

# 2 Flute Drills

## Short Length Self Centering Drills • DIN 6539

| Series<br>101M, 108M<br>Metric | Hardness                                                                                     | Vc<br>(m/min)                                                       | DC • mm       |               |       |       |       |       |       |       |       |
|--------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------|---------------|-------|-------|-------|-------|-------|-------|-------|
|                                |                                                                                              |                                                                     | 1             | 3             | 6     | 8     | 10    | 12    | 16    |       |       |
| P                              | CARBON STEELS<br>1018, 1040, 1080, 1090,<br>10L50, 1140, 1212,<br>12L15, 1525, 1536          | 81                                                                  | RPM           | 25690         | 8563  | 4282  | 3211  | 2569  | 2141  | 1606  |       |
|                                |                                                                                              | (65-97)                                                             | Fr            | 0.014         | 0.041 | 0.082 | 0.109 | 0.136 | 0.163 | 0.218 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 350           | 350   | 350   | 350   | 350   | 350   | 350   |       |
|                                |                                                                                              | 38                                                                  | RPM           | 12118         | 4039  | 2020  | 1515  | 1212  | 1010  | 757   |       |
|                                |                                                                                              | (30-46)                                                             | Fr            | 0.012         | 0.036 | 0.072 | 0.096 | 0.120 | 0.144 | 0.191 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 145           | 145   | 145   | 145   | 145   | 145   | 145   |       |
|                                |                                                                                              | 26                                                                  | RPM           | 8240          | 2747  | 1373  | 1030  | 824   | 687   | 515   |       |
|                                |                                                                                              | (21-31)                                                             | Fr            | 0.007         | 0.020 | 0.040 | 0.053 | 0.067 | 0.080 | 0.107 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 55            | 55    | 55    | 55    | 55    | 55    | 55    |       |
|                                |                                                                                              | ALLOY STEELS<br>4140, 4150, 4320, 5120,<br>5150, 8630, 86L20, 50100 | 70            | RPM           | 22297 | 7432  | 3716  | 2787  | 2230  | 1858  | 1394  |
|                                |                                                                                              |                                                                     | (56-84)       | Fr            | 0.012 | 0.036 | 0.073 | 0.097 | 0.121 | 0.145 | 0.194 |
|                                |                                                                                              |                                                                     |               | Feed (mm/min) | 270   | 270   | 270   | 270   | 270   | 270   | 270   |
|                                | 44                                                                                           |                                                                     | RPM           | 14057         | 4686  | 2343  | 1757  | 1406  | 1171  | 879   |       |
|                                | (35-53)                                                                                      |                                                                     | Fr            | 0.012         | 0.036 | 0.073 | 0.097 | 0.121 | 0.145 | 0.194 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 170           | 170   | 170   | 170   | 170   | 170   | 170   |       |
|                                | 18                                                                                           |                                                                     | RPM           | 5816          | 1939  | 969   | 727   | 582   | 485   | 364   |       |
|                                | (15-22)                                                                                      |                                                                     | Fr            | 0.005         | 0.015 | 0.030 | 0.040 | 0.050 | 0.060 | 0.080 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 29            | 29    | 29    | 29    | 29    | 29    | 29    |       |
|                                | TOOL STEELS<br>A2, D2, H13, L2, M2,<br>P20, S7, T15, W2                                      |                                                                     | 26            | RPM           | 8240  | 2747  | 1373  | 1030  | 824   | 687   | 515   |
|                                |                                                                                              |                                                                     | (21-31)       | Fr            | 0.007 | 0.020 | 0.040 | 0.053 | 0.067 | 0.080 | 0.107 |
|                                |                                                                                              |                                                                     |               | Feed (mm/min) | 55    | 55    | 55    | 55    | 55    | 55    | 55    |
|                                |                                                                                              | 17                                                                  | RPM           | 5332          | 1777  | 889   | 666   | 533   | 444   | 333   |       |
|                                |                                                                                              | (13-20)                                                             | Fr            | 0.003         | 0.010 | 0.020 | 0.027 | 0.034 | 0.041 | 0.054 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 18            | 18    | 18    | 18    | 18    | 18    | 18    |       |
| M                              | STAINLESS STEELS<br>(FREE MACHINING)<br>303, 416, 420F, 430F 440F                            | 64                                                                  | RPM           | 20358         | 6786  | 3393  | 2545  | 2036  | 1696  | 1272  |       |
|                                |                                                                                              | (51-77)                                                             | Fr            | 0.010         | 0.029 | 0.059 | 0.079 | 0.098 | 0.118 | 0.157 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 200           | 200   | 200   | 200   | 200   | 200   | 200   |       |
|                                |                                                                                              | 34                                                                  | RPM           | 10664         | 3555  | 1777  | 1333  | 1066  | 889   | 666   |       |
|                                |                                                                                              | (27-40)                                                             | Fr            | 0.006         | 0.017 | 0.034 | 0.045 | 0.056 | 0.068 | 0.090 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 60            | 60    | 60    | 60    | 60    | 60    | 60    |       |
|                                | STAINLESS STEELS<br>(DIFFICULT)<br>304, 316, 321, 13-8 PH,<br>15-5PH, 17-4 PH,<br>Custom 450 | 20                                                                  | RPM           | 6301          | 2100  | 1050  | 788   | 630   | 525   | 394   |       |
|                                |                                                                                              | (16-24)                                                             | Fr            | 0.007         | 0.021 | 0.043 | 0.057 | 0.071 | 0.086 | 0.114 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 45            | 45    | 45    | 45    | 45    | 45    | 45    |       |
|                                |                                                                                              | 17                                                                  | RPM           | 5332          | 1777  | 889   | 666   | 533   | 444   | 333   |       |
|                                |                                                                                              | (13-20)                                                             | Fr            | 0.007         | 0.020 | 0.039 | 0.053 | 0.066 | 0.079 | 0.105 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 35            | 35    | 35    | 35    | 35    | 35    | 35    |       |
| K                              | CAST IRONS<br>Gray, Malleable,<br>Ductile                                                    | 85                                                                  | RPM           | 27144         | 9048  | 4524  | 3393  | 2714  | 2262  | 1696  |       |
|                                |                                                                                              | (68-102)                                                            | Fr            | 0.016         | 0.049 | 0.097 | 0.130 | 0.162 | 0.195 | 0.259 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 440           | 440   | 440   | 440   | 440   | 440   | 440   |       |
|                                |                                                                                              | 76                                                                  | RPM           | 24235         | 8078  | 4039  | 3029  | 2424  | 2020  | 1515  |       |
|                                |                                                                                              | (61-91)                                                             | Fr            | 0.017         | 0.050 | 0.099 | 0.132 | 0.165 | 0.198 | 0.264 |       |
|                                |                                                                                              |                                                                     | Feed (mm/min) | 400           | 400   | 400   | 400   | 400   | 400   | 400   |       |

continued on next page

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| Series<br>101M, 108M<br>Metric | Hardness                                                                                                                  | Vc<br>(m/min)               | DC • mm       |       |       |       |       |       |       |       |       |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                |                                                                                                                           |                             | 1             | 3     | 6     | 8     | 10    | 12    | 16    |       |       |
| N                              | ALUMINUM ALLOYS<br>2017, 2024, 356,<br>6061, 7075                                                                         | ≤ 80 Bhn<br>or<br>≤ 47 HRb  | 165           | RPM   | 52348 | 17449 | 8725  | 6544  | 5235  | 4362  | 3272  |
|                                |                                                                                                                           |                             | (132-198)     | Fr    | 0.020 | 0.060 | 0.120 | 0.160 | 0.200 | 0.240 | 0.319 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 1045  | 1045  | 1045  | 1045  | 1045  | 1045  | 1045  |       |
|                                |                                                                                                                           | ≤ 150 Bhn<br>or<br>≤ 88 HRb | 139           | RPM   | 44108 | 14703 | 7351  | 5514  | 4411  | 3676  | 2757  |
|                                |                                                                                                                           |                             | (111-166)     | Fr    | 0.020 | 0.060 | 0.120 | 0.160 | 0.200 | 0.239 | 0.319 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 880   | 880   | 880   | 880   | 880   | 880   | 880   |       |
|                                | COPPER ALLOYS<br>Alum Bronze, C110,<br>Muntz Brass                                                                        | ≤ 140 Bhn<br>or<br>≤ 3 HRc  | 58            | RPM   | 18419 | 6140  | 3070  | 2302  | 1842  | 1535  | 1151  |
|                                |                                                                                                                           |                             | (46-69)       | Fr    | 0.010 | 0.030 | 0.060 | 0.080 | 0.100 | 0.121 | 0.161 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 185   | 185   | 185   | 185   | 185   | 185   | 185   |       |
|                                |                                                                                                                           | ≤ 200 Bhn<br>or<br>≤ 23 HRc | 53            | RPM   | 16965 | 5655  | 2827  | 2121  | 1696  | 1414  | 1060  |
|                                |                                                                                                                           |                             | (43-64)       | Fr    | 0.010 | 0.030 | 0.060 | 0.080 | 0.100 | 0.120 | 0.160 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 170   | 170   | 170   | 170   | 170   | 170   | 170   |       |
| PLASTICS<br>Polycarbonate, PVC | 152<br><br>(122-183)                                                                                                      | RPM                         | 48471         | 16157 | 8078  | 6059  | 4847  | 4039  | 3029  |       |       |
|                                |                                                                                                                           | Fr                          | 0.020         | 0.060 | 0.120 | 0.160 | 0.200 | 0.240 | 0.320 |       |       |
|                                |                                                                                                                           | Feed (mm/min)               | 970           | 970   | 970   | 970   | 970   | 970   | 970   |       |       |
| S                              | HIGH TEMP ALLOYS<br>(NICKEL, COBALT,<br>IRON BASE)<br>Inconel 601, 617, 625,<br>Incoloy 800, Monel 400,<br>Rene, Waspaloy | ≤ 220 Bhn<br>or<br>≤ 19 HRc | 12            | RPM   | 3878  | 1293  | 646   | 485   | 388   | 323   | 242   |
|                                |                                                                                                                           |                             | (10-15)       | Fr    | 0.006 | 0.019 | 0.039 | 0.052 | 0.064 | 0.077 | 0.103 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 25    | 25    | 25    | 25    | 25    | 25    | 25    |       |
|                                |                                                                                                                           | ≤ 320 Bhn<br>or<br>≤ 34 HRc | 8             | RPM   | 2424  | 808   | 404   | 303   | 242   | 202   | 151   |
|                                |                                                                                                                           |                             | (6-9)         | Fr    | 0.006 | 0.019 | 0.037 | 0.050 | 0.062 | 0.074 | 0.099 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 15    | 15    | 15    | 15    | 15    | 15    | 15    |       |
|                                |                                                                                                                           | ≤ 425 Bhn<br>or<br>≤ 45 HRc | 6             | RPM   | 1939  | 646   | 323   | 242   | 194   | 162   | 121   |
|                                |                                                                                                                           |                             | (5-7)         | Fr    | 0.005 | 0.015 | 0.031 | 0.041 | 0.052 | 0.062 | 0.083 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 10    | 10    | 10    | 10    | 10    | 10    | 10    |       |
|                                | TITANIUM ALLOYS<br>(DIFFICULT)<br>Pure Titanium, Ti6Al4V,<br>Ti6Al2Sn4Zr2Mo,<br>Ti4Al4Mo2Sn0.5Si,<br>Ti-6Al4V             | ≤ 275 Bhn<br>or<br>≤ 28 HRc | 26            | RPM   | 8240  | 2747  | 1373  | 1030  | 824   | 687   | 515   |
|                                |                                                                                                                           |                             | (21-31)       | Fr    | 0.013 | 0.040 | 0.080 | 0.107 | 0.133 | 0.160 | 0.214 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 110   | 110   | 110   | 110   | 110   | 110   | 110   |       |
|                                |                                                                                                                           | ≤ 350 Bhn<br>or<br>≤ 38 HRc | 20            | RPM   | 6301  | 2100  | 1050  | 788   | 630   | 525   | 394   |
|                                |                                                                                                                           |                             | (16-24)       | Fr    | 0.007 | 0.021 | 0.043 | 0.057 | 0.071 | 0.086 | 0.114 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 45    | 45    | 45    | 45    | 45    | 45    | 45    |       |
|                                |                                                                                                                           | ≤ 440 Bhn<br>or<br>≤ 47 HRc | 17            | RPM   | 5332  | 1777  | 889   | 666   | 533   | 444   | 333   |
|                                |                                                                                                                           |                             | (13-20)       | Fr    | 0.007 | 0.020 | 0.039 | 0.053 | 0.066 | 0.079 | 0.105 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 35    | 35    | 35    | 35    | 35    | 35    | 35    |       |
| H                              | TOOL STEELS<br>A2, D2, H13, L2, M2,<br>P20, S7, T15, W2                                                                   | ≤ 475 Bhn<br>or<br>≤ 50 HRc | 12            | RPM   | 3878  | 1293  | 646   | 485   | 388   | 323   | 242   |
|                                |                                                                                                                           |                             | (10-15)       | Fr    | 0.003 | 0.009 | 0.019 | 0.025 | 0.031 | 0.037 | 0.050 |
|                                |                                                                                                                           |                             | Feed (mm/min) | 12    | 12    | 12    | 12    | 12    | 12    | 12    |       |

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)

rpm = (Vc x 1000) / (DC x 3.14)

mm/min = Fr x rpm

reduce speed and feed 30 percent when using uncoated drills

reduce speed and feed for materials harder than listed

refer to the SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)