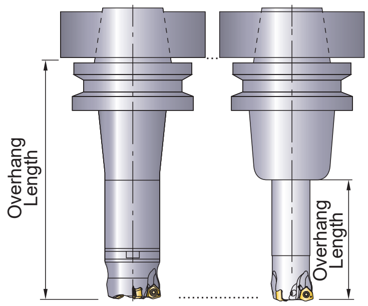
RECOMMENDED CUTTING CONDITIONS

■Correction Value According to Overhang Length

Please use by multiplying the recommended cutting conditions by the correction factor for the overhang length.

Type	DCX (mm)	Overhang Length (mm)	Correction Value		
			vc (m/min)	**ap** (mm)	**fz** (mm/t)
Shank Type Screw-in Type	25—40	< 2.5×DCON	100%	100%	100%
		3.0×DCON	90%	100%	90%
		4.0×DCON	85%	90%	85%
		5.0×DCON	80%	85%	80%
		7.5×DCON	70%	75%	75%
Arbor Type	40—66	< 2.5×DCX	100%	100%	100%
		3.0×DCX	85%	100%	90%
		4.0×DCX	80%	80%	80%
		5.0×DCX	75%	75%	60%
		6.0×DCX	70%	70%	40%



■Cutting Speed (Dry Cutting)

	Workpiece Material	Characteristics	Cutting Speed (Priority Basis) **vc** (m/min)				
P			MP6130	MP6120	VP15TF	MC7020	VP30RT
	Mild Steels	≤180HB	160 (110—200)	170 (120—220)	170 (120—220)	230 (180—280)	140 (100—180)
	Carbon Steels Alloy Steels	180—280HB	140 (90—200)	160 (100—220)	160 (100—220)	220 (170—270)	120 (80—170)
	Carbon Steels Alloy Steels	280—350HB	140 (90—200)	160 (100—220)	160 (100—220)	220 (170—270)	120 (80—170)
	Alloy Tool Steels	≤350HB (Annealing)	140 (90—200)	160 (100—220)	160 (100—220)	220 (170—270)	120 (80—170)
	Pre-hardened Steels	35—45HRC	100 (60—140)	120 (80—160)	120 (80—160)	—	90 (50—130)
M			MP7130	MP7140	MC7020	VP30RT	
	Austenitic Stainless Steels	≤200HB	160 (130—200)	150 (120—180)	220 (170—270)	150 (120—180)	
	Austenitic Stainless Steels	>200HB	140 (100—200)	130 (80—180)	190 (140—240)	130 (80—180)	
	Ferritic and Martensitic Stainless Steels	≤200HB	150 (100—200)	130 (80—180)	220 (170—270)	130 (80—180)	
	Duplex Stainless Steels	≤280HB	130 (80—180)	110 (60—160)	180 (130—230)	110 (60—160)	
	Precipitation-Hardening Stainless Steel	<450HB	110 (60—160)	90 (50—130)	170 (120—220)	90 (50—130)	
K			VP15TF				
	Gray Cast Irons	≤350MPa	180 (140—220)				
	Ductile Cast Irons	≤450MPa	160 (120—210)				
	Ductile Cast Irons	≤800MPa	130 (90—170)				
S			MP9130	MP9120	VP15TF		
	Titanium Alloys	—	40 (30—60)	50 (30—65)	50 (30—65)		
	Heat Resistant Alloys	—	30 (20—40)	40 (20—50)	40 (20—50)		
H			VP15TF				
	Hardened Steels	40—55HRC	70 (40—100)				

Note 1) To discharge chips effectively, use an air blower when machining. When the air blower is less effective at discharging chips, we recommend wet cutting.
Note 2) Tools may have a shorter life with wet cutting than dry cutting. For the cutting speed, multiply the values in the table above by 75% before use.
Note 3) When large vibration occurs, reduce the cutting conditions.
Note 4) For interrupted cutting, multiply the cutting speed listed in the table above by 80% and the feed rate per tooth by 80%.

Depth of Cut / Feed per Tooth

	Workpiece Material	Characteristics	Depth of Cut **ap** (mm)	Breaker	Cutting Dia. Max. DCX=25,28(Z=2) Feed **fz**(mm/t)	Cutting Dia. Max. DCX=25,28(Z=3) Feed **fz**(mm/t)	Cutting Dia. Max. DCX=32– Feed **fz**(mm/t)	Cutting Mode
P	Mild Steels	Hardness ≤180HB	≤0.5	M,R	1.3(0.4–2.0)	1.3(0.4–2.0)	1.5(0.5–2.0)	Dry
				L	1.2(0.4–1.6)	1.2(0.4–1.6)	1.2(0.4–1.6)	
			≤1.0	M,R	1.0(0.3–1.3)	0.8(0.3–1.0)	1.2(0.4–1.5)	
				L	0.8(0.3–1.2)	0.8(0.3–1.0)	0.8(0.3–1.2)	
			≤1.5	M,R	0.6(0.3–1.0)	–	0.8(0.4–1.2)	
	Carbon Steels Alloy Steels	Hardness 180–280HB	≤0.5	M,R	1.3(0.4–1.7)	1.3(0.4–1.7)	1.5(0.4–2.0)	Dry
				L	1.2(0.3–1.5)	1.2(0.3–1.5)	1.2(0.3–1.5)	
			≤1.0	M,R	0.8(0.3–1.0)	0.7(0.3–0.9)	1.0(0.3–1.3)	
				L	0.7(0.2–1.0)	0.7(0.2–0.9)	0.7(0.2–1.0)	
			≤1.5	M,R	0.5(0.3–0.7)	–	0.7(0.3–1.0)	
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280–350HB ≤350HB (Annealing)	≤0.5	M,R	1.3(0.4–1.7)	1.3(0.4–1.7)	1.5(0.4–2.0)	Dry
				L	1.2(0.3–1.5)	1.2(0.3–1.5)	1.2(0.3–1.5)	
			≤1.0	M,R	0.8(0.3–1.0)	0.7(0.3–0.9)	1.0(0.3–1.3)	
				L	0.7(0.2–1.0)	0.7(0.2–0.9)	0.7(0.2–1.0)	
			≤1.5	M,R	0.5(0.3–0.7)	–	0.7(0.3–1.0)	
	Pre-hardened Steels	Hardness 35–45HRC	≤0.5	M,R	1.0(0.3–1.3)	1.0(0.3–1.3)	1.2(0.3–1.5)	Dry
				L	0.8(0.3–1.2)	0.8(0.3–1.2)	0.8(0.3–1.2)	
			≤1.0	M,R	0.6(0.2–0.8)	0.6(0.2–0.8)	0.8(0.2–1.0)	
				L	0.5(0.2–0.8)	0.5(0.2–0.8)	0.5(0.2–0.8)	
M	Austenitic Stainless Steels	–	≤0.5	L	0.8(0.3–1.0)	0.8(0.3–1.0)	0.8(0.3–1.0)	Dry
				M	1.0(0.4–1.2)	1.0(0.4–1.2)	1.0(0.4–1.2)	
			≤1.0	L	0.6(0.2–0.8)	0.6(0.2–0.8)	0.6(0.2–0.8)	
				M	0.8(0.3–1.0)	0.8(0.3–1.0)	0.8(0.3–1.0)	
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	≤0.5	L	0.8(0.3–1.0)	0.8(0.3–1.0)	0.8(0.3–1.0)	Dry
				M	1.0(0.4–1.2)	1.0(0.4–1.2)	1.0(0.4–1.2)	
			≤1.0	L	0.6(0.2–0.8)	0.6(0.2–0.8)	0.6(0.2–0.8)	
				M	0.8(0.3–1.0)	0.8(0.3–1.0)	0.8(0.3–1.0)	
	Duplex Stainless Steels	Hardness ≤280HB	≤0.5	L	0.6(0.3–0.8)	0.6(0.3–0.8)	0.6(0.3–0.8)	Dry
				M	0.7(0.3–1.0)	0.7(0.3–1.0)	0.7(0.3–1.0)	
			≤1.0	L	0.5(0.2–0.7)	0.5(0.2–0.7)	0.5(0.2–0.7)	
				M	0.6(0.3–0.7)	0.6(0.3–0.7)	0.6(0.3–0.7)	
	Precipitation-Hardening Stainless Steel	Hardness <450HB	≤0.5	L	0.6(0.3–0.8)	0.6(0.3–0.8)	0.6(0.3–0.8)	Dry
				M	0.7(0.3–1.0)	0.7(0.3–1.0)	0.7(0.3–1.0)	
			≤1.0	L	0.5(0.2–0.7)	0.5(0.2–0.7)	0.5(0.2–0.7)	
				M	0.6(0.3–0.7)	0.6(0.3–0.7)	0.6(0.3–0.7)	
K	Gray Cast Irons	Tensile Strength ≤350MPa	≤0.5	M,R	1.3(0.4–2.0)	1.3(0.4–2.0)	1.5(0.5–2.0)	Dry
				L	1.2(0.4–1.6)	1.2(0.4–1.6)	1.2(0.4–1.6)	
			≤1.0	M,R	1.0(0.3–1.3)	0.8(0.3–1.0)	1.2(0.4–1.5)	
				L	1.0(0.3–1.3)	0.8(0.3–1.0)	1.0(0.3–1.3)	
			≤1.5	M,R	0.6(0.3–1.0)	–	0.8(0.4–1.2)	
	Ductile Cast Irons	Tensile Strength ≤450MPa	≤0.5	M,R	1.3(0.4–1.7)	1.3(0.4–1.7)	1.5(0.4–2.0)	Dry
				L	1.0(0.3–1.3)	1.0(0.3–1.3)	1.0(0.3–1.3)	
			≤1.0	M,R	0.8(0.3–1.0)	0.7(0.3–0.9)	1.0(0.3–1.3)	
				L	0.8(0.2–1.0)	0.7(0.2–0.9)	0.8(0.2–1.2)	
			≤1.5	M,R	0.5(0.3–0.7)	–	0.7(0.3–1.0)	
	Ductile Cast Irons	Tensile Strength ≤800MPa	≤0.5	M,R	1.0(0.2–1.5)	1.0(0.2–1.5)	1.3(0.3–1.7)	Dry
				L	0.8(0.3–1.2)	0.8(0.3–1.2)	0.8(0.3–1.2)	
			≤1.0	M,R	0.8(0.2–1.0)	0.6(0.2–0.8)	1.0(0.3–1.2)	
				L	0.5(0.2–0.8)	0.5(0.2–0.8)	0.5(0.2–0.8)	
S	Titanium Alloys	–	≤0.5	L	0.3(0.2–0.6)	0.3(0.2–0.6)	0.3(0.2–0.6)	Wet
			≤1.0	L	0.3(0.2–0.4)	0.3(0.2–0.4)	0.3(0.2–0.4)	
	Heat Resistant Alloys	–	≤0.5	L,M,R	0.8(0.3–1.2)	0.8(0.3–1.2)	0.8(0.3–1.2)	Wet
			≤1.0	L,M,R	0.7(0.3–1.0)	0.7(0.3–1.0)	0.7(0.3–1.0)	
H	Hardened Steels	Hardness 40–55HRC	≤0.5	R,M	0.6(0.3–1.0)	0.6(0.3–1.0)	0.6(0.3–1.0)	Dry
			≤1.0	R,M	0.5(0.3–0.8)	0.4(0.3–0.6)	0.5(0.3–0.8)	

Note 1) To discharge chips effectively, use an air blower when machining. When the air blower is less effective at discharging chips, we recommend wet cutting.
Note 2) When large vibration occurs, reduce the cutting conditions.
Note 3) For interrupted cutting, multiply the cutting speed listed in the table on page L246 by 80% and the feed rate per tooth listed in the table above by 80%.
Note 4) If ap is set at 2mm or more, avoid machining on the walls or ramping.

Cutting Conditions (Guide) :
● : Stable Cutting ◐ : General Cutting ✤ : Unstable Cutting

■ Selecting the Proper Breaker

	Workpiece Material	Characteristics	L Breaker		M Breaker		R Breaker	
			Cutting Conditions	Depth of Cut **ap** (mm)	Cutting Conditions	Depth of Cut **ap** (mm)	Cutting Conditions	Depth of Cut **ap** (mm)
P	Mild Steels	Hardness ≤180HB	● ◐	≤1.0	● ◐	≤1.5	◐ ✤	≤1.5
P	Carbon Steels Alloy Steels	Hardness 180–350HB	● ◐	≤1.0	● ◐	≤1.5	◐ ✤	≤1.5
M	Precipitation-Hardening Stainless Steel	Hardness <450HB	● ◐	≤1.0	● ◐	≤1.0	–	–
K	Ductile Cast Irons	Tensile Strength ≤450MPa	● ◐	≤1.0	● ◐	≤1.5	–	≤1.5
K	Ductile Cast Irons	Tensile Strength ≤800MPa	● ◐	≤1.0	● ◐	≤1.0	–	≤1.0

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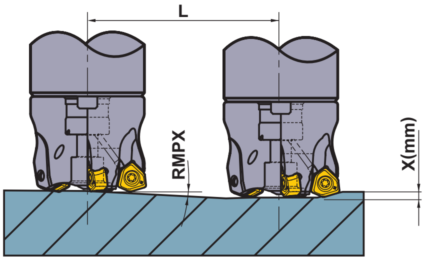
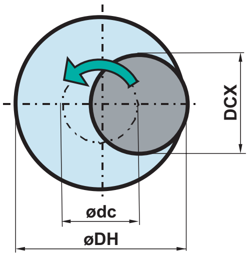
Note 4) For interrupted cutting, multiply the cutting speed listed in the table on page L246 by 80% and the feed rate per tooth listed in the table above by 80%.

Maximum Capacities by Mode

■Ramping



■Helical Milling



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

ødc = øDH - DCX

Locus of the Centre of the Tool — Desired Hole Diameter — Cutting Diameter Maximum

Tool Holder Type	DCX (mm)	DC (mm)	APMX (mm)	Ramping		Helical Milling (Blind Hole, Flat Bottom)		Helical Milling (Through Hole)		AZ (mm)
				RMPX	L (mm) Required Distance for X mm Depth	DH (mm)		DH (mm)	Maximum Pitch P max. (mm)	
					x = 1 (mm)	Min.	Max.	Min.		
WJX09R25	25	14.0	1.2	4.7°	12.2	38	47	34	1.2	0.8
WJX09R28	28	16.9	1.2	5.6°	10.2	44	53	38	1.2	1.2
WJX09R32	32	20.9	1.2	4.2°	13.7	52	61	46	1.2	1.2
WJX09R35	35	23.8	1.2	3.6°	15.9	58	67	52	1.2	1.2
WJX09R40	40	28.8	1.2	2.9°	19.8	68	77	61	1.2	1.2
WJX09-040	40	28.8	1.2	2.9°	19.8	68	77	61	1.2	1.2
WJX09-050	50	38.8	1.2	2.0°	28.7	88	97	81	1.2	1.2
WJX09R050	50	38.8	1.2	2.0°	28.7	88	97	81	1.2	1.2
WJX09-052	52	40.8	1.2	1.9°	30.2	92	101	85	1.2	1.2
WJX09-063	63	51.8	1.2	1.4°	41.0	114	123	107	1.2	1.2
WJX09R063	63	51.8	1.2	1.4°	41.0	114	123	107	1.2	1.2
WJX09-066	66	54.8	1.2	1.4°	41.0	120	129	113	1.2	1.2

Note 1) When ramping and helical milling, it is recommended to reduce the feed per tooth.
Note 2) When ramping, helical milling and drilling, long continuous chips may be scattered so please be careful.

<Helical Milling>
To obtain a flat bottom surface when helical milling, it requires to remove “the uncut part” in the centre of the workpiece material at a final pass.
When helical milling, make sure that the depth of cut per helical pass doesn’t exceed the maximum depth of cut (APMX).
<Drilling>
When drilling, set the axial feed per revolution at 0.2 mm/rev or less.