# Speeds and Feeds

1) Select your material in the ISO colored chart.
2) Start with the appropriate feed per tooth, $f_z$ (mm) for your application. Start with a middle/average value for cutting speed, $V_c$ (m/min). Adjust the cutting speeds and/or feed based on your cutting conditions.

## RECOMMENDED CUTTING SPEED AND FEED

| ISO | VDI 3323 | Material Description | HB | HRC | Cutting Speed (SMM) | Feed per tooth (mm/tooth) | |
|---|---|---|---|---|---|---|---|
| | | | | | With Coolant Hole | With Coolant Hole | |
| | | | | | | ØDCX ≤ 8 | ØDCX > 8 |
| P | 1 | Non-alloy steel | 125 | | 75-120 | 0.025-0.051 | 0.051-0.097 |
| | 2 | | 190 | 13 | 75-115 | 0.02-0.041 | 0.041-0.086 |
| | 3 | | 250 | 25 | 75-110 | 0.02-0.041 | 0.041-0.086 |
| | 4 | | 270 | 28 | 70-100 | 0.015-0.036 | 0.036-0.076 |
| | 5 | | 300 | 32 | 70-100 | 0.015-0.036 | 0.036-0.076 |
| | 6 | Low alloy steel | 180 | 10 | 75-110 | 0.02-0.041 | 0.041-0.086 |
| | 7 | | 275 | 29 | 70-100 | 0.015-0.036 | 0.036-0.076 |
| | 8 | | 300 | 32 | 70-100 | 0.015-0.036 | 0.036-0.076 |
| | 9 | | 350 | 38 | 60-90 | 0.015-0.036 | 0.036-0.076 |
| | 10 | High alloyed steel, and tool steel | 200 | 15 | 70-100 | 0.02-0.041 | 0.041-0.086 |
| | 11 | | 325 | 35 | 60-90 | 0.015-0.036 | 0.036-0.066 |
| M | 12 | Stainless steel | 200 | 15 | 60-75 | 0.015-0.025 | 0.025-0.056 |
| | 13 | | 240 | 23 | 60-75 | 0.01-0.02 | 0.02-0.046 |
| | 14 | | 180 | 10 | 45-75 | 0.015-0.025 | 0.025-0.056 |
| K | 15 | Grey cast iron | 180 | 10 | 75-120 | 0.03-0.051 | 0.051-0.104 |
| | 16 | | 260 | 26 | 75-110 | 0.02-0.041 | 0.041-0.086 |
| | 17 | Nodular cast iron | 160 | 3 | 75-120 | 0.03-0.051 | 0.051-0.104 |
| | 18 | | 250 | 25 | 70-100 | 0.02-0.041 | 0.041-0.086 |
| | 19 | Malleable cast iron | 130 | | 70-100 | 0.02-0.041 | 0.041-0.086 |
| | 20 | | 230 | 21 | 70-105 | 0.03-0.051 | 0.051-0.104 |

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## RECOMMENDED CUTTING SPEED AND FEED

| ISO | VDI 3323 | Material Description | HB | HRC | Cutting Speed (SMM) | Feed per tooth (mm/tooth) | |
|---|---|---|---|---|---|---|---|
| | | | | | With Coolant Hole | With Coolant Hole | |
| | | | | | | ØDCX ≤ 8 | ØDCX > 8 |
| N | 21 | Aluminum-wrought alloy | 60 | | 150-305 | 0.061-0.081 | 0.081-0.124 |
| | 22 | | 100 | | 120-245 | 0.051-0.071 | 0.071-0.104 |
| | 23 | Aluminum-cast, alloyed | 75 | | 105-275 | 0.03-0.051 | 0.051-0.086 |
| | 24 | | 90 | | 105-275 | 0.03-0.051 | 0.051-0.086 |
| | 25 | | 130 | | 105-245 | 0.02-0.041 | 0.041-0.076 |
| | 26 | Copper and Copper Alloys (Bronze / Brass) | 110 | | 150-245 | 0.041-0.061 | 0.061-0.097 |
| | 27 | | 90 | | 105-245 | 0.041-0.061 | 0.061-0.097 |
| | 28 | | 100 | | 90-185 | 0.03-0.051 | 0.051-0.086 |
| | 29 | Non Metallic Materials | | | 105-275 | 0.03-0.051 | 0.051-0.086 |
| | 30 | | | | 105-275 | 0.03-0.051 | 0.051-0.086 |
| S | 31 | Heat Resistant Super Alloys | 200 | 15 | 30-60 | 0.01-0.02 | 0.02-0.036 |
| | 32 | | 280 | 30 | 20-55 | 0.005-0.015 | 0.015-0.036 |
| | 33 | | 250 | 25 | 15-45 | 0.005-0.015 | 0.015-0.025 |
| | 34 | | 350 | 38 | 15-35 | 0.005-0.015 | 0.015-0.025 |
| | 35 | | 320 | 34 | 15-45 | 0.005-0.015 | 0.015-0.023 |
| | 36 | Titanium Alloys | 400 Rm | | 30-75 | 0.015-0.025 | 0.025-0.056 |
| | 37 | | 1050 Rm | | 20-45 | 0.005-0.015 | 0.015-0.025 |

# Speeds and Feeds

| Feed Rate, Per Revolution (mm/min) |
| --- |
| $v_f = f_n \cdot n$ |

| Feed Rate, Per Tooth (mm/min) |
| --- |
| $v_f = f_z \cdot n \cdot Z$ |

| Feed Per Revolution (mm/rev) |
| --- |
| $f_n = \frac{v_f}{n}$ |

| Feed Per Tooth (mm) |
| --- |
| $f_z = \frac{v_f}{n \cdot Z}$ |

| Cutting Speed (m/min) |
| --- |
| $v_c = \frac{\pi \cdot D_{tool} \cdot n}{1000}$ |

| Spindle Speed (rev/min) |
| --- |
| $n = \frac{v_c \cdot 1000}{\pi \cdot D_{tool}}$ |

| Material Removal Rate ($cm^3$/min) |
| --- |
| $MMR = \frac{a_p \cdot a_e \cdot v_f}{1000}$ |

**Metric**

| Symbol | Definition | Unit |
| --- | --- | --- |
| $v_f$ | Feed rate | *mm/min* |
| $f_n$ | Feed per revolution | *mm/rev* |
| $f_z$ | Feed per tooth | *mm* |
| $v_c$ | Cutting speed | *m/min (SMM)* |
| $n$ | Spindle speed | *rev/min (RPM)* |
| $D_{tool}$ | Tool cutting diameter | *mm* |
| $MMR$ | Material removal rate | *($cm^3$/min)* |
| $a_e$ | Radial depth of cut | *mm* |
| $a_p$ | Axial depth of cut | *mm* |
| $Z$ | Number of teeth/flutes | |