

RECOMMENDED CUTTING CONDITIONS

CUTTING SPEED

Work Material	Hardness	Insert		Breaker	Cutting Width a_e (mm)			
		Grade			$\leq 0.25D_1$	0.25–0.5D ₁	0.5–0.75D ₁	D ₁ (Slot)
		1st Recommendation	2nd Recommendation					
Cutting Speed v_c (m/min)								
P Mild Steel	<180HB	MP6120	VP15TF	M H	230(180–270)	220(170–260)	180(140–210)	180(140–210)
		MP6130	VP20RT	M H	200(150–240)	190(140–230)	150(110–180)	150(110–180)
Carbon Steel Alloy Steel	180–350HB	MP6120	VP15TF	M H	180(140–210)	170(130–200)	140(110–160)	140(110–160)
		MP6130	VP20RT	M H	150(110–180)	140(100–170)	110(80–130)	110(80–130)
M Stainless Steel	<270HB	MP7130	VP15TF	M H	180(140–210)	170(130–200)	140(110–160)	140(110–160)
K Gray Cast Iron	<350MPa	MC5020		H	250(200–300)	240(190–290)	210(160–260)	140(110–160)
	Ductile, Cast Iron <800MPa	MC5020		H	130(100–150)	120(90–140)	100(80–120)	100(80–120)
N Aluminium Alloy	–	TF15		GM	500(200–1000)	500(200–1000)	500(200–1000)	500(200–1000)
S Titanium Alloy	<350HB	MP9120	VP15TF	M H	50(40–70)			50(40–70)
		MP9130	VP20RT	M H	40(30–60)			40(30–60)
Heat-resistant Alloy	–	MP9120	VP15TF	M H	40(30–60)			40(30–60)
		MP9130	VP20RT	M H	30(20–40)			30(20–40)
H Hardened Steel	40–55HRC	VP15TF		H	90(70–100)	85(60–100)	70(50–80)	70(50–80)

DEPTH OF CUT / FEED PER TOOTH

Work Material	Hardness	Cutting Width a_e (mm)	Cutter Diameter (mm)					
			$\phi 12-\phi 16$		$\phi 18-\phi 25$		$\phi 28-\phi 100$	
			Depth of Cut a_p (mm)	Feed per Tooth f_z (mm/tooth)	Depth of Cut a_p (mm)	Feed per Tooth f_z (mm/tooth)	Depth of Cut a_p (mm)	Feed per Tooth f_z (mm/tooth)
P Mild Steel Carbon Steel Alloy Steel	$\leq 180HB$ 180–350HB	$\leq 0.25D_1$	<4	0.15	<5	0.25	<5	0.20
			4–7	0.10	5–7	0.20	5–7	0.15
					7–8.5	0.15	7–8.5	0.10
					8.5–10	0.10	8.5–10	0.07
		0.25–0.5D ₁	<2	0.15	<3	0.25	<3	0.20
			2–5	0.10	3–5.5	0.20	3–5.5	0.15
					5.5–8	0.15	5.5–8	0.10
					8–10	0.10	8–10	0.07
		0.5–0.75D ₁	<4	0.10	<4	0.15	<3	0.10
					4–10	0.10	3–7	0.07
		D ₁ (Slot)	<3	0.10	<4	0.10	<3	0.10
					4–7	0.07	3–5	0.07
M Stainless Steel	$\leq 270HB$	$\leq 0.25D_1$	<4	0.15	<5	0.20	<5	0.20
			4–7	0.10	5–7	0.15	5–7	0.15
					7–8.5	0.10	7–8.5	0.10
					8.5–10	0.07	8.5–10	0.07
		0.25–0.5D ₁	<2	0.15	<3	0.20	<3	0.20
			2–5	0.10	3–5.5	0.15	3–5.5	0.15
					5.5–8	0.10	5.5–8	0.10
					8–10	0.07	8–10	0.07
		0.5–0.75D ₁	<4	0.10	<4	0.10	<3	0.10
					4–10	0.07	3–7	0.07
		D ₁ (Slot)	<3	0.10	<4	0.10	<3	0.10
					4–7	0.07	3–5	0.07
K Gray Cast Iron	Tensile Strength $\leq 350MPa$	$\leq 0.25D_1$	<4	0.15	<5	0.25	<5	0.20
			4–7	0.10	5–7	0.20	5–7	0.15
					7–8.5	0.15	7–8.5	0.10
					8.5–10	0.10	8.5–10	0.07
		0.25–0.5D ₁	<2	0.15	<3	0.25	<3	0.20
			2–5	0.10	3–5.5	0.20	3–5.5	0.15
					5.5–8	0.15	5.5–8	0.10
					8–10	0.10	8–10	0.07
		0.5–0.75D ₁	<4	0.10	<4	0.15	<3	0.10
					4–10	0.10	3–7	0.07
		D ₁ (Slot)	<3	0.10	<4	0.10	<3	0.10
					4–7	0.07	3–5	0.07
Ductile, Cast Iron	Tensile Strength $\leq 800MPa$	$\leq 0.25D_1$	<4	0.10	<5	0.20	<5	0.20
			4–7	0.07	5–7	0.15	5–7	0.15
					7–8.5	0.10	7–8.5	0.10
					8.5–10	0.07	8.5–10	0.07
		0.25–0.5D ₁	<2	0.10	<3	0.20	<3	0.20
			2–5	0.07	3–5.5	0.15	3–5.5	0.15
					5.5–8	0.10	5.5–8	0.10
					8–10	0.07	8–10	0.07
		0.5–0.75D ₁	<4	0.07	<4	0.10	<3	0.10
					4–10	0.07	3–7	0.07
		D ₁ (Slot)	<3	0.07	<4	0.10	<3	0.10
					4–7	0.07	3–5	0.07

Work Material	Hardness	Cutting Width ae (mm)	Cutter Diameter (mm)					
			ø12-ø16		ø18-ø25		ø28-ø100	
			Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)
N Aluminium Alloy	-	≤ 0.25D ₁	<4	0.15	<4	0.25	<4	0.20
			4-7	0.10	4-7	0.15	4-7	0.10
		0.25-0.5D ₁	<4	0.15	<4	0.20	<4	0.20
			4-7	0.10	4-7	0.10	4-7	0.10
S Titanium Alloy	≤ 350HB	≤ 0.25D ₁	<4	0.15	<4	0.15	<4	0.10
			4-7	0.10	4-7	0.10	4-7	0.07
		0.25-0.5D ₁	<3	0.05	<3	0.05	<3	0.05
			4-7	0.10	4-7	0.10	4-7	0.10
Heat-resistant Alloy	-	0.5-0.75D ₁	<2	0.10	<2	0.05	<2	0.05
			4-7	0.10	4-7	0.10	4-7	0.10
		D ₁ (Slot)	<1	0.05	<1	0.05	<1	0.05
			4-7	0.10	4-7	0.10	4-7	0.10
H Hardened Steel	40-55HRC	≤ 0.25D ₁	<4	0.10	<5	0.15	<5	0.15
			4-7	0.07	5-7	0.10	5-7	0.10
		0.25-0.5D ₁	<2	0.10	<3	0.15	<3	0.15
			2-5	0.07	3-5.5	0.10	<3	0.15
		0.5-0.75D ₁	<4	0.07	<4	0.07	<3	0.07
			4-7	0.07	<4	0.07	<3	0.07
		D ₁ (Slot)	<3	0.07	<4	0.07	<3	0.07
			4-7	0.07	<4	0.07	<3	0.07

(Note 1) These cutting conditions are a guide to the standard shank type and the arbor type.

Please make adjustments according to the machining conditions.

(Note 2) Vibration is liable to occur in certain cases. Please reduce the depth of cut and / or reduce cutting conditions in the following cases.

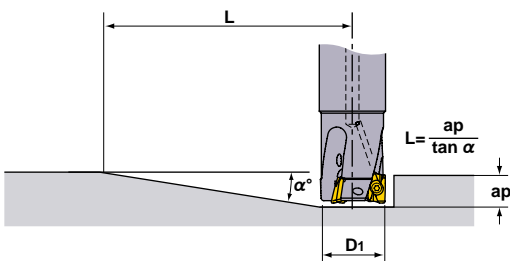
- When using the long shank type and extra long shank type.
- When using long tool overhang with the standard or arbor type.
- When the application has poor clamping rigidity or when using a low rigidity machine.

(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.

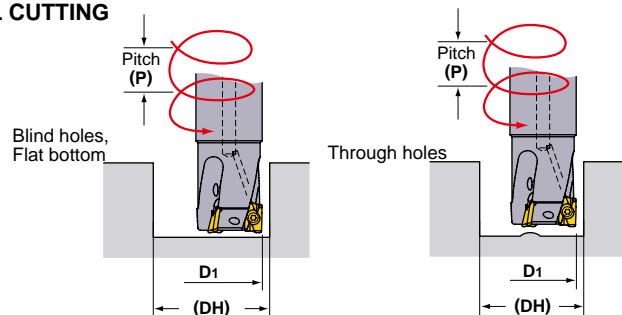
(Note 4) For heavy interrupted and unstable cutting, the H breaker is first recommendation.

RAMPING/HELICAL CUTTING

RAMPING



HELICAL CUTTING



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

Cutting Edge Diameter D ₁ (mm)	Ramping		Helical Cutting (Blind Hole, Flat Bottom)				Helical Cutting (Through Hole)	
	Maximum Ramping Angle α°	Minimum Distance*1 L(mm)	Maximum Hole Diameter*2 DH max.(mm)	Maximum Pitch P max.(mm)	Minimum Hole Diameter DH min.(mm)	Maximum Pitch P max.(mm)	Minimum Hole Diameter DH min.(mm)	Maximum Pitch P max.(mm)
12	6.0	95	22	2.5	20.5	2	14	0.5
14	6.0	95	26	2.5	24.5	2	18	1
16	11.3	50	30	9	28	7	21	2
18	8.6	66	34	5	32	4.5	25	2
20	6.9	83	38	5	36	4.5	29	2
22	5.7	100	42	5	40	4.5	33	2
25	4.6	124	48	6	46	5	39	3
28	3.8	151	54	4.5	52	4	45	2
30	3.4	168	58	4.5	56	4	49	2
32	3.1	185	62	4.5	60	4	53	2
35	2.7	212	68	4	66	3.5	59	2
40	2.2	260	78	4	76	3.5	69	2
50	1.7	337	98	2	96	2	89	2
63	1.3	441	124	2	122	2	115	2
80	1.0	573	158	2	156	2	149	2
100	0.8	716	198	1	196	1	189	1

(Note) When machining highly ductile materials with ramping angles above, chips could be continuous.

In this case, decrease the ramping angle or feed per tooth.

*1 L (=10 / tan α). Cutters' moving distance until depth of cut reaches 10mm at a maximum ramping angle.

*2 In case corner radius of 0.8mm. Other than that, find with the below formula.

$$\{(cutting\ edge\ diameter\ D_1) - (corner\ radius) - 0.2\} \times 2$$