# RECOMMENDED CUTTING CONDITIONS (SHANK TYPE)

## CUTTING CONDITIONS FOR SHOULDER MILLING

| Work Material | | Hardness | Insert Grade/Breaker | | Cutting Speed **vc** (m/min) | Width of Cut: **ae** (mm) Feed per Tooth: **fz** (mm/tooth) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $\phi$50 (the last letter of order number for cutter body) | | | $\phi$63 (the last letter of order number for cutter body) | | | |
| | | | | | | **S** (ap≤110) | **M** (ap=157) | **L** (ap=205) | **S** (ap=110) | **M** (ap=157) | **L** (ap=205) | **X** (ap=261) |
| **P** | Mild Steel | ≤180HB | VP15TF | WH | 120 (100−140) | ≤10.0 0.15−0.25 | ≤5.0 0.15−0.25 | ≤2.5 0.10−0.20 | ≤12.5 0.15−0.25 | ≤10.0 0.15−0.25 | ≤5.0 0.15−0.25 | ≤2.5 0.10−0.20 |
| | | | | JM | 120 (100−140) | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 | ≤10.0 0.10−0.20 | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 |
| | Carbon Steel Alloy Steel | 180−350HB | | WH | 80 (70−120) | ≤10.0 0.15−0.25 | ≤5.0 0.15−0.25 | ≤2.5 0.10−0.20 | ≤12.5 0.15−0.25 | ≤10.0 0.15−0.25 | ≤5.0 0.15−0.25 | ≤2.5 0.10−0.20 |
| | | | | JM | 80 (70−120) | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 | ≤10.0 0.10−0.20 | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 |
| | Alloy Tool Steel | ≤300HB | | WH | 80 (60−100) | ≤10.0 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 | ≤12.5 0.10−0.20 | ≤10.0 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 |
| | | | | JM | 80 (60−100) | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.05−0.10 | ≤10.0 0.10−0.15 | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.05−0.10 |
| **M** | Stainless Steel | ≤200HB | VP20RT | WH | 80 (60−100) | ≤7.5 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 | ≤10.0 0.08−0.15 | ≤7.5 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 |
| | | | | JM | 80 (60−100) | ≤5.0 0.08−0.15 | ≤3.5 0.08−0.15 | ≤2.0 0.05−0.10 | ≤7.5 0.08−0.15 | ≤5.0 0.08−0.15 | ≤3.5 0.08−0.15 | ≤2.0 0.05−0.10 |
| **K** | Cast Iron | Tensile Strength ≤350MPa | VP15TF | WH | 100 (80−120) | ≤10.0 0.15−0.40 | ≤5.0 0.15−0.35 | ≤2.5 0.10−0.30 | ≤12.5 0.15−0.40 | ≤10.0 0.15−0.40 | ≤5.0 0.15−0.35 | ≤2.5 0.10−0.30 |
| | | | | JM | 100 (80−120) | ≤7.5 0.10−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.05−0.20 | ≤10.0 0.10−0.25 | ≤7.5 0.10−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.05−0.20 |
| | Ductile Cast Iron | Tensile Strength ≤800MPa | | WH | 80 (60−100) | ≤10.0 0.15−0.35 | ≤5.0 0.15−0.30 | ≤2.5 0.10−0.25 | ≤12.5 0.15−0.35 | ≤10.0 0.15−0.35 | ≤5.0 0.15−0.30 | ≤2.5 0.10−0.25 |
| | | | | JM | 80 (60−100) | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 | ≤10.0 0.10−0.20 | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.05−0.15 |
| **S** | Ti Alloy | ≤350HB | VP20RT | WH | 40 (35−50) | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 | ≤7.5 0.05−0.10 | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 |
| | | | | JM | 40 (35−50) | ≤3.5 0.05−0.10 | ≤2.5 0.05−0.10 | ≤1.5 0.05−0.10 | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.5 0.05−0.10 | ≤1.5 0.05−0.10 |

(Note 1) The above cutting conditons are determined based on high rigidity machine and workpiece, where no vibration occurred. Please adjust the machining conditions if vibration is generated.

(Note 2) For the tools of cutting edge length is 200mm or more, please reduce the cutting speed and table feed by 10-20% and the cutting width by 50%.

(Note 3) If the cutting angle between the tool and workpiece exceeds 90º when machining corners. Reduce the cutting speed and table feed by 10-20% and ae by 50%. Also if possible, set a radius cutting path for corners.

## CUTTING CONDITIONS FOR SLOT MILLING

| Work Material | | Hardness | Insert Grade/Breaker | | Cutting Speed **vc** (m/min) | Width of Cut: **ap** (mm) Feed per Tooth: **fz** (mm/tooth) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $\phi$50 (the last letter of order number for cutter body) | | | $\phi$63 (the last letter of order number for cutter body) | | | |
| | | | | | | **S** (ap≤110) | **M** (ap=157) | **L** (ap=205) | **S** (ap=110) | **M** (ap=157) | **L** (ap=205) | **X** (ap=261) |
| **P** | Mild Steel | ≤180HB | VP15TF | WH | 60 (50−120) | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 | ≤12.5 0.10−0.25 | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 |
| | | | | JM | 60 (50−120) | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 | ≤10.0 0.10−0.15 | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 |
| | Carbon Steel Alloy Steel | 180−350HB | | WH | 60 (50−100) | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 | ≤12.5 0.10−0.25 | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 |
| | | | | JM | 60 (50−100) | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 | ≤10.0 0.10−0.15 | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 |
| | Alloy Tool Steel | ≤300HB | | WH | 50 (40−80) | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 | ≤12.5 0.10−0.25 | ≤10.0 0.10−0.25 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.15 |
| | | | | JM | 50 (40−80) | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 | ≤10.0 0.10−0.15 | ≤7.5 0.10−0.15 | ≤5.0 0.10−0.15 | ≤2.5 0.10−0.15 |
| **M** | Stainless Steel | ≤200HB | VP20RT | WH | 40 (35−80) | ≤10.0 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 | ≤12.5 0.08−0.15 | ≤10.0 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 |
| | | | | JM | 40 (35−80) | ≤7.5 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 | ≤10.0 0.08−0.15 | ≤7.5 0.08−0.15 | ≤5.0 0.08−0.15 | ≤2.5 0.05−0.10 |
| **K** | Cast Iron | Tensile Strength ≤350MPa | VP15TF | WH | 50 (40−80) | ≤10.0 0.15−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.10−0.20 | ≤12.5 0.15−0.25 | ≤10.0 0.15−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.10−0.20 |
| | | | | JM | 50 (40−80) | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.20 | ≤10.0 0.10−0.20 | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.20 |
| | Ductile Cast Iron | Tensile Strength ≤800MPa | | WH | 40 (35−80) | ≤10.0 0.15−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.10−0.20 | ≤12.5 0.15−0.25 | ≤10.0 0.15−0.25 | ≤5.0 0.10−0.25 | ≤2.5 0.10−0.20 |
| | | | | JM | 40 (35−80) | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.20 | ≤10.0 0.10−0.20 | ≤7.5 0.10−0.20 | ≤5.0 0.10−0.20 | ≤2.5 0.10−0.20 |
| **S** | Ti Alloy | ≤350HB | VP20RT | WH | 35 (30−50) | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 | ≤7.5 0.05−0.10 | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 |
| | | | | JM | 35 (30−50) | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 | ≤7.5 0.05−0.10 | ≤5.0 0.05−0.10 | ≤3.5 0.05−0.10 | ≤2.0 0.05−0.10 |

(Note 1) The above cutting conditons are determined based on high rigidity machine and workpiece, where no vibration occurred. Please adjust the machining conditions if vibration is generated.

(Note 2) For slotting, please use high rigidity tools such as SPX4R05016WNES/BT50NES.

# RECOMMENDED CUTTING CONDITIONS (SHELL TYPE)

## CUTTING CONDITIONS FOR SHOULDER MILLING

| | Work Material | Hardness | Insert Grade/Breaker | Cutting Speed **vc** (m/min) | Depth of Cut **ap** (mm) | Width of Cut **ae** (mm) | Feed per Tooth **fz** (mm/tooth) |
|---|---|---|---|---|---|---|---|
| P | Mild Steel | ≤180HB | **VP15TF JM** | 120 (100—140) | —0.5$D_1$ | —10 | 0.15—0.30 |
| | | | | 120 (100—140) | 0.5$D_1$— | —10 | 0.15—0.25 |
| | Carbon Steel Alloy Steel | 180—350HB | **VP15TF JM** | 120 (80—130) | —0.5$D_1$ | —10 | 0.15—0.30 |
| | | | | 100 (80—120) | 0.5$D_1$— | —10 | 0.15—0.25 |
| | Alloy Tool Steel | ≤300HB | **VP15TF JM** | 100 (60—110) | —0.5$D_1$ | —10 | 0.10—0.20 |
| | | | | 80 (60—100) | 0.5$D_1$— | —10 | 0.10—0.15 |
| M | Stainless Steel | ≤200HB | **VP20RT JM** | 140 (100—150) | —0.5$D_1$ | —10 | 0.10—0.25 |
| | | | | 120 (100—140) | 0.5$D_1$— | —10 | 0.10—0.20 |
| K | Cast Iron | Tensile Strength ≤350MPa | **VP15TF WH** | 120 (80—130) | —0.5$D_1$ | —10 | 0.25—0.40 |
| | | | | 100 (80—120) | 0.5$D_1$— | —10 | 0.25—0.40 |
| | | | **VP15TF JM** | 120 (80—130) | —0.5$D_1$ | —10 | 0.15—0.30 |
| | | | | 100 (80—120) | 0.5$D_1$— | —10 | 0.15—0.25 |
| | Ductile Cast Iron | Tensile Strength ≤800MPa | **VP15TF WH** | 100 (60—110) | —0.5$D_1$ | —10 | 0.20—0.35 |
| | | | | 80 (60—110) | 0.5$D_1$— | —10 | 0.20—0.35 |
| | | | **VP15TF JM** | 100 (60—120) | —0.5$D_1$ | —10 | 0.15—0.30 |
| | | | | 80 (60—120) | 0.5$D_1$— | —10 | 0.15—0.30 |
| S | Ti Alloy | ≤350HB | **VP20RT JM** | 45 (35—50) | —0.5$D_1$ | —10 | 0.08—0.10 |
| | | | | 40 (35—50) | 0.5$D_1$— | —10 | 0.08—0.10 |

(Note 1) The above cutting conditons are determined based on high rigidity machine and workpiece, where no vibration occurred.
Please adjust the machining conditions if vibration is generated.

## CUTTING CONDITIONS FOR SLOT MILLING

| | Work Material | Hardness | Insert Grade/Breaker | Cutting Speed **vc** (m/min) | Depth of Cut **ap** (mm) | Width of Cut **ae** (mm) | Feed per Tooth **fz** (mm/tooth) |
|---|---|---|---|---|---|---|---|
| P | Mild Steel | ≤180HB | **VP15TF JM** | 120 (100—140) | —10 | $D_1$ | 0.15—0.25 |
| | Carbon Steel Alloy Steel | 180—350HB | **VP15TF JM** | 100 (80—120) | —0.25$D_1$ | $D_1$ | 0.15—0.25 |
| | Alloy Tool Steel | ≤300HB | **VP15TF JM** | 80 (60—100) | —10 | $D_1$ | 0.10—0.20 |
| M | Stainless Steel | ≤200HB | **VP20RT JM** | 100 (80—140) | —10 | $D_1$ | 0.10—0.15 |
| K | Cast Iron | Tensile Strength ≤350MPa | **VP15TF WH** | 80 (60—100) | —0.25$D_1$ | $D_1$ | 0.10—0.25 |
| | | | | 60 (50—100) | —0.6$D_1$ | $D_1$ | 0.10—0.20 |
| | | | **VP15TF JM** | 80 (60—100) | —0.25$D_1$ | $D_1$ | 0.10—0.20 |
| | | | | 60 (50—100) | —0.6$D_1$ | $D_1$ | 0.10—0.15 |
| | Ductile Cast Iron | Tensile Strength ≤800MPa | **VP15TF WH** | 80 (60—100) | —0.25$D_1$ | $D_1$ | 0.10—0.25 |
| | | | | 60 (50—100) | —0.5$D_1$ | $D_1$ | 0.10—0.20 |
| | | | **VP15TF JM** | 80 (60—100) | —0.25$D_1$ | $D_1$ | 0.10—0.20 |
| | | | | 60 (50—100) | —0.5$D_1$ | $D_1$ | 0.10—0.15 |
| S | Ti Alloy | ≤350HB | **VP20RT JM** | 40 (35—50) | —0.25$D_1$ | $D_1$ | 0.06—0.10 |

(Note 1) The above cutting conditons are determined based on high rigidity machine and workpiece, where no vibration occurred.
Please adjust the machining conditions if vibration is generated.