Chip Breaker Recommendation

■ Chip Breaker Selection Table

	Workpiece Material	Properties	Cutting Conditions	Chip Breaker		Grade	
				1st Recommended	2nd Recommended	1st Recommended	2nd Recommended
P	Mild Steels	Hardness ≤180HB	● ●	L	M	MP6120	VP15TF
			✱	M	L	MP6130	—
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 180-350HB ≤350HB (Annealing)	●	L	M	MP6120	VP15TF
			●	M	L	MP6120	VP15TF
			✱	M	L	MP6130	—
	Pre-hardened Steels	Hardness 35—45HRC	● ●	M	L	MP6120	VP15TF
			✱	M	L	MP6130	—
M	Austenitic Stainless Steels	Hardness ≤280HB	● ●	L	M	MP7130	VP15TF
			✱	M	L	MP7130	—
		Hardness >200HB	● ●	L	M	MP7130	VP15TF
			✱	M	L	MP7130	—
	Duplex Stainless Steels	Hardness ≤280HB	● ●	L	M	MP7130	VP15TF
			✱	M	L	MP7130	—
	Ferritic and Martensitic Stainless Steels	—	● ●	L	M	MP7130	VP15TF
			✱	M	L	MP7130	—
	Precipitation Hardening Stainless Steels	Hardness <450HB	● ●	L	M	MP7130	VP15TF
			✱	M	L	MP7130	—
K	Gray Cast Irons	Tensile Strength ≤350MPa	● ●	M	L	MC5020	VP15TF
			✱	M	L	VP15TF	—
	Ductile Cast Irons	Tensile Strength ≤800MPa	● ●	M	L	MC5020	VP15TF
			✱	M	L	VP15TF	—
N	Aluminium Alloys	Content Si<5%	● ●	L	M	TF15	—
			✱	M	L	TF15	—
S	Titanium Alloys (Ti-6Al-4V,etc.)	—	● ●	L	M	MP9120	VP15TF
			✱	M	L	MP9130	—
	Titanium Alloys (Ti-5Al-5V-5Mo-3Cr,etc.)	—	● ●	L	M	MP9120	VP15TF
			✱	M	L	MP9130	—
	Heat Resistant Alloys	—	● ●	M	L	MP9120	VP15TF
			✱	M	L	MP9130	—
H	Hardened Steels	Hardness 40—55HRC	● ● ✱	M	—	VP15TF	—

For cutting conditions please refer to page 19—25.

Recommended Cutting Conditions

■ Dry Cutting

Cutting Speed

(mm)

	Workpiece Material	Properties	Cutting Conditions	Insert Grade	ae ≤0.25DC	ae 0.25—0.5DC	ae 0.5—0.75DC	ae DC(Slot)
					vc (m/min)			
P	Mild Steels	Hardness ≤180HB	● ●	MP6120, VP15TF	230 (180—270)	220 (170—260)	180 (140—210)	180 (140—210)
			✲	MP6130	200 (150—240)	190 (170—260)	150 (110—180)	150 (110—180)
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 180—350HB ≤350HB (Annealing)	● ●	MP6120, VP15TF	180 (140—210)	170 (130—200)	140 (110—160)	140 (110—180)
			✲	MP6130	150 (110—180)	140 (100—170)	110 (80—130)	110 (80—130)
	Pre-hardened Steels	Hardness 35—45HRC	● ●	MP6120, VP15TF	120 (90—140)	110 (80—130)	100 (70—120)	100 (70—120)
			✲	MP6130	100 (80—120)	90 (70—110)	80 (60—100)	80 (60—100)
M	Austenitic Stainless Steels	Hardness ≤200HB	● ● ✲	MP7130, VP15TF	180 (140—210)	170 (130—200)	140 (110—160)	140 (110—160)
		Hardness >200HB	● ● ✲	MP7130, VP15TF	150 (110—180)	140 (100—160)	110 (80—130)	110 (80—130)
	Duplex Stainless Steels	Hardness ≤280HB	● ● ✲	MP7130, VP15TF	140 (110—170)	130 (90—150)	100 (70—120)	100 (70—120)
	Ferritic and Martensitic Stainless Steels	—	● ● ✲	MP7130, VP15TF	180 (140—210)	170 (130—200)	140 (110—160)	140 (110—160)
	Precipitation Hardening Stainless Steels	Hardness <450HB	● ● ✲	MP7130, VP15TF	130 (100—160)	120 (80—140)	90 (60—110)	90 (60—110)
K	Gray Cast Irons	Tensile Strength ≤350MPa	● ●	MC5020	250 (200—300)	240 (190—290)	210 (160—260)	210 (160—260)
			● ● ✲	VP15TF	200 (150—250)	190 (140—240)	160 (110—210)	160 (110—210)
	Ductile Cast Irons	Tensile Strength ≤800MPa	● ●	MC5020	180 (150—200)	170 (140—190)	150 (120—170)	150 (120—170)
			● ● ✲	VP15TF	130 (100—150)	120 (90—140)	100 (80—120)	100 (80—120)
N	Aluminium Alloys	Content Si<5%	● ● ✲	TF15	600 (400—1000)	600 (400—1000)	600 (400—1000)	600 (400—1000)
H	Hardened Steels	Hardness 40—55HRC	● ● ✲	VP15TF	90 (70—100)	85 (60—100)	70 (50—80)	70 (50—80)

Note 1) These cutting conditions should be referenced for standard shank types (last letter in designation is S) and arbor shank types. If there is chatter, insert chipping, etc. during machining, alter conditions accordingly.
Note 2) Chattering vibration is more likely under the following circumstances. Use a cut and feed per tooth that are at minimum recommended conditions or below.
- When tool overhang is long (using a long shank, screw-in type, etc.)
- Rigidity of machine, workpiece material or attachment of workpiece material is low
- Corner radius during pocket milling

Note 3) A type with fewer teeth is recommended when the depth of cut in the radius direction (ae) is 0.5 DC or more.
Note 4) Wet cutting is recommended, when focusing on the surface finish. (Service life is shorter than for dry cutting.)
Note 5) When using under higher than recommended cutting conditions, or for long periods of time, the clamp screw may become fatigued and break during machining. Please change out the clamp screw periodically.

Depth of Cut / Feed per Tooth

(mm)

	Workpiece Material	Properties	ae	Cutting Conditions	DC ø25 ap	DC ø25 fz (mm/t.)	DC ø28—ø80 ap	DC ø28—ø80 fz (mm/t.)
P	Mild Steels	Hardness ≤180HB	≤0.25DC	● ● ✲	≤11	0.10 — 0.20	≤11	0.10 — 0.30
			0.25—0.5DC	● ● ✲	≤11	0.10 — 0.15	≤11	0.10 — 0.25
			0.5—0.75DC	● ● ✲	≤8	0.08 — 0.12	≤8	0.10 — 0.20
			DC(Slot)	● ● ✲	≤5	0.06 — 0.10	≤5	0.08 — 0.15
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 180—280HB	≤0.25DC	● ● ✲	≤11	0.10 — 0.20	≤11	0.10 — 0.30
			0.25—0.5DC	● ● ✲	≤11	0.10 — 0.15	≤11	0.10 — 0.25
			0.5—0.75DC	● ● ✲	≤8	0.08 — 0.12	≤8	0.10 — 0.20
			DC(Slot)	● ● ✲	≤5	0.06 — 0.10	≤5	0.08 — 0.15
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280—350HB ≤350HB (Annealing)	≤0.25DC	● ● ✲	≤11	0.10 — 0.15	≤11	0.10 — 0.25
			0.25—0.5DC	● ● ✲	≤11	0.08 — 0.12	≤11	0.10 — 0.20
			0.5—0.75DC	● ● ✲	≤8	0.06 — 0.10	≤8	0.10 — 0.15
			DC(Slot)	● ● ✲	≤5	0.06 — 0.10	≤5	0.08 — 0.12
	Pre-hardened Steels	Hardness 35—45HRC	≤0.25DC	● ● ✲	≤11	0.10 — 0.15	≤11	0.10 — 0.25
			0.25—0.5DC	● ● ✲	≤11	0.08 — 0.12	≤11	0.10 — 0.20
			0.5—0.75DC	● ● ✲	≤8	0.06 — 0.10	≤8	0.10 — 0.15
			DC(Slot)	● ● ✲	≤5	0.06 — 0.10	≤5	0.08 — 0.12

Cutting Conditions (Guide) :
● : Stable Cutting ◔ : General Cutting ✣ : Unstable Cutting

Depth of Cut / Feed per Tooth

(mm)

	Workpiece Material	Properties	ae	Cutting Conditions	DC ø25 ap	DC ø25 fz (mm/t.)	DC ø28—ø80 ap	DC ø28—ø80 fz (mm/t.)
M	Austenitic Stainless Steels	—	≤0.25DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.20
				✣	≤11	0.08 —0.15	≤11	0.08 —0.15
			0.25—0.5DC	● ◔	≤11	0.08 —0.15	≤11	0.08 —0.15
				✣	≤11	0.08 —0.12	≤11	0.08 —0.12
			0.5—0.75DC	● ◔	≤8	0.08 —0.12	≤8	0.08 —0.12
				✣	≤8	0.06 —0.10	≤8	0.06 —0.10
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.06 —0.10
				✣	≤5	0.06 —0.08	≤5	0.06 —0.08
	Duplex Stainless Steels	Hardness ≤280HB	≤0.25DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.20
				✣	≤11	0.08 —0.15	≤11	0.08 —0.15
			0.25—0.5DC	● ◔	≤11	0.08 —0.15	≤11	0.08 —0.15
				✣	≤11	0.08 —0.12	≤11	0.08 —0.12
			0.5—0.75DC	● ◔	≤8	0.08 —0.12	≤8	0.08 —0.12
				✣	≤8	0.06 —0.10	≤8	0.06 —0.10
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.06 —0.10
				✣	≤5	0.06 —0.08	≤5	0.06 —0.08
	Ferritic and Martensitic Stainless Steels	—	≤0.25DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.20
				✣	≤11	0.08 —0.15	≤11	0.08 —0.15
			0.25—0.5DC	● ◔	≤11	0.08 —0.15	≤11	0.08 —0.15
				✣	≤11	0.08 —0.12	≤11	0.08 —0.12
			0.5—0.75DC	● ◔	≤8	0.08 —0.12	≤8	0.08 —0.12
				✣	≤8	0.06 —0.10	≤8	0.06 —0.10
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.06 —0.10
				✣	≤5	0.06 —0.08	≤5	0.06 —0.08
	Precipitation Hardening Stainless Steels	Hardness <450HB	≤0.25DC	● ◔	≤11	0.10 —0.15	≤11	0.10 —0.15
				✣	≤11	0.08 —0.12	≤11	0.08 —0.12
			0.25—0.5DC	● ◔	≤11	0.08 —0.12	≤11	0.08 —0.12
				✣	≤11	0.08 —0.12	≤11	0.06 —0.10
			0.5—0.75DC	● ◔	≤8	0.06 —0.10	≤8	0.06 —0.10
				✣	≤8	0.06 —0.08	≤8	0.06 —0.08
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.06 —0.10
				✣	≤5	0.06 —0.08	≤5	0.06 —0.08
K	Gray Cast Irons	Tensile Strength ≤350MPa	≤0.25DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.30
				✣	≤11	0.08 —0.15	≤11	0.10 —0.25
			0.25—0.5DC	● ◔	≤11	0.08 —0.15	≤11	0.10 —0.25
				✣	≤11	0.08 —0.12	≤11	0.10 —0.20
			0.5—0.75DC	● ◔	≤8	0.08 —0.12	≤8	0.10 —0.20
				✣	≤8	0.06 —0.10	≤8	0.08 —0.15
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.08 —0.15
				✣	≤5	0.06 —0.08	≤5	0.08 —0.12
	Ductile Cast Irons	Tensile Strength ≤800MPa	≤0.25DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.25
				✣	≤11	0.10 —0.15	≤11	0.10 —0.20
			0.25—0.5DC	● ◔	≤11	0.10 —0.15	≤11	0.10 —0.20
				✣	≤11	0.08 —0.12	≤11	0.10 —0.15
			0.5—0.75DC	● ◔	≤8	0.08 —0.12	≤8	0.10 —0.15
				✣	≤8	0.08 —0.12	≤8	0.08 —0.12
			DC(Slot)	● ◔	≤5	0.06 —0.10	≤5	0.08 —0.12
				✣	≤5	0.06 —0.08	≤5	0.06 —0.10
N	Aluminium Alloys	Content Si<5%	≤0.25DC	● ◔	≤11	0.10 —0.25	≤11	0.10 —0.25
				✣	≤11	0.10 —0.20	≤11	0.10 —0.20
			0.25—0.5DC	● ◔	≤11	0.10 —0.20	≤11	0.10 —0.20
				✣	≤11	0.10 —0.15	≤11	0.10 —0.15
			0.5—0.75DC	● ◔	≤8	0.06 —0.15	≤8	0.08 —0.15
				✣	≤8	0.06 —0.15	≤8	0.08 —0.15
			DC(Slot)	● ◔	≤5	0.06 —0.15	≤5	0.08 —0.15
				✣	≤5	0.06 —0.15	≤5	0.08 —0.12
H	Hardened Steels	Hardness 40—55HRC	≤0.25DC	● ◔	≤5	0.08 —0.15	≤5	0.08 —0.15
				✣	≤5	0.08 —0.12	≤5	0.08 —0.12
			0.25—0.5DC	● ◔	≤4	0.08 —0.12	≤4	0.08 —0.12
				✣	≤4	0.06 —0.10	≤4	0.06 —0.10
			0.5—0.75DC	● ◔	≤3	0.06 —0.10	≤3	0.06 —0.10
				✣	≤3	0.06 —0.08	≤3	0.06 —0.08
			DC(Slot)	● ◔	≤2	0.06 —0.10	≤2	0.06 —0.10
				✣	≤2	0.06 —0.08	≤2	0.06 —0.08

Note 1) These cutting conditions should be referenced for standard shank types (last letter in designation is S) and arbor shank types. If there is chatter, insert chipping, etc. during machining, alter conditions accordingly.
Note 2) Chattering vibration is more likely under the following circumstances. Use a cut and feed per tooth that are at minimum recommended conditions or below.
・When tool overhang is long (using a long shank, screw-in type, etc.)
・Rigidity of machine, workpiece material or attachment of workpiece material is low
・Corner radius during pocket milling
Note 3) A type with fewer teeth is recommended when the depth of cut in the radius direction (ae) is 0.5 DC or more.
Note 4) Wet cutting is recommended, when focusing on the surface finish. (Service life is shorter than for dry cutting.)
Note 5) When using under higher than recommended cutting conditions, or for long periods of time, the clamp screw may become fatigued and break during machining. Please change out the clamp screw periodically.

Recommended Cutting Conditions

■ Wet Cutting

Cutting Speed

(mm)

	Workpiece Material	Properties	Cutting Conditions	Insert Grade	ae ≤0.25DC	ae 0.25—0.5DC	ae 0.5—0.75DC	ae DC(Slot)
					vc (m/min)			
P	Mild Steels	Hardness ≤180HB	● ● ✱	MP6120 MP6130 VP15TF	140 (100—190)	130 (90—180)	100 (70—120)	100 (70—120)
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 180—350HB ≤350HB (Annealing)	● ● ✱	MP6120 MP6130 VP15TF	120 (90—140)	110 (80—130)	100 (70—120)	100 (70—120)
	Pre-hardened Steels	Hardness 35—45HRC	● ● ✱	MP6120 MP6130 VP15TF	100 (80—120)	90 (70—110)	80 (60—100)	80 (60—100)
M	Austenitic Stainless Steels	Hardness ≤200HB	● ● ✱	MP7130, VP15TF	120 (100—150)	110 (90—140)	90 (70—120)	90 (70—120)
		Hardness >200HB	● ● ✱	MP7130, VP15TF	100 (80—130)	90 (70—120)	70 (50—100)	70 (50—100)
	Duplex Stainless Steels	Hardness ≤280HB	● ● ✱	MP7130, VP15TF	100 (80—130)	90 (70—120)	70 (50—100)	70 (50—100)
	Ferritic and Martensitic Stainless Steels	—	● ● ✱	MP7130, VP15TF	120 (100—150)	110 (90—140)	90 (70—120)	90 (70—120)
	Precipitation Hardening Stainless Steels	Hardness <450HB	● ● ✱	MP7130, VP15TF	90 (70—120)	80 (60—110)	60 (40—90)	60 (40—90)
K	Gray Cast Irons	Tensile Strength ≤350MPa	● ●	MC5020	180 (160—220)	170 (150—210)	150 (130—190)	150 (130—190)
			● ● ✱	VP15TF	130 (100—150)	120 (90—140)	100 (80—120)	100 (80—120)
	Ductile Cast Irons	Tensile Strength ≤800MPa	● ●	MC5020	160 (140—180)	150 (130—170)	130 (110—150)	130 (110—150)
			● ● ✱	VP15TF	110 (80—140)	100 (70—130)	80 (60—120)	80 (60—120)
N	Aluminium Alloys	Content Si<5%	● ● ✱	TF15	600 (400—1000)	600 (400—1000)	600 (400—1000)	600 (400—1000)
S	Titanium Alloys (Ti-6Al-4V,etc.)	—	● ●	MP9120, VP15TF	50 (40—70)	50 (40—70)	50 (40—70)	50 (40—70)
			✱	MP9130	40 (30—60)	40 (30—60)	40 (30—60)	40 (30—60)
	Titanium Alloys (Ti-5Al-5V-5Mo-3Cr,etc.)	—	● ●	MP9120, VP15TF	30 (20—40)	30 (20—40)	30 (20—40)	30 (20—40)
			✱	MP9130	30 (20—40)	30 (20—40)	30 (20—40)	30 (20—40)
	Heat Resistant Alloys	—	● ●	MP9120, VP15TF	40 (30—60)	40 (30—60)	40 (30—60)	40 (30—60)
			✱	MP9130	30 (20—40)	30 (20—40)	30 (20—40)	30 (20—40)
H	Hardened Steels	Hardness 40—55HRC	● ● ✱	VP15TF	90 (70—100)	85 (60—100)	70 (50—80)	70 (50—80)

Note 1) These cutting conditions should be referenced for standard shank types (last letter in designation is S) and arbor shank types. If there is chatter, insert chipping, etc. during machining, alter conditions accordingly.

Note 2) Chattering vibration is more likely under the following circumstances. Use a cut and feed per tooth that are at minimum recommended conditions or below.
- When tool overhang is long (using a long shank, screw-in type, etc.)
- Rigidity of machine, workpiece material or attachment of workpiece material is low
- Corner radius during pocket milling

Note 3) A type with fewer teeth is recommended when the depth of cut in the radius direction (ae) is 0.5 DC or more.

Note 4) Wet cutting is recommended, when focusing on the surface finish. (Service life is shorter than for dry cutting.)

Note 5) When using under higher than recommended cutting conditions, or for long periods of time, the clamp screw may become fatigued and break during machining. Please change out the clamp screw periodically.

Cutting Conditions (Guide) :
● : Stable Cutting ◔ : General Cutting ✲ : Unstable Cutting

Depth of Cut / Feed per Tooth

(mm)

	Workpiece Material	Properties	ae	Cutting Conditions	DC			
					ø25		ø28—ø80	
					ap	fz (mm/t.)	ap	fz (mm/t.)
P	Mild Steels	Hardness ≤180HB	≤0.25DC	● ◔ ✲	≤11	0.10—0.20	≤11	0.10—0.30
			0.25—0.5DC	● ◔ ✲	≤11	0.10—0.15	≤11	0.10—0.25
			0.5—0.75DC	● ◔ ✲	≤8	0.08—0.12	≤8	0.10—0.20
			DC(Slot)	● ◔ ✲	≤5	0.06—0.10	≤5	0.08—0.15
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 180—280HB	≤0.25DC	● ◔ ✲	≤11	0.10—0.20	≤11	0.10—0.30
			0.25—0.5DC	● ◔ ✲	≤11	0.10—0.15	≤11	0.10—0.25
			0.5—0.75DC	● ◔ ✲	≤8	0.08—0.12	≤8	0.10—0.20
			DC(Slot)	● ◔ ✲	≤5	0.06—0.10	≤5	0.08—0.15
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280—350HB ≤350HB (Annealing)	≤0.25DC	● ◔ ✲	≤11	0.10—0.15	≤11	0.10—0.25
			0.25—0.5DC	● ◔ ✲	≤11	0.08—0.12	≤11	0.10—0.20
			0.5—0.75DC	● ◔ ✲	≤8	0.06—0.10	≤8	0.10—0.15
			DC(Slot)	● ◔ ✲	≤5	0.06—0.10	≤5	0.08—0.12
	Pre-hardened Steels	Hardness 35—45HRC	≤0.25DC	● ◔ ✲	≤11	0.10—0.15	≤11	0.10—0.25
			0.25—0.5DC	● ◔ ✲	≤11	0.08—0.12	≤11	0.10—0.20
			0.5—0.75DC	● ◔ ✲	≤8	0.06—0.10	≤8	0.10—0.15
			DC(Slot)	● ◔ ✲	≤5	0.06—0.10	≤5	0.08—0.12
M	Austenitic Stainless Steels	—	≤0.25DC	● ◔	≤11	0.10—0.20	≤11	0.10—0.20
				✲	≤11	0.08—0.15	≤11	0.08—0.15
			0.25—0.5DC	● ◔	≤11	0.08—0.12	≤11	0.08—0.15
				✲	≤11	0.06—0.10	≤11	0.08—0.12
			0.5—0.75DC	● ◔	≤8	0.06—0.10	≤8	0.08—0.12
				✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◔	≤5	0.06—0.10	≤5	0.06—0.10
				✲	≤5	0.06—0.08	≤5	0.06—0.08
	Duplex Stainless Steels	Hardness ≤280HB	≤0.25DC	● ◔	≤11	0.10—0.20	≤11	0.10—0.20
				✲	≤11	0.08—0.15	≤11	0.08—0.15
			0.25—0.5DC	● ◔	≤11	0.08—0.15	≤11	0.08—0.15
				✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◔	≤8	0.08—0.12	≤8	0.08—0.12
				✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◔	≤5	0.06—0.10	≤5	0.06—0.10
				✲	≤5	0.06—0.08	≤5	0.06—0.08
	Ferritic and Martensitic Stainless Steels	—	≤0.25DC	● ◔	≤11	0.10—0.20	≤11	0.10—0.20
				✲	≤11	0.08—0.15	≤11	0.08—0.15
			0.25—0.5DC	● ◔	≤11	0.08—0.15	≤11	0.08—0.15
				✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◔	≤8	0.08—0.12	≤8	0.08—0.12
				✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◔	≤5	0.06—0.10	≤5	0.06—0.10
				✲	≤5	0.06—0.08	≤5	0.06—0.08
	Precipitation Hardening Stainless Steels	Hardness <450HB	≤0.25DC	● ◔	≤11	0.10—0.15	≤11	0.10—0.15
				✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.25—0.5DC	● ◔	≤11	0.08—0.12	≤11	0.08—0.12
				✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◔	≤8	0.06—0.10	≤8	0.06—0.10
				✲	≤8	0.06—0.08	≤8	0.06—0.08
			DC(Slot)	● ◔	≤5	0.06—0.10	≤5	0.06—0.10
				✲	≤5	0.06—0.08	≤5	0.06—0.08

Note 1) These cutting conditions should be referenced for standard shank types (last letter in designation is S) and arbor shank types. If there is chatter, insert chipping, etc. during machining, alter conditions accordingly.
Note 2) Chattering vibration is more likely under the following circumstances. Use a cut and feed per tooth that are at minimum recommended conditions or below.
・When tool overhang is long (using a long shank, screw-in type, etc.)
・Rigidity of machine, workpiece material or attachment of workpiece material is low
・Corner radius during pocket milling
Note 3) A type with fewer teeth is recommended when the depth of cut in the radius direction (ae) is 0.5 DC or more.
Note 4) Wet cutting is recommended, when focusing on the surface finish. (Service life is shorter than for dry cutting.)
Note 5) When using under higher than recommended cutting conditions, or for long periods of time, the clamp screw may become fatigued and break during machining. Please change out the clamp screw periodically.

Recommended Cutting Conditions

■ Wet Cutting

Depth of Cut / Feed per Tooth

(mm)

	Workpiece Material	Properties	ae	Cutting Conditions	DC			
					ø25		ø28—ø80	
					ap	fz (mm/t.)	ap	fz (mm/t.)
K	Gray Cast Irons	Tensile Strength ≤350MPa	≤0.25DC	● ◐	≤11	0.10—0.20	≤11	0.10—0.30
				✲	≤11	0.08—0.15	≤11	0.10—0.25
			0.25—0.5DC	● ◐	≤11	0.08—0.15	≤11	0.10—0.25
				✲	≤11	0.08—0.12	≤11	0.10—0.20
			0.5—0.75DC	● ◐	≤8	0.08—0.12	≤8	0.10—0.20
				✲	≤8	0.06—0.10	≤8	0.08—0.15
			DC(Slot)	● ◐	≤5	0.06—0.10	≤5	0.08—0.15
				✲	≤5	0.06—0.08	≤5	0.08—0.12
	Ductile Cast Irons	Tensile Strength ≤800MPa	≤0.25DC	● ◐	≤11	0.10—0.20	≤11	0.10—0.25
				✲	≤11	0.10—0.15	≤11	0.10—0.20
			0.25—0.5DC	● ◐	≤11	0.10—0.15	≤11	0.10—0.20
				✲	≤11	0.08—0.12	≤11	0.10—0.15
			0.5—0.75DC	● ◐	≤8	0.08—0.12	≤8	0.10—0.15
				✲	≤8	0.06—0.10	≤8	0.08—0.12
			DC(Slot)	● ◐	≤5	0.06—0.10	≤5	0.08—0.12
				✲	≤5	0.06—0.08	≤5	0.06—0.10
N	Aluminium Alloys	Content Si＜5%	≤0.25DC	● ◐	≤11	0.10—0.25	≤11	0.10—0.25
				✲	≤11	0.10—0.20	≤11	0.10—0.20
			0.25—0.5DC	● ◐	≤11	0.10—0.20	≤11	0.10—0.20
				✲	≤11	0.10—0.15	≤11	0.10—0.15
			0.5—0.75DC	● ◐	≤8	0.06—0.15	≤8	0.08—0.15
				✲	≤8	0.06—0.15	≤8	0.08—0.15
			DC(Slot)	● ◐	≤5	0.06—0.15	≤5	0.08—0.15
				✲	≤5	0.06—0.15	≤5	0.08—0.12
S	Titanium Alloys (Ti-6Al-4V,etc.)	—	≤0.25DC	● ◐ ✲	≤11	0.08—0.15	≤11	0.08—0.15
			0.25—0.5DC	● ◐ ✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◐ ✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◐ ✲	≤5	0.06—0.10	≤5	0.06—0.10
	Titanium Alloys (Ti-5Al-5V-5Mo-3Cr,etc.)	—	≤0.25DC	● ◐ ✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.25—0.5DC	● ◐ ✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◐ ✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◐ ✲	≤5	0.06—0.10	≤5	0.06—0.10
	Heat Resistant Alloys	—	≤0.25DC	● ◐ ✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.25—0.5DC	● ◐ ✲	≤11	0.08—0.12	≤11	0.08—0.12
			0.5—0.75DC	● ◐ ✲	≤8	0.06—0.10	≤8	0.06—0.10
			DC(Slot)	● ◐ ✲	≤5	0.06—0.10	≤5	0.06—0.10
H	Hardened Steels	Hardness 40—55HRC	≤0.25DC	● ◐	≤5	0.08—0.15	≤5	0.08—0.15
				✲	≤5	0.08—0.12	≤5	0.08—0.12
			0.25—0.5DC	● ◐	≤4	0.08—0.12	≤4	0.08—0.12
				✲	≤4	0.06—0.10	≤4	0.06—0.10
			0.5—0.75DC	● ◐	≤3	0.06—0.10	≤3	0.06—0.10
				✲	≤3	0.06—0.10	≤3	0.06—0.08
			DC(Slot)	● ◐	≤2	0.06—0.10	≤2	0.06—0.10
				✲	≤2	0.06—0.10	≤2	0.06—0.08

Note 1) These cutting conditions should be referenced for standard shank types (last letter in designation is S) and arbor shank types. If there is chatter, insert chipping, etc. during machining, alter conditions accordingly.

Note 2) Chattering vibration is more likely under the following circumstances. Use a cut and feed per tooth that are at minimum recommended conditions or below.

- When tool overhang is long (using a long shank, screw-in type, etc.)
- Rigidity of machine, workpiece material or attachment of workpiece material is low
- Corner radius during pocket milling

Note 3) A type with fewer teeth is recommended when the depth of cut in the radius direction (ae) is 0.5 DC or more.

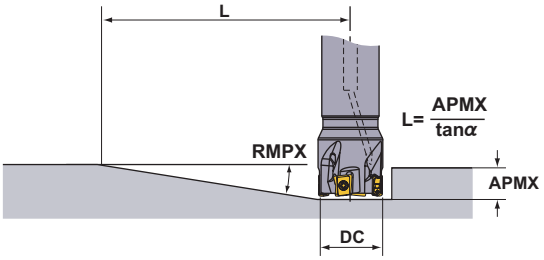
Note 4) Wet cutting is recommended, when focusing on the surface finish. (Service life is shorter than for dry cutting.)

Note 5) When using under higher than recommended cutting conditions, or for long periods of time, the clamp screw may become fatigued and break during machining. Please change out the clamp screw periodically.

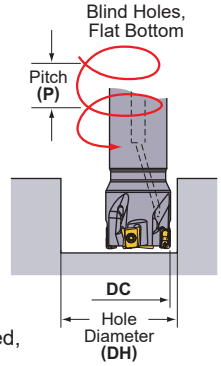
Recommended Cutting Conditions

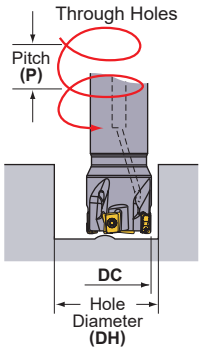
Ramping / Helical Milling

Ramping



Helical Milling





Refer to the table below for cutting conditions. For feed per tooth and cutting speed, follow the cutting conditions for slot milling.

(mm)

DC	RE	Ramping		Helical Milling (Blind Hole, Flat Bottom)				Helical Milling (Through Hole)	
		RMPX	L *	DH max.	P max.	DH min.	P max.	DH min.	P max.
25	0.2	2.13°	296	49.0	2.8	42.7	2.1	36.9	1.4
	0.4	2.13°	296	48.6	2.8	42.7	2.1	36.9	1.4
	0.8	2.13°	296	47.8	2.7	42.7	2.1	36.9	1.4
	1.0	2.13°	296	47.4	2.6	42.7	2.1	36.9	1.4
	1.2	2.13°	296	47.0	2.6	42.7	2.1	36.9	1.4
	1.6	2.13°	296	46.2	2.5	42.7	2.1	36.9	1.4
	2.0	2.13°	296	45.4	2.4	42.7	2.1	36.9	1.4
	2.4	2.13°	296	44.6	2.3	42.7	2.1	36.9	1.4
	3.0	2.13°	296	43.4	2.2	42.7	2.1	36.9	1.4
	3.2	2.13°	296	43.0	2.1	42.7	2.1	36.9	1.4
28	0.2	1.77°	356	55.0	2.6	48.7	2.0	42.7	1.4
	0.4	1.77°	356	54.6	2.6	48.7	2.0	42.7	1.4
	0.8	1.77°	356	53.8	2.5	48.7	2.0	42.7	1.4
	1.0	1.77°	356	53.4	2.5	48.7	2.0	42.7	1.4
	1.2	1.77°	356	53.0	2.4	48.7	2.0	42.7	1.4
	1.6	1.77°	356	52.2	2.4	48.7	2.0	42.7	1.4
	2.0	1.77°	356	51.4	2.3	48.7	2.0	42.7	1.4
	2.4	1.77°	356	50.6	2.2	48.7	2.0	42.7	1.4
	3.0	1.77°	356	49.4	2.1	48.7	2.0	42.7	1.4
	3.2	1.77°	356	49.0	2.0	48.7	2.0	42.7	1.4
30	0.2	1.61°	392	59.0	2.6	52.7	2.0	46.6	1.5
	0.4	1.61°	392	58.6	2.5	52.7	2.0	46.6	1.5
	0.8	1.61°	392	57.8	2.5	52.7	2.0	46.6	1.5
	1.0	1.61°	392	57.4	2.4	52.7	2.0	46.6	1.5
	1.2	1.61°	392	57.0	2.4	52.7	2.0	46.6	1.5
	1.6	1.61°	392	56.2	2.3	52.7	2.0	46.6	1.5
	2.0	1.61°	392	55.4	2.2	52.7	2.0	46.6	1.5
	2.4	1.61°	392	54.6	2.2	52.7	2.0	46.6	1.5
	3.0	1.61°	392	53.4	2.1	52.7	2.0	46.6	1.5
	3.2	1.61°	392	53.0	2.0	52.7	2.0	46.6	1.5
32	0.2	1.47°	429	63.0	2.5	56.7	2.0	50.6	1.5
	0.4	1.47°	429	62.6	2.5	56.7	2.0	50.6	1.5
	0.8	1.47°	429	61.8	2.4	56.7	2.0	50.6	1.5
	1.0	1.47°	429	61.4	2.4	56.7	2.0	50.6	1.5
	1.2	1.47°	429	61.0	2.3	56.7	2.0	50.6	1.5
	1.6	1.47°	429	60.2	2.3	56.7	2.0	50.6	1.5
	2.0	1.47°	429	59.4	2.2	56.7	2.0	50.6	1.5
	2.4	1.47°	429	58.6	2.1	56.7	2.0	50.6	1.5
	3.0	1.47°	429	57.4	2.1	56.7	2.0	50.6	1.5
	3.2	1.47°	429	57.0	2.0	56.7	2.0	50.6	1.5

(mm)

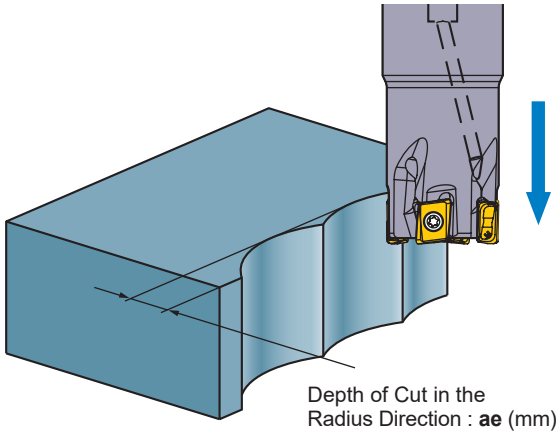
DC	RE	Ramping		Helical Milling (Blind Hole, Flat Bottom)				Helical Milling (Through Hole)	
		RMPX	L *	DH max.	P max.	DH min.	P max.	DH min.	P max.
35	0.2	1.28°	493	69.0	2.4	62.8	1.9	56.6	1.5
	0.4	1.28°	493	68.6	2.4	62.8	1.9	56.6	1.5
	0.8	1.28°	493	67.8	2.3	62.8	1.9	56.6	1.5
	1.0	1.28°	493	67.4	2.3	62.8	1.9	56.6	1.5
	1.2	1.28°	493	67.0	2.2	62.8	1.9	56.6	1.5
	1.6	1.28°	493	66.2	2.2	62.8	1.9	56.6	1.5
	2.0	1.28°	493	65.4	2.1	62.8	1.9	56.6	1.5
	2.4	1.28°	493	64.6	2.1	62.8	1.9	56.6	1.5
	3.0	1.28°	493	63.4	2.0	62.8	1.9	56.6	1.5
	3.2	1.28°	493	63.0	2.0	62.8	1.9	56.6	1.5
40	0.2	1.06°	595	78.8	2.3	72.7	1.9	66.5	1.5
	0.4	1.06°	595	78.4	2.2	72.7	1.9	66.5	1.5
	0.8	1.06°	595	77.6	2.2	72.7	1.9	66.5	1.5
	1.0	1.06°	595	77.2	2.2	72.7	1.9	66.5	1.5
	1.2	1.06°	595	76.8	2.1	72.7	1.9	66.5	1.5
	1.6	1.06°	595	76.0	2.1	72.7	1.9	66.5	1.5
	2.0	1.06°	595	75.2	2.0	72.7	1.9	66.5	1.5
	2.4	1.06°	595	74.4	2.0	72.7	1.9	66.5	1.5
	3.0	1.06°	595	73.2	1.9	72.7	1.9	66.5	1.5
	3.2	1.06°	595	72.8	1.9	72.7	1.9	66.5	1.5
50	0.2	0.79°	798	98.8	2.1	92.7	1.8	86.5	1.6
	0.4	0.79°	798	98.4	2.1	92.7	1.8	86.5	1.6
	0.8	0.79°	798	97.6	2.1	92.7	1.8	86.5	1.6
	1.0	0.79°	798	97.2	2.0	92.7	1.8	86.5	1.6
	1.2	0.79°	798	96.8	2.0	92.7	1.8	86.5	1.6
	1.6	0.79°	798	96.0	2.0	92.7	1.8	86.5	1.6
	2.0	0.79°	798	95.2	2.0	92.7	1.8	86.5	1.6
	2.4	0.79°	798	94.4	1.9	92.7	1.8	86.5	1.6
	3.0	0.79°	798	93.2	1.9	92.7	1.8	86.5	1.6
	3.2	0.79°	798	92.8	1.9	92.7	1.8	86.5	1.6
63	0.2	0.6°	1051	124.8	2.0	118.7	1.8	112.5	1.6
	0.4	0.6°	1051	124.4	2.0	118.7	1.8	112.5	1.6
	0.8	0.6°	1051	123.6	2.0	118.7	1.8	112.5	1.6
	1.0	0.6°	1051	123.2	2.0	118.7	1.8	112.5	1.6
	1.2	0.6°	1051	122.8	2.0	118.7	1.8	112.5	1.6
	1.6	0.6°	1051	122.0	1.9	118.7	1.8	112.5	1.6
	2.0	0.6°	1051	121.2	1.9	118.7	1.8	112.5	1.6
	2.4	0.6°	1051	120.4	1.9	118.7	1.8	112.5	1.6
	3.0	0.6°	1051	119.2	1.9	118.7	1.8	112.5	1.6
	3.2	0.6°	1051	118.8	1.8	118.7	1.8	112.5	1.6
80	0.2	0.45°	1401	158.8	1.9	152.6	1.8	146.5	1.6
	0.4	0.45°	1401	158.4	1.9	152.7	1.8	146.5	1.6
	0.8	0.45°	1401	157.6	1.9	152.7	1.8	146.5	1.6
	1.0	0.45°	1401	157.2	1.9	152.7	1.8	146.5	1.6
	1.2	0.45°	1401	156.8	1.9	152.7	1.8	146.5	1.6
	1.6	0.45°	1401	156.0	1.9	152.7	1.8	146.5	1.6
	2.0	0.45°	1401	155.2	1.9	152.7	1.8	146.5	1.6
	2.4	0.45	1401	154.4	1.8	152.7	1.8	146.5	1.6
	3.0	0.45	1401	153.2	1.8	152.7	1.8	146.5	1.6
	3.2	0.45	1401	152.8	1.8	152.7	1.8	146.5	1.6

Note 1) When machining a highly ductile workpiece material with the ramping angles in the table above, chips may be elongated.
* Shows the distance until a maximum depth of cut of 11 mm is achieved at the maximum ramping angle L (= 11/tan α).

For Plunging and Drilling

See the tables to the right for cutting conditions. Follow the cutting conditions for slot milling regarding feed per tooth and cutting speed.

● Plunging



VPX200 (mm)

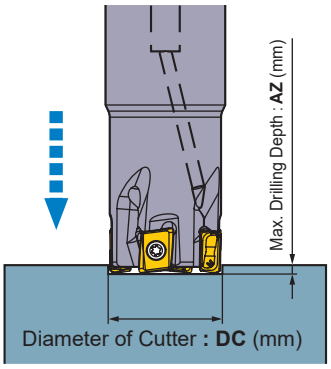
DC	ae max.
16	3.9
18	3.9
20	3.9
22	4.0
25	4.0
28	4.0
30	4.0
32	4.0
35	4.0
40	4.0
50	4.0
63	4.0

VPX300 (mm)

DC	ae max.
25	6.5
28	6.6
30	6.6
32	6.6
35	6.7
40	6.7
50	6.7
63	6.7
80	6.7

Note1) No step feed necessary.

● Drilling



VPX200 (mm)

DC	AZ max.
16	0.3
18	0.3
20	0.3
22	0.3
25	0.3
28	0.3
30	0.3
32	0.3
35	0.3
40	0.3
50	0.3
63	0.3

VPX300 (mm)

DC	AZ max.
25	0.55
28	0.55
30	0.55
32	0.55
35	0.55
40	0.55
50	0.55
63	0.55
80	0.55

Note 1) Exercise due caution as chips scatter easily.
Note 2) Use compressed air to eliminate chips (or coolant for when machining aluminium alloy).