RECOMMENDED CUTTING CONDITIONS

CUTTING SPEED

	Work Material	Hardness	Insert Grade 1st Recommenedation	Insert Grade 2nd Recommenedation	Breaker		Cutting Width **ae** (mm) ≤0.25D1	0.25—0.5D1	0.5—0.75D1	D1 (Slot)
							Cutting Speed **vc** (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	VP20RT	M	H	180(140—210)	170(130—200)	140(110—160)	140(110—160)
K	Gray Cast Iron	≤350MPa	MC5020	VP15TF	H		250(200—300)	240(190—290)	210(160—260)	140(110—160)
	Ductile, Cast Iron	≤800MPa	MC5020	VP15TF	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 **ae** (mm)	Cutter Diameter (mm) ø12—ø16 Depth of Cut **ap** (mm)	ø12—ø16 Feed per Tooth **fz** (mm/tooth)	ø18—ø25 Depth of Cut **ap** (mm)	ø18—ø25 Feed per Tooth **fz** (mm/tooth)	ø28—ø100 Depth of Cut **ap** (mm)	ø28—ø100 Feed per Tooth **fz** (mm/tooth)
P	Mild Steel Carbon Steel Alloy Steel	≤180HB 180—350HB	≤0.25D1	≤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—0.5D1	≤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—0.75D1	≤4	0.10	≤4	0.15	≤3	0.10
						4—10	0.10	3—7	0.07
			D1 (Slot)	≤3	0.10	≤4	0.10	≤3	0.10
						4—7	0.07	3—5	0.07
M	Stainless Steel	≤270HB	≤0.25D1	≤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—0.5D1	≤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—0.75D1	≤4	0.10	≤4	0.10	≤3	0.10
						4—10	0.07	3—7	0.07
			D1 (Slot)	≤3	0.10	≤4	0.10	≤3	0.10
						4—7	0.07	3—5	0.07
K	Gray Cast Iron	Tensile Strength ≤350MPa	≤0.25D1	≤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—0.5D1	≤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—0.75D1	≤4	0.10	≤4	0.15	≤3	0.10
						4—10	0.10	3—7	0.07
			D1 (Slot)	≤3	0.10	≤4	0.10	≤3	0.10
						4—7	0.07	3—5	0.07
	Ductile, Cast Iron	Tensile Strength ≤800MPa	≤0.25D1	≤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—0.5D1	≤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—0.75D1	≤4	0.07	≤4	0.10	≤3	0.10
						4—10	0.07	3—7	0.07
			D1 (Slot)	≤3	0.07	≤4	0.10	≤3	0.10
						4—7	0.07	3—5	0.07

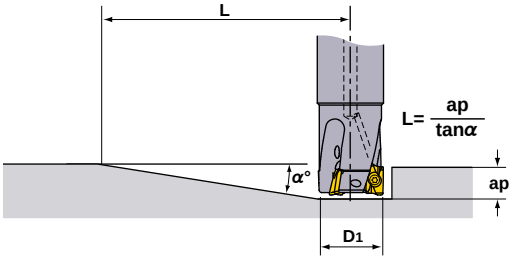
	Work Material	Hardness	Cutting Width **ae** (mm)	Cutter Diameter (mm)					
				ø12—ø16		**ø18—ø25**		**ø28—ø100**	
				Depth of Cut **ap** (mm)	Feed per Tooth **fz** (mm/tooth)	Depth of Cut **ap** (mm)	Feed per Tooth **fz** (mm/tooth)	Depth of Cut **ap** (mm)	Feed per Tooth **fz** (mm/tooth)
N	Aluminium Alloy	—	≤0.25D1	≤4	0.15	≤4	0.25	≤4	0.20
				4—7	0.10	4—7	0.15	4—7	0.10
			0.25—0.5D1	≤4	0.15	≤4	0.20	≤4	0.20
				4—7	0.10	4—7	0.10	4—7	0.10
			0.5—0.75D1	≤5	0.10	≤5	0.15	≤5	0.10
			D1 (Slot)	≤5	0.10	≤5	0.20	≤5	0.15
S	Titanium Alloy	≤350HB	≤0.25D1	≤4	0.15	≤4	0.15	≤4	0.10
				4—7	0.10	4—7	0.10	4—7	0.07
			0.25—0.5D1	≤3	0.05	≤3	0.05	≤3	0.05
	Heat-resistant Alloy	—	0.5—0.75D1	≤2	0.10	≤2	0.05	≤2	0.05
			D1 (Slot)	≤1	0.05	≤1	0.05	≤1	0.05
H	Hardened Steel	40—55HRC	≤0.25D1	≤4	0.10	≤5	0.15	≤5	0.15
				4—7	0.07	5—7	0.10	5—7	0.10
						7—8.5	0.07		
			0.25—0.5D1	≤2	0.10	≤3	0.15	≤3	0.15
				2—5	0.07	3—5.5	0.10		
			0.5—0.75D1	≤4	0.07	≤4	0.07	≤3	0.07
			D1 (Slot)	≤3	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.

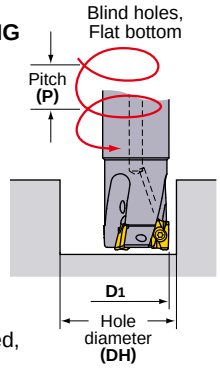
(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.
(Note 4) For heavy interrupted and unstable cutting, the H breaker is first recommendation.

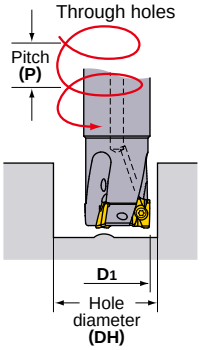
RAMPING/HELICAL CUTTING

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 **D1**(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 D1)—(corner radius)—0.2)}×2