RECOMMENDED CUTTING CONDITIONS

	Workpiece Material	Hardness	Cutting Speed (m/min)	Inner Breaker	ϕ14—ϕ16.5mm Feed Rate (mm/rev)		
					L/D=2, 3	4	5
P	Mild Steel (ASTM A36, AISI 1010 etc.)	≤180HB	200 (180—235)	UM	0.05 (0.04—0.06)	0.05 (0.04—0.06)	0.05 (0.04—0.06)
				UH	—	—	—
	Carbon Steel, Alloy Steel (AISI 1045, AISI 4140 etc.)	180—280HB	140 (115—180)	UM	0.08 (0.06—0.14)	0.08 (0.06—0.09)	0.08 (0.06—0.09)
				UH	—	—	—
	Carbon Steel, Alloy Steel (AISI 4340 etc.)	280—350HB	100 (75—140)	UM	0.08 (0.06—0.14)	0.08 (0.06—0.09)	0.08 (0.06—0.09)
				UH	—	—	—
	Alloy Tool Steel (SKD, SKT etc.)	≤350HB	135 (100—170)	UM	0.08 (0.06—0.14)	0.08 (0.06—0.09)	0.08 (0.06—0.09)
				UH	—	—	—
M	Austenitic Stainless Steel (AISI 304, AISI 316 etc.)	≤200HB	130 (80—180)	US	—	—	—
				UM	0.06 (0.04—0.08)	0.05 (0.04—0.06)	0.05 (0.04—0.06)
	Austenitic Stainless Steel (AISI 304LN, AISI 316LN etc.)	>200HB	130 (80—180)	US	—	—	—
				UM	0.06 (0.04—0.08)	0.05 (0.04—0.06)	0.05 (0.04—0.06)
	Ferritic and Martensitic Stainless Steel (AISI 410, AISI 430 etc.)	≤200HB	120 (80—165)	US	—	—	—
				UM	0.06 (0.04—0.08)	0.05 (0.04—0.06)	0.05 (0.04—0.06)
	Ferritic and Martensitic Stainless Steel (AISI 431, AISI 420J2 etc.)	>200HB	120 (80—165)	US	—	—	—
				UM	0.06 (0.04—0.08)	0.05 (0.04—0.06)	0.05 (0.04—0.06)
K	Gray Cast Iron (FC300 etc.)	Tensile Strength ≤350MPa	160 (130—195)	UM	0.10 (0.06—0.14)	0.08 (0.06—0.10)	0.08 (0.06—0.10)
	Ductile Cast Iron (FCD450 etc.)	Tensile Strength ≤450MPa	100 (80—135)	UM	0.10 (0.06—0.14)	0.08 (0.06—0.10)	0.08 (0.06—0.10)
	Ductile Cast Iron (FCD700 etc.)	Tensile Strength ≤800MPa	100 (70—125)	UM	0.08 (0.06—0.12)	0.07 (0.06—0.08)	0.07 (0.06—0.08)
N	Aluminium Alloys (A6061, A7075)	Si<5%	200 (100—350)	UN	—	—	—
	Aluminium Alloys (AC4B)	5%≤Si≤10%	150 (100—200)	UN	—	—	—
	Aluminium Alloys (ADC12, A390)	Si>10%	150 (100—200)	UN	—	—	—
H	Hardened Steel (AISI H13, JIS SKT4)	38—45HRC	50 (30—80)	UH	—	—	—

Note 1) Reduce the cutting speed to around 70% when VP15TF is used as an outer insert.
Note 2) L/D=3 is the recommended maximum depth when only external coolant is used.
Note 3) Internal through coolant is highly necessary when drilling stainless steel.

ϕ17–ϕ19.5mm				ϕ20–ϕ23.5mm				ϕ24–ϕ29.5mm			
Feed Rate (mm/rev)				Feed Rate (mm/rev)				Feed Rate (mm/rev)			
L/D=2, 3	4	5	6	L/D=2, 3	4	5	6	L/D=2, 3	4	5	6
0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.04 (0.04–0.05)	0.06 (0.04–0.08)	0.06 (0.04–0.07)	0.06 (0.04–0.07)	0.04 (0.04–0.05)	0.07 (0.04–0.08)	0.06 (0.04–0.07)	0.06 (0.04–0.07)	0.05 (0.04–0.06)
0.08 (0.06–0.14)	0.08 (0.06–0.09)	0.08 (0.06–0.09)	0.05 (0.04–0.06)	0.10 (0.06–0.18)	0.09 (0.06–0.12)	0.09 (0.06–0.12)	0.07 (0.06–0.08)	0.12 (0.08–0.18)	0.10 (0.08–0.12)	0.10 (0.08–0.12)	0.09 (0.08–0.10)
0.08 (0.06–0.14)	0.08 (0.06–0.09)	0.08 (0.06–0.09)	0.05 (0.04–0.06)	0.10 (0.06–0.18)	0.09 (0.06–0.12)	0.09 (0.06–0.12)	0.07 (0.06–0.08)	0.12 (0.08–0.18)	0.10 (0.08–0.12)	0.10 (0.08–0.12)	0.09 (0.08–0.10)
0.08 (0.06–0.14)	0.08 (0.06–0.09)	0.08 (0.06–0.09)	0.05 (0.04–0.06)	0.10 (0.06–0.18)	0.09 (0.06–0.12)	0.09 (0.06–0.12)	0.07 (0.06–0.08)	0.12 (0.08–0.18)	0.10 (0.08–0.12)	0.10 (0.08–0.12)	0.09 (0.08–0.10)
0.08 (0.06–0.12)	0.06 (0.04–0.08)	0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.10 (0.06–0.14)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.10 (0.06–0.14)	0.08 (0.06–0.10)	0.08 (0.06–0.10)	0.07 (0.06–0.08)
0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.04 (0.04–0.05)	0.08 (0.06–0.12)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.09 (0.06–0.12)	0.07 (0.06–0.09)	0.07 (0.06–0.09)	0.06 (0.06–0.08)
0.08 (0.06–0.12)	0.06 (0.04–0.08)	0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.10 (0.06–0.14)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.10 (0.06–0.14)	0.08 (0.06–0.10)	0.08 (0.06–0.10)	0.07 (0.06–0.08)
0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.04 (0.04–0.05)	0.08 (0.06–0.12)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.09 (0.06–0.12)	0.07 (0.06–0.09)	0.07 (0.06–0.09)	0.06 (0.06–0.08)
0.08 (0.06–0.12)	0.06 (0.04–0.08)	0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.10 (0.06–0.14)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.10 (0.06–0.14)	0.08 (0.06–0.10)	0.08 (0.06–0.10)	0.07 (0.06–0.08)
0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.04 (0.04–0.05)	0.08 (0.06–0.12)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.09 (0.06–0.12)	0.07 (0.06–0.09)	0.07 (0.06–0.09)	0.06 (0.06–0.08)
0.08 (0.06–0.12)	0.06 (0.04–0.08)	0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.10 (0.06–0.14)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.10 (0.06–0.14)	0.08 (0.06–0.10)	0.08 (0.06–0.10)	0.07 (0.06–0.08)
0.06 (0.04–0.08)	0.05 (0.04–0.06)	0.05 (0.04–0.06)	0.04 (0.04–0.05)	0.08 (0.06–0.12)	0.07 (0.06–0.08)	0.07 (0.06–0.08)	0.06 (0.06–0.07)	0.09 (0.06–0.12)	0.07 (0.06–0.09)	0.07 (0.06–0.09)	0.06 (0.06–0.08)
0.11 (0.08–0.14)	0.09 (0.08–0.10)	0.09 (0.08–0.10)	0.05 (0.04–0.06)	0.14 (0.10–0.18)	0.10 (0.10–0.12)	0.10 (0.10–0.12)	0.07 (0.06–0.08)	0.15 (0.10–0.20)	0.11 (0.10–0.13)	0.11 (0.10–0.13)	0.09 (0.08–0.10)
0.11 (0.08–0.14)	0.09 (0.08–0.10)	0.09 (0.08–0.10)	0.05 (0.04–0.06)	0.13 (0.10–0.16)	0.10 (0.10–0.11)	0.10 (0.10–0.11)	0.07 (0.06–0.08)	0.14 (0.10–0.18)	0.11 (0.10–0.12)	0.11 (0.10–0.12)	0.09 (0.08–0.10)
0.11 (0.08–0.14)	0.09 (0.08–0.10)	0.09 (0.08–0.10)	0.05 (0.04–0.06)	0.13 (0.10–0.16)	0.10 (0.10–0.11)	0.10 (0.10–0.11)	0.07 (0.06–0.08)	0.14 (0.10–0.18)	0.11 (0.10–0.12)	0.11 (0.10–0.12)	0.09 (0.08–0.10)
0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)
0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)
0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.12 (0.05–0.18)	0.08 (0.05–0.12)
0.08 (0.04–0.12)	0.06 (0.04–0.09)	–	–	0.09 (0.06–0.14)	0.07 (0.06–0.09)	–	–	0.09 (0.06–0.14)	0.07 (0.06–0.09)	–	–

RECOMMENDED CUTTING CONDITIONS

	Workpiece Material	Hardness	Cutting Speed (m/min)	Inner Breaker	ϕ30—ϕ63mm Feed Rate (mm/rev)			
					L/D=2, 3	4	5	6
P	Mild Steel (ASTM A36, AISI 1010 etc.)	≤180HB	200 (180—235)	UM	0.08 (0.06—0.10)	0.07 (0.06—0.08)	0.07 (0.06—0.08)	0.06 (0.06—0.07)
				UH				
	Carbon Steel, Alloy Steel (AISI 1045, AISI 4140 etc.)	180—280HB	140 (115—180)	UM	0.14 (0.08—0.20)	0.12 (0.08—0.16)	0.12 (0.08—0.16)	0.11 (0.10—0.12)
				UH				
	Carbon Steel, Alloy Steel (AISI 4340 etc.)	280—350HB	100 (75—140)	UM	0.14 (0.08—0.20)	0.12 (0.08—0.16)	0.12 (0.08—0.16)	0.11 (0.10—0.12)
				UH				
	Alloy Tool Steel (SKD, SKT etc.)	≤350HB	135 (100—170)	UM	0.14 (0.08—0.20)	0.12 (0.08—0.16)	0.12 (0.08—0.16)	0.10 (0.08—0.12)
				UH				
M	Austenitic Stainless Steel (AISI 304, AISI 316 etc.)	≤200HB	130 (80—180)	US	0.10 (0.06—0.14)	0.09 (0.06—0.12)	0.09 (0.06—0.12)	0.07 (0.06—0.10)
				UM	0.09 (0.06—0.12)	0.08 (0.06—0.10)	0.08 (0.06—0.10)	0.07 (0.06—0.08)
	Austenitic Stainless Steel (AISI 304LN, AISI 316LN etc.)	>200HB	130 (80—180)	US	0.10 (0.06—0.14)	0.09 (0.06—0.12)	0.09 (0.06—0.12)	0.07 (0.06—0.10)
				UM	0.09 (0.06—0.12)	0.08 (0.06—0.10)	0.08 (0.06—0.10)	0.07 (0.06—0.08)
	Ferritic and Martensitic Stainless Steel (AISI 410, AISI 430 etc.)	≤200HB	120 (80—165)	US	0.10 (0.06—0.14)	0.09 (0.06—0.12)	0.09 (0.06—0.12)	0.07 (0.06—0.10)
				UM	0.09 (0.06—0.12)	0.08 (0.06—0.10)	0.08 (0.06—0.10)	0.07 (0.06—0.08)
	Ferritic and Martensitic Stainless Steel (AISI 431, AISI 420J2 etc.)	>200HB	120 (80—165)	US	0.10 (0.06—0.14)	0.09 (0.06—0.12)	0.09 (0.06—0.12)	0.07 (0.06—0.10)
				UM	0.09 (0.06—0.12)	0.08 (0.06—0.10)	0.08 (0.06—0.10)	0.07 (0.06—0.08)
K	Gray Cast Iron (FC300 etc.)	Tensile Strength ≤350MPa	160 (130—195)	UM	0.15 (0.10—0.20)	0.12 (0.10—0.13)	0.12 (0.10—0.13)	0.11 (0.10—0.12)
	Ductile Cast Iron (FCD450 etc.)	Tensile Strength ≤450MPa	100 (80—135)	UM	0.15 (0.10—0.20)	0.12 (0.10—0.13)	0.12 (0.10—0.13)	0.11 (0.10—0.12)
	Ductile Cast Iron (FCD700 etc.)	Tensile Strength ≤800MPa	100 (70—125)	UM	0.15 (0.10—0.20)	0.12 (0.10—0.13)	0.12 (0.10—0.13)	0.11 (0.10—0.12)
N	Aluminium Alloys (A6061, A7075)	Si<5%	200 (100—350)	UN	0.12 (0.05—0.20)	0.12 (0.05—0.18)	0.12 (0.05—0.18)	0.08 (0.05—0.12)
	Aluminium Alloys (AC4B)	5%≤Si≤10%	150 (100—200)	UN	0.12 (0.05—0.20)	0.12 (0.05—0.18)	0.12 (0.05—0.18)	0.08 (0.05—0.12)
	Aluminium Alloys (ADC12, A390)	Si>10%	150 (100—200)	UN	0.12 (0.05—0.20)	0.12 (0.05—0.18)	0.12 (0.05—0.18)	0.08 (0.05—0.12)
H	Hardened Steel (AISI H13, JIS SKT4)	38—45HRC	50 (30—80)	UH	0.11 (0.06—0.16)	0.09 (0.06—0.012)	—	—

Note 1) Reduce the cutting speed to around 70% when VP15TF is used as an outer insert.
Note 2) L/D=3 is the recommended maximum depth when only external coolant is used.
Note 3) Internal through coolant is highly necessary when drilling stainless steel.