth) |        |        |        |        |        |
|--------------------|--|-------------------|--------------|------------|------------------|---------------|---------------------|--------|--------|--------|--------|--------|
|                    |  |                   |              |            |                  |               | 6,0                 | 10,0   | 12,0   | 16,0   | 20,0   | 25,0   |
| <b>K</b>           | Cast Iron - Gray<br>ASTM-A48<br>Class 20, 25, 30, 35 & 40                  | Peripheral - HEM* | <=3 x D      | .1 x D     | 9                | 122           | 0.0914              | 0.1518 | 0.1829 | 0.2432 | 0.3036 | 0.3658 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 122           | 0.0823              | 0.1366 | 0.1646 | 0.2189 | 0.2732 | 0.3292 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 119           | 0.0732              | 0.1214 | 0.1463 | 0.1946 | 0.2429 | 0.2926 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 137           | 0.0330              | 0.0548 | 0.0660 | 0.0878 | 0.1096 | 0.1321 |
|                    | Cast Iron<br>Malleable   | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 119           | 0.0737              | 0.1223 | 0.1473 | 0.1959 | 0.2446 | 0.2946 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 119           | 0.0663              | 0.1100 | 0.1326 | 0.1763 | 0.2201 | 0.2652 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 114           | 0.0589              | 0.0978 | 0.1179 | 0.1567 | 0.1956 | 0.2357 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 107           | 0.0267              | 0.0443 | 0.0533 | 0.0709 | 0.0885 | 0.1067 |
| <b>P</b>           | Low Carbon Steel ≤ 38 Rc<br>1018, 1020, 12L14, 5120, 8620                  | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 148           | 0.0953              | 0.1581 | 0.1905 | 0.2534 | 0.3162 | 0.3810 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 148           | 0.0857              | 0.1423 | 0.1715 | 0.2280 | 0.2846 | 0.3429 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 142           | 0.0762              | 0.1265 | 0.1524 | 0.2027 | 0.2530 | 0.3048 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 128           | 0.0356              | 0.0590 | 0.0711 | 0.0946 | 0.1181 | 0.1422 |
|                    | Medium Carbon Steels ≤ 48 Rc<br>1045, 4140, 4340, 5140                     | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 137           | 0.0902              | 0.1497 | 0.1803 | 0.2399 | 0.2994 | 0.3607 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 137           | 0.0812              | 0.1347 | 0.1623 | 0.2159 | 0.2694 | 0.3246 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 130           | 0.0721              | 0.1197 | 0.1443 | 0.1919 | 0.2395 | 0.2885 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 119           | 0.0318              | 0.0527 | 0.0635 | 0.0845 | 0.1054 | 0.1270 |
|                    | Tool & Die Steels ≤ 48 Rc<br>A2, D2, O1, S7, P20, H13                      | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 128           | 0.0813              | 0.1349 | 0.1626 | 0.2162 | 0.2698 | 0.3251 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 128           | 0.0732              | 0.1214 | 0.1463 | 0.1946 | 0.2429 | 0.2926 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 120           | 0.0650              | 0.1079 | 0.1300 | 0.1730 | 0.2159 | 0.2601 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 111           | 0.0267              | 0.0443 | 0.0533 | 0.0709 | 0.0885 | 0.1067 |
| <b>M</b>           | Austenitic Stainless Steels,<br>FeNi Alloys<br>303, 304, 316, Invar, Kovar | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 137           | 0.0813              | 0.1349 | 0.1626 | 0.2162 | 0.2698 | 0.3251 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 134           | 0.0732              | 0.1214 | 0.1463 | 0.1946 | 0.2429 | 0.2926 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .07 x D    | 9                | 130           | 0.0650              | 0.1079 | 0.1300 | 0.1730 | 0.2159 | 0.2601 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 119           | 0.0305              | 0.0506 | 0.0610 | 0.0811 | 0.1012 | 0.1219 |
|                    | Martensitic & Ferritic<br>Stainless Steels<br>410, 416, 440                | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 137           | 0.0953              | 0.1581 | 0.1905 | 0.2534 | 0.3162 | 0.3810 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 137           | 0.0857              | 0.1423 | 0.1715 | 0.2280 | 0.2846 | 0.3429 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 130           | 0.0762              | 0.1265 | 0.1524 | 0.2027 | 0.2530 | 0.3048 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 119           | 0.0318              | 0.0527 | 0.0635 | 0.0845 | 0.1054 | 0.1270 |
|                    | Precipitation Hardening<br>Stainless Steels<br>17-4, 15-5, 13-8            | Peripheral - HEM* | <=3 x D      | .08 x D    | 9                | 134           | 0.0787              | 0.1307 | 0.1575 | 0.2094 | 0.2614 | 0.3150 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 134           | 0.0709              | 0.1176 | 0.1417 | 0.1885 | 0.2353 | 0.2835 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .07 x D    | 9                | 126           | 0.0630              | 0.1046 | 0.1260 | 0.1676 | 0.2091 | 0.2520 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 116           | 0.0254              | 0.0422 | 0.0508 | 0.0676 | 0.0843 | 0.1016 |
| <b>S</b>           | Titanium Alloys<br>6Al-4V, 6-2-4   | Peripheral - HEM* | <=3 x D      | .1 x D     | 9                | 123           | 0.0521              | 0.0864 | 0.1041 | 0.1385 | 0.1729 | 0.2083 |
|                    |  | Peripheral - HEM* | >3xD-4xD     | .08 x D    | 9                | 123           | 0.0469              | 0.0778 | 0.0937 | 0.1247 | 0.1556 | 0.1875 |
|                    |  | Peripheral - HEM* | >4xD-5xD     | .08 x D    | 9                | 119           | 0.0417              | 0.0691 | 0.0833 | 0.1108 | 0.1383 | 0.1666 |
|                    |  | Finish            | 3 x D        | .015 x D   | 9                | 107           | 0.0203              | 0.0337 | 0.0406 | 0.0541 | 0.0675 | 0.0813 |
|                    | Difficult to Machine<br>Titanium Alloys<br>10-2-3                          | Peripheral - HEM* | <=2.5 x D    | .08 x D    | 9                | 102           | 0.0508              | 0.0843 | 0.1016 | 0.1351 | 0.1687 | 0.2032 |
|                    |  | Peripheral - HEM* | >2.5xD-3.5xD | .07 x D    | 9                | 99            | 0.0457              | 0.0759 | 0.0914 | 0.1216 | 0.1518 | 0.1829 |
|                    |  | Peripheral - HEM* | >3.5xD-4xD   | .06 x D    | 9                | 93            | 0.0406              | 0.0675 | 0.0813 | 0.1081 | 0.1349 | 0.1626 |
|                    |  | Finish            | 3 x D        | .01 x D    | 9                | 88            | 0.0178              | 0.0295 | 0.0356 | 0.0473 | 0.0590 | 0.0711 |
|                    | Hastalloy, Waspalloy   | Peripheral - HEM* | <=1.5 x D    | .08 x D    | 9                | 30            | 0.1143              | 0.1897 | 0.2286 | 0.3040 | 0.3795 | 0.4572 |
|                    |  | Peripheral - HEM* | >1.5xD-2.5xD | .08 x D    | 9                | 29            | 0.1029              | 0.1708 | 0.2057 | 0.2736 | 0.3415 | 0.4115 |
|                    |  | Peripheral - HEM* | >2.5xD-3.5xD | .06 x D    | 9                | 26            | 0.0914              | 0.1518 | 0.1829 | 0.2432 | 0.3036 | 0.3658 |
|                    |  | Finish            | 2 x D        | .01 x D    | 9                | 27            | 0.0610              | 0.1012 | 0.1219 | 0.1622 | 0.2024 | 0.2438 |
|                    | Inconel 718, Rene 88   | Peripheral - HEM* | <=1.5 x D    | .07 x D    | 9                | 29            | 0.1156              | 0.1918 | 0.2311 | 0.3074 | 0.3837 | 0.4623 |
|                    |  | Peripheral - HEM* | >1.5xD-2.5xD | .06 x D    | 9                | 27            | 0.1040              | 0.1727 | 0.2080 | 0.2767 | 0.3453 | 0.4161 |
|                    |  | Peripheral - HEM* | >2.5xD-3xD   | .06 x D    | 9                | 26            | 0.0925              | 0.1535 | 0.1849 | 0.2459 | 0.3070 | 0.3698 |
|                    |  | Finish            | 2 x D        | .01 x D    | 9                | 26            | 0.0584              | 0.0970 | 0.1168 | 0.1554 | 0.1940 | 0.2337 |

D = Tool Diameter \* HEM = High-efficiency machining (chip-thinning calculations have already been applied to HEM parameters shown)