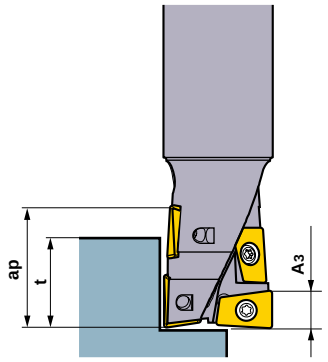
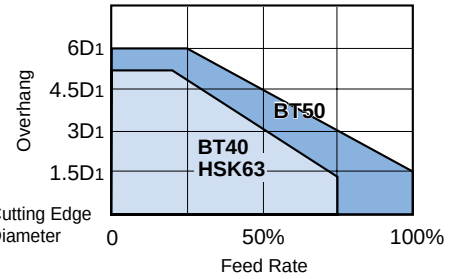
RECOMMENDED CUTTING CONDITIONS



∗Figures for A3 and ap are shown in the table of holder standard.

- A3 is the depth of cut for the full dual insert portion at the end of the cutting edge.
- Beyond the range of A3 where overlapping occurs, there is an area where the cutting edge becomes a single insert, not forming full dual insert configuration. As such, please pay special attention to the relationship between depth of cut and feed.
- In general, the edge at the border of cut tends to suffer from damages. At large depth of cut operations, applying the following depth of cut (t), at which the edge is full dual insert at the border of cut, is recommended to prevent damage to the cutting edge.

Tool diameter	Recommended depth of cut t (mm)
ϕ16,17	12 — 14
ϕ20,21	14 — 17
ϕ25,26	17 — 22
ϕ32,33	22 — 28
ϕ35	25 — 32
ϕ40	28 — 35
ϕ50	35 — 45



∗D1=Cutting Edge Diameter

- Chatter vibration and other problems tend to occur at operations where overhang length is large and/or machine rigidity is low, resulting in unstable machining.
- Please reduce feed accordingly, using the above chart as a guideline.

CUTTING CONDITIONS FOR SHOULDER MILLING

	Work Material	Hardness	Grade	Cutting Speed (m/min)	ϕ16, ϕ17			ϕ20, ϕ21		
					Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)
P	Mild Steel	≤180HB	**VP15TF**	180 (150—220)	—4.5	—8	0.25	—6	—10	0.30
					4.5—12	—5	0.16	6—14	—7	0.25
					12—17	—3	0.10	14—22	—4	0.18
	Carbon Steel Alloy Steel	180—350HB	**VP15TF**	160 (120—200)	—4.5	—8	0.20	—6	—10	0.25
					4.5—12	—4	0.14	6—14	—6	0.20
					12—17	—2	0.08	14—22	—3	0.16
M	Stainless Steel	≤270HB	**VP30RT (VP15TF)**	150 (120—180)	—4.5	—8	0.20	—6	—10	0.25
					4.5—12	—4	0.14	6—14	—6	0.20
					12—17	—2	0.08	14—22	—3	0.16
K	Cast Iron	Tensile Strength ≤450MPa	**VP15TF**	180 (150—220)	—4.5	—8	0.25	—6	—10	0.30
					4.5—12	—5	0.16	6—14	—7	0.25
					12—17	—3	0.10	14—22	—4	0.18
N	Aluminium Alloy	—	**HTi10** (G1 Breaker)	500 (200—800)	—4.5	—11	0.30	—6	—14	0.35
					4.5—12	—8	0.21	6—14	—10	0.30
					12—17	—5	0.15	14—22	—6	0.23
H	Hardened Steel	45—55HRC	**VP15TF**	80 (50—120)	—4.5	—5	0.16	—6	—6	0.20
					4.5—12	—3	0.10	6—14	—4	0.16
					12—17	—1	0.06	14—22	—2	0.12

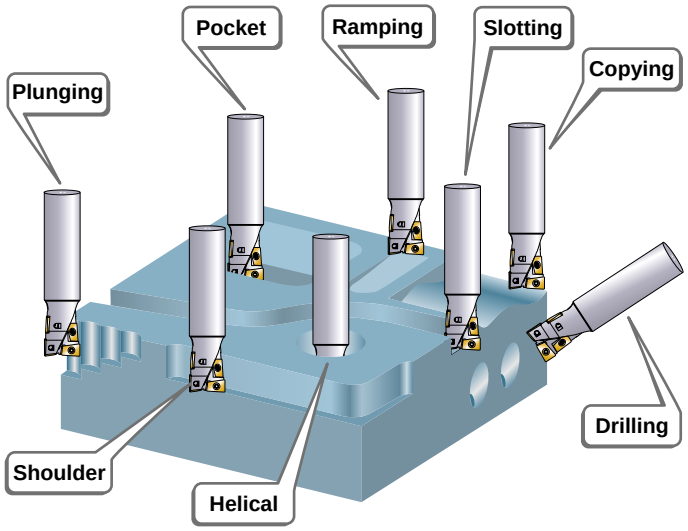
(Note 1) Please pay special attention on the depth of cut when using the short edge type.
(Note 2) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.

CUTTING CONDITIONS FOR SLOTTING

	Work Material	Hardness	Grade	Cutting Speed (m/min)	ϕ16, ϕ17		ϕ20, ϕ21	
					Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)
P	Mild Steel	≤180HB	**VP15TF**	180 (150—220)	—4.5	0.16	—6	0.18
					4.5—12	0.10	6—14	0.14
					12—17	0.07	14—22	0.10
	Carbon Steel Alloy Steel	180—350HB	**VP15TF**	160 (120—200)	—4.5	0.14	—6	0.16
					4.5—12	0.09	6—14	0.12
					12—17	0.05	14—22	0.10
M	Stainless Steel	≤270HB	**VP30RT (VP15TF)**	150 (120—180)	—4.5	0.14	—6	0.16
					4.5—12	0.09	6—14	0.12
					12—17	0.05	14—22	0.10
K	Cast Iron	Tensile Strength ≤450MPa	**VP15TF**	180 (150—220)	—4.5	0.16	—6	0.18
					4.5—12	0.10	6—14	0.14
					12—17	0.07	14—22	0.10
N	Aluminium Alloy	—	**HTi10** (G1 Breaker)	500 (200—800)	—4.5	0.18	—6	0.20
					4.5—12	0.12	6—14	0.16
					12—17	0.09	14—22	0.12
H	Hardened Steel	45—55HRC	**VP15TF**	80 (50—120)	—4.5	0.10	—6	0.12
					4.5—12	0.07	6—14	0.10

(Note 1) Please pay special attention on the depth of cut when using the short edge type.
(Note 2) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.

CUTTING MODES

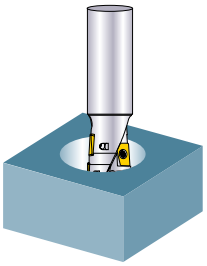


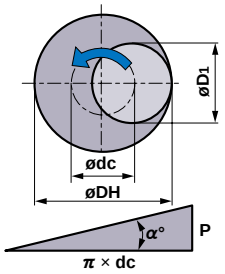
ϕ25, ϕ26			ϕ32, ϕ33			ϕ35			ϕ40			ϕ50		
Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)
−7.5	−12.5	0.35	−9.5	−16	0.40	−11	−17.5	0.45	−12	−20	0.50	−15	−25	0.60
7.5−17	−8	0.28	9.5−22	−11	0.32	11−25	−12	0.35	12−28	−13	0.40	15−35	−16	0.50
17−27	−5	0.20	22−35	−6	0.25	25−40	−6.5	0.28	28−44	−7	0.30	35−55	−10	0.35
−7.5	−12.5	0.30	−9.5	−16	0.35	−11	−17.5	0.37	−12	−20	0.40	−15	−25	0.50
7.5−17	−7	0.25	9.5−22	−10	0.28	11−25	−11	0.30	12−28	−12	0.32	15−35	−14	0.40
17−27	−4	0.18	22−35	−5	0.20	25−40	−5.5	0.22	28−44	−6	0.25	35−55	−8	0.30
−7.5	−12.5	0.30	−9.5	−16	0.35	−11	−17.5	0.37	−12	−20	0.40	−15	−25	0.50
7.5−17	−7	0.25	9.5−22	−10	0.28	11−25	−12	0.30	12−28	−12	0.32	15−35	−14	0.40
17−27	−4	0.18	22−35	−5	0.20	25−40	−6.5	0.22	28−44	−6	0.25	35−55	−8	0.30
−7.5	−12.5	0.35	−9.5	−16	0.40	−11	−17.5	0.45	−12	−20	0.50	−15	−25	0.60
7.5−17	−8	0.28	9.5−22	−11	0.32	11−25	−12	0.35	12−28	−13	0.40	15−35	−16	0.50
17−27	−5	0.20	22−35	−6	0.25	25−40	−6.5	0.28	28−44	−7	0.30	35−55	−10	0.35
−7.5	−17.5	0.40	−9.5	−23	0.45	−11	−24.5	0.50	−12	−28	0.55	−15	−35	0.65
7.5−17	−12.5	0.33	9.5−22	−16	0.37	11−25	−17.5	0.40	12−28	−20	0.45	15−35	−25	0.55
17−27	−7.5	0.25	22−35	−10	0.30	25−40	−10.5	0.32	28−44	−12	0.35	35−55	−15	0.40
−7.5	−7	0.22	−9.5	−8	0.25	−11	−9	0.28	−12	−10	0.30	−15	−14	0.35
7.5−17	−4	0.18	9.5−22	−5	0.20	11−25	−5.5	0.22	12−28	−6	0.24	15−35	−8	0.30
17−27	−2	0.14	22−35	−2	0.16	25−40	−2	0.17	28−44	−2	0.18	35−55	−4	0.22

ϕ25, ϕ26		ϕ32, ϕ33		ϕ35		ϕ40		ϕ50	
Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)
−7.5	0.20	−9.5	0.25	−11	0.27	−12	0.30	−15	0.35
7.5−17	0.16	9.5−22	0.20	11−25	0.22	12−28	0.25	15−35	0.30
17−27	0.12	22−35	0.14	25−40	0.16	28−44	0.18	35−55	0.22
−7.5	0.18	−9.5	0.20	−11	0.22	−12	0.25	−15	0.30
7.5−17	0.14	9.5−22	0.16	11−25	0.18	12−28	0.20	15−35	0.25
17−27	0.10	22−35	0.12	25−40	0.13	28−44	0.14	35−55	0.16
−7.5	0.18	−9.5	0.20	−11	0.22	−12	0.25	−15	0.30
7.5−17	0.14	9.5−22	0.16	11−25	0.18	12−28	0.20	15−35	0.25
17−27	0.10	22−35	0.12	25−40	0.13	28−44	0.14	35−55	0.16
−7.5	0.20	−9.5	0.25	−11	0.27	−12	0.30	−15	0.35
7.5−17	0.16	9.5−22	0.20	11−25	0.22	12−28	0.25	15−35	0.30
17−27	0.12	22−35	0.14	25−40	0.16	28−44	0.18	35−55	0.22
−7.5	0.22	−9.5	0.27	−11	0.30	−12	0.32	−15	0.37
7.5−17	0.18	9.5−22	0.22	11−25	0.25	12−28	0.27	15−35	0.32
17−27	0.14	22−35	0.16	25−40	0.18	28−44	0.20	35−55	0.25
−7.5	0.14	−9.5	0.16	−11	0.17	−12	0.18	−15	0.22
7.5−17	0.12	9.5−22	0.12	11−25	0.13	12−28	0.14	15−35	0.16

RECOMMENDED CUTTING CONDITIONS

FOR HELICAL CUTTING





● How to derive a locus of the centre of the tool.

$$Ø\,dc = Ø\,DH - Ø\,D_1$$

Locus of the centre of the tool / Desired hole diameter / Cutting edge diameter

● Depth of cut per pass.

$$P = \pi \times dc \times \tan \alpha°$$

$*\alpha° \leq 3°$

● Min. machined hole diameter for helical cutting : $1.2D_1$
Max. machined hole diameter for helical cutting : $1.8D_1$

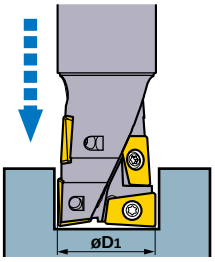
● For chip discharge, please always apply air blow.
(When aluminium cutting, please use coolant.)

● When using G1 breaker (VP15TF), please reduce the feed rate by 20%.

Work Material		Hardness	Grade	Cutting Speed (m/min)	ϕ16, ϕ17				ϕ20, ϕ21				ϕ25, ϕ26			
					Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)
P	Mild Steel	≤180HB	**VP15TF**	180 (150−220)	20	8	0.16	0.44	24	10	0.18	0.44	30	12.5	0.20	0.55
					25	12	0.14	0.99	30	15	0.16	1.10	38	19	0.18	1.43
					29	16	0.12	1.43	36	20	0.14	1.76	45	25	0.16	2.20
	Carbon Steel Alloy Steel	180−350HB	**VP15TF**	160 (120−200)	20	8	0.14	0.33	24	10	0.16	0.33	30	12.5	0.18	0.41
					25	12	0.12	0.74	30	15	0.14	0.82	38	19	0.16	1.07
					29	16	0.10	1.07	36	20	0.12	1.32	45	25	0.14	1.65
M	Stainless Steel	≤270HB	**VP30RT (VP15TF)**	150 (120−180)	20	3	0.14	0.22	24	4	0.16	0.22	30	5	0.18	0.27
					25	5	0.12	0.49	30	7	0.14	0.55	38	9	0.16	0.71
					29	8	0.10	0.71	36	10	0.12	0.88	45	12.5	0.14	1.10
K	Cast Iron	Tensile Strength ≤450MPa	**VP15TF**	180 (150−220)	20	10	0.16	0.55	24	14	0.18	0.55	30	18	0.20	0.69
					25	13	0.14	1.23	30	17	0.16	1.37	38	21	0.18	1.78
					29	16	0.12	1.78	36	20	0.14	2.19	45	25	0.16	2.74
N	Aluminium Alloy	–	**HTi10** (G1 Breaker)	500 (200−800)	20	10	0.18	0.44	24	14	0.20	0.44	30	18	0.22	0.55
					25	13	0.16	0.99	30	17	0.18	1.10	38	21	0.20	1.43
					29	16	0.14	1.43	36	20	0.16	1.76	45	25	0.18	2.20
H	Hardened Steel	45−55HRC	**VP15TF**	80 (50−120)	20	3	0.10	0.22	24	4	0.12	0.22	30	5	0.14	0.27
					25	5	0.08	0.49	30	7	0.10	0.55	38	9	0.12	0.71
					29	8	0.06	0.71	36	10	0.08	0.88	45	12.5	0.10	1.10

FOR DRILLING AND PLUNGING

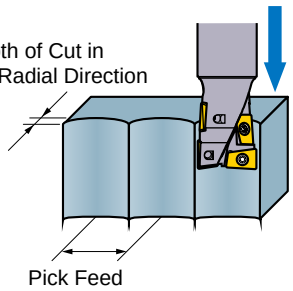
● Drilling



- The recommended drilling depth is less than $0.5D_1$.
- Use step feed when drilling (0.25−0.5mm) to ensure that the chips are effectively broken.
- Use internal or external cooling to ensure that the chip disposal is sufficiently achieved.
- The chips generated can dispel in any direction, so ensure that adequate safety precautions are taken.

● Plunging

Depth of Cut in the Radial Direction



- The feed for plunging is the same as the feed for drilling.
- No step feed necessary.
- Please refer to the following table for the depth of cut at plunging operations.

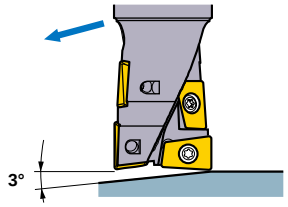
Depth of Cut in the Radial Direction	≤ $0.4D_1$
Pick Feed	≤ $0.5D_1$

Work Material		Hardness	Grade	Cutting Speed (m/min)	ϕ16, ϕ17		ϕ20, ϕ21		ϕ25, ϕ26	
					Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)
P	Mild Steel	≤180HB	**VP15TF**	180 (150−220)	0.035	0.2	0.045	0.3	0.05	0.3
	Carbon Steel Alloy Steel	180−350HB	**VP15TF**	160 (120−200)	0.03	0.2	0.04	0.3	0.045	0.3
M	Stainless Steel	≤270HB	**VP30RT (VP15TF)**	150 (120−180)	0.03	0.15	0.04	0.25	0.045	0.25
K	Cast Iron	Tensile Strength ≤450MPa	**VP15TF**	180 (150−220)	0.04	0.4	0.05	0.5	0.06	0.5
N	Aluminium Alloy	–	**HTi10** (G1 Breaker)	500 (200−800)	0.04	0.2	0.05	0.3	0.06	0.3
H	Hardened Steel	45−55HRC	**VP15TF**	80 (50−120)	0.02	0.15	0.03	0.25	0.035	0.25

(Note 1) Helical grooving is strongly recommended for machining tempered steel.
(Note 2) When using G1 breaker (VP15TF), please reduce the feed rate by 20%.

ϕ32, ϕ33				ϕ35				ϕ40				ϕ50			
Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining Diameter (mm)	Max. Depth of Cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)
38	16	0.25	0.66	42	18	0.28	0.77	48	20	0.30	0.88	60	25	0.35	1.10
48	24	0.22	1.76	53	27	0.24	1.97	60	30	0.26	2.19	75	38	0.30	2.74
58	32	0.20	2.85	63	35	0.21	3.07	72	40	0.22	3.51	90	50	0.26	4.39
38	16	0.20	0.49	42	18	0.22	0.58	48	20	0.25	0.66	60	25	0.28	0.82
48	24	0.18	1.32	53	27	0.2	1.48	60	30	0.22	1.65	75	38	0.26	2.06
58	32	0.16	2.14	63	35	0.18	2.3	72	40	0.20	2.63	90	50	0.24	3.29
38	6	0.20	0.33	42	7	0.22	0.38	48	8	0.25	0.44	60	10	0.28	0.55
48	11	0.18	0.88	53	13	0.2	0.99	60	14	0.22	1.10	75	18	0.26	1.37
58	16	0.16	1.43	63	18	0.18	1.53	72	20	0.20	1.75	90	25	0.24	2.19
38	22	0.25	0.82	42	25	0.28	0.95	48	28	0.30	1.10	60	35	0.35	1.37
48	27	0.22	2.19	53	30	0.24	2.47	60	34	0.26	2.74	75	43	0.30	3.43
58	32	0.20	3.57	63	35	0.21	3.84	72	40	0.22	4.39	90	50	0.26	5.49
38	22	0.27	0.66	42	25	0.3	0.77	48	28	0.32	0.88	60	35	0.37	1.10
48	27	0.24	1.76	53	30	0.26	1.97	60	34	0.28	2.19	75	43	0.32	2.74
58	32	0.22	2.85	63	35	0.21	3.07	72	40	0.24	3.51	90	50	0.27	4.39
38	6	0.16	0.33	42	7	0.17	0.38	48	8	0.18	0.44	60	10	0.20	0.55
48	11	0.14	0.88	53	13	0.15	0.99	60	14	0.16	1.10	75	18	0.18	1.37
58	16	0.12	1.43	63	18	0.13	1.53	72	20	0.14	1.75	90	25	0.16	2.19

FOR RAMPING



- When machining steel the recommended ramping angle is 3°. If a ramping angle larger than 3° is used, then the chips may not be broken effectively resulting in chips wrapping around the tool.
- When ramping, it is recommended to reduce the feed rate by 40%.

ϕ32, ϕ33, ϕ35		ϕ40		ϕ50	
Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)
0.055	0.3	0.06	0.3	0.065	0.3
0.05	0.3	0.055	0.3	0.06	0.3
0.05	0.25	0.055	0.25	0.06	0.25
0.065	0.5	0.07	0.5	0.075	0.5
0.065	0.3	0.07	0.3	0.075	0.3
0.04	0.25	0.045	0.25	0.05	0.25