Recommended Cutting Conditions

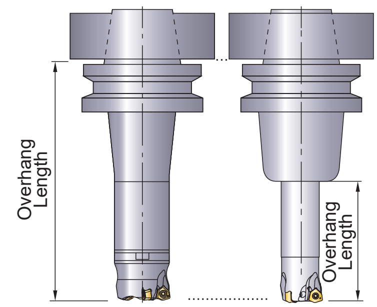
Correction Value According to Overhang Length

Multiply the recommended cutting conditions on pages 16 - 18 by the corrections factor x overhang length.

(inch)

Type	Cutting Dia. Max. **DCX**	Overhang Length	Correction Value According		
			Cutting Speed **vc** (SFM)	Depth of Cut **ap**	Feed **fz** (IPT)
Shank Type	1.969	< 2.5 × DCON	100%	100%	100%
		3.0 × DCON	90%	100%	90%
		4.0 × DCON	80%	80%	90%
Arbor Type	2.000—3.150	< 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%
	≥3.937	8.0	100%	100%	100%
		12.0	85%	100%	90%
		16.0	80%	80%	80%

DCON=Connection Dia.



Cutting Speed (Dry Cutting)

(inch)

	Workpiece Material	Properties	Cutting Speed **vc** (SFM)				
P			MP6130	MP6120	MC7020	VP15TF	VP30RT
	Mild Steels	Hardness ≤180HB	460 (295—590)	490 (330—655)	720 (560—885)	490 (330—655)	395 (260—525)
	Carbon Steels Alloy Steels	Hardness 180—280HB	395 (230—590)	460 (260—655)	655 (490—820)	460 (260—655)	330 (195—490)
	Carbon Steels Alloy Steels	Hardness 280—350HB	395 (230—590)	460 (260—655)	655 (490—820)	460 (260—655)	330 (195—490)
	Alloy Tool Steels	Hardness ≤350HB (Annealing)	395 (230—590)	460 (260—655)	655 (490—820)	460 (260—655)	330 (195—490)
	Pre-hardened Steels	Hardness 35—45HRC	295 (165—425)	360 (230—490)	—	360 (230—490)	260 (130—395)
M			MP7130	MP7140	MC7020	VP30RT	
	Austenitic Stainless Steels	Hardness ≤200HB	525 (425—655)	490 (395—590)	720 (560—885)	490 (395—590)	
	Austenitic Stainless Steels	Hardness >200HB	460 (330—655)	425 (260—590)	620 (460—785)	425 (260—590)	
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	490 (330—655)	425 (260—590)	720 (560—885)	425 (260—590)	
	Duplex Stainless Steels	Hardness ≤280HB	425 (260—590)	360 (195—525)	590 (425—755)	360 (195—525)	
	Precipitation Hardening Stainless Steels	Hardness <450HB	360 (195—525)	295 (165—425)	560 (395—720)	295 (165—425)	
K			VP15TF				
	Gray Cast Irons	Tensile Strength ≤350MPa	525 (395—655)				
	Ductile Cast Irons	Tensile Strength ≤450MPa	490 (330—655)				
	Ductile Cast Irons	Tensile Strength ≤800MPa	395 (260—525)				
S			MP9130	MP9120	VP15TF		
	Titanium Alloys	—	130 (100—195)	165 (100—210)	165 (100—210)		
	Heat Resistant Alloys	—	100 (65—130)	130 (65—165)	130 (65—165)		
H			VP15TF				
	Hardened Steels	Hardness 40—55HRC	230 (130—330)				

Note 1) To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
Note 2) When wet cutting, tool life may become shorter than dry cutting. When carrying out wet cutting for the applications recommended with dry cutting, reduce the cutting speed by 25%.
Note 3) When large vibration occurs, reduce the cutting conditions.
Note 4) For interrupted cutting, reduce the cutting speed and feed rate by 20%.

■ Depth of Cut / Feed per Tooth

(inch)

	Workpiece Material	Properties	Depth of Cut **ap**	Breaker	Cutting Dia. Max. DCX=2.000", 50mm, 52mm Feed **fz** (IPT)	Cutting Dia. Max. DCX≥2.500", 63mm Feed **fz** (IPT)	Cutting Mode
P	Mild Steels	Hardness ≤180HB	≤.040	M,R *	.059 (.024 – .098)	.067 (.024 – .110)	Dry
				L	.047 (.016 – .079)	.047 (.016 – .079)	Dry
			≤.060	M,R *	.051 (.024 – .079)	.059 (.024 – .098)	Dry
				L	.039 (.016 – .071)	.039 (.016 – .071)	Dry
			≤.080	M,R *	.047 (.024 – .079)	.051 (.024 – .098)	Dry
				L	.031 (.016 – .067)	.031 (.016 – .067)	Dry
			≤.100	M,R	.031 (.012 – .059)	.039 (.012 – .063)	Dry
			≤.120	M,R	.016 (.008 – .039)	.020 (.008 – .047)	Dry
	Carbon Steels Alloy Steels	Hardness 180-280HB	≤.040	M,R *	.059 (.020 – .079)	.067 (.020 – .098)	Dry
				L	.039 (.012 – .067)	.039 (.012 – .067)	Dry
			≤.060	M,R *	.047 (.020 – .067)	.051 (.020 – .098)	Dry
				L	.031 (.012 – .059)	.031 (.012 – .059)	Dry
			≤.080	M,R *	.039 (.020 – .059)	.047 (.020 – .079)	Dry
				L	.028 (.012 – .047)	.028 (.012 – .047)	Dry
			≤.100	M,R	.028 (.012 – .047)	.035 (.012 – .059)	Dry
			≤.120	M,R	.012 (.008 – .031)	.016 (.008 – .039)	Dry
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280-350HB ≤350HB (Annealing)	≤.040	M,R *	.059 (.020 – .079)	.067 (.020 – .098)	Dry
				L	.039 (.012 – .067)	.039 (.012 – .067)	Dry
			≤.060	M,R *	.047 (.020 – .067)	.051 (.020 – .087)	Dry
				L	.031 (.012 – .059)	.031 (.012 – .059)	Dry
			≤.080	M,R *	.039 (.020 – .059)	.047 (.020 – .079)	Dry
				L	.028 (.012 – .047)	.028 (.012 – .047)	Dry
			≤.100	M,R	.028 (.012 – .047)	.035 (.012 – .059)	Dry
			≤.120	M,R	.012 (.008 – .031)	.016 (.008 – .039)	Dry
	Pre-hardened Steels	Hardness 35-45HRC	≤.040	M,R *	.051 (.016 – .067)	.059 (.016 – .079)	Dry
				L	.028 (.012 – .047)	.028 (.012 – .047)	Dry
			≤.060	M,R *	.039 (.016 – .059)	.047 (.016 – .059)	Dry
				L	.024 (.012 – .039)	.024 (.012 – .039)	Dry
			≤.080	M,R *	.031 (.016 – .047)	.039 (.016 – .051)	Dry
				L	.020 (.012 – .031)	.020 (.012 – .031)	Dry
M	Austenitic Stainless Steels	–	≤.040	L *	.031 (.012 – .047)	.031 (.012 – .047)	Dry
				M	.039 (.020 – .047)	.039 (.020 – .047)	Dry
			≤.060	L *	.031 (.012 – .039)	.031 (.012 – .039)	Dry
				M	.039 (.020 – .039)	.039 (.020 – .039)	Dry
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	≤.040	L *	.031 (.012 – .047)	.031 (.012 – .047)	Dry
				M	.039 (.020 – .047)	.039 (.020 – .047)	Dry
			≤.060	L *	.031 (.012 – .039)	.031 (.012 – .039)	Dry
				M	.039 (.020 – .039)	.039 (.020 – .039)	Dry
	Duplex Stainless Steels	Hardness ≤280HB	≤.040	L *	.024 (.012 – .039)	.024 (.012 – .039)	Dry
				M	.031 (.016 – .039)	.031 (.016 – .039)	Dry
			≤.060	L *	.024 (.012 – .031)	.024 (.012 – .031)	Dry
				M	.031 (.016 – .031)	.031 (.016 – .031)	Dry
	Precipitation Hardening Stainless Steels	Hardness <450HB	≤.040	L *	.024 (.012 – .039)	.024 (.012 – .039)	Dry
				M	.031 (.016 – .039)	.031 (.016 – .039)	Dry
			≤.060	L *	.024 (.012 – .031)	.024 (.012 – .031)	Dry
				M	.031 (.016 – .031)	.031 (.016 – .031)	Dry

* The 1st recommend chip breaker for each depth of cut (**ap**).

Note 1) To discharge chips effectively, use an air blow when machining. When the air blow 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, reduce the cutting speed and feed rate by 20%.

Note 4) If ap is set at .079" or more, avoid machining on the walls or ramping.

(inch)

	Workpiece Material	Properties	Depth of Cut **ap**	Breaker	Cutting Dia. Max. DCX=2.000", 50mm, 52mm Feed **fz** (IPT)	Cutting Dia. Max. DCX≧2.500", 63mm Feed **fz** (IPT)	Cutting Mode
K	Gray Cast Irons	Tensile Strength ≤350MPa	≤.040	M,R *	.067(.024−.098)	.071(.024−.110)	Dry
				L	.051(.016−.079)	.051(.016−.079)	Dry
			≤.060	M,R *	.059(.024−.079)	.067(.024−.098)	Dry
				L	.047(.016−.071)	.047(.016−.071)	Dry
			≤.080	M,R *	.051(.024−.079)	.059(.024−.098)	Dry
				L	.039(.016−.059)	.039(.016−.059)	Dry
			≤.100	M,R	.031(.012−.059)	.039(.012−.063)	Dry
			≤.120	M,R	.016(.008−.039)	.020(.008−.047)	Dry
	Ductile Cast Irons	Tensile Strength ≤450MPa	≤.040	M,R *	.059(.020−.079)	.067(.020−.098)	Dry
				L	.047(.012−.079)	.047(.012−.079)	Dry
			≤.060	M,R *	.051(.020−.071)	.059(.020−.079)	Dry
				L	.039(.012−.067)	.039(.012−.067)	Dry
			≤.080	M,R *	.047(.020−.071)	.051(.020−.079)	Dry
				L	.031(.012−.059)	.031(.012−.059)	Dry
			≤.100	M,R	.028(.012−.047)	.035(.012−.059)	Dry
			≤.120	M,R	.012(.008−.031)	.016(.008−.039)	Dry
	Ductile Cast Irons	Tensile Strength ≤800MPa	≤.040	M,R *	.051(.016−.071)	.059(.016−.079)	Dry
				L	.039(.012−.067)	.039(.012−.067)	Dry
			≤.060	M,R *	.047(.016−.059)	.051(.016−.071)	Dry
				L	.031(.012−.059)	.031(.012−.059)	Dry
			≤.080	M,R *	.039(.016−.059)	.047(.016−.071)	Dry
				L	.028(.012−.047)	.028(.012−.047)	Dry
S	Titanium Alloys	−	≤.040	L	.012(.008−.024)	.012(.008−.024)	Wet
			≤.060	L	.012(.008−.020)	.012(.008−.020)	Wet
			≤.080	L	.012(.008−.016)	.012(.008−.016)	Wet
	Heat Resistant Alloys	−	≤.040	L,M,R	.039(.012−.051)	.039(.012−.051)	Wet
			≤.060	L,M,R	.031(.012−.047)	.031(.012−.047)	Wet
			≤.080	L,M,R	.028(.012−.047)	.028(.012−.047)	Wet
H	Hardened Steels	Hardness 40-55HRC	≤.040	R,M	.031(.012−.047)	.031(.012−.047)	Dry
			≤.060	R,M	.024(.012−.039)	.024(.012−.039)	Dry
			≤.080	R,M	.020(.012−.031)	.020(.012−.031)	Dry

* The 1st recommend chip breaker for each depth of cut (**ap**).

Note 1) To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.

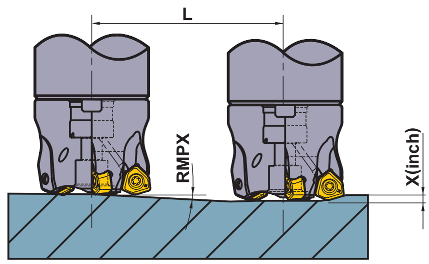
Note 2) When large vibration occurs, reduce the cutting conditions.

Note 3) For interrupted cutting, reduce the cutting speed and feed rate by 20%.

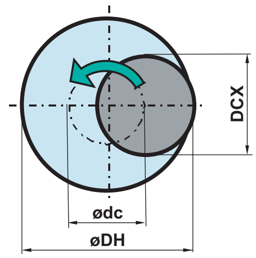
Note 4) If ap is set at .079" or more, avoid machining on the walls or ramping.

Maximum Capacities by Mode

■Ramping



■Helical Milling



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

ødc = øDH - DCX

Locus of the Center of the Tool | Desired Hole Diameter | Cutting Diameter Maximum

(inch)

Tool Holder Type	DCX	DC	APMX	Ramping			Helical Milling (Blind Hole, Flat Bottom)		Helical Milling (Through Hole)	AZ
				RMPX	L (inch) Required Distance for X inch Depth		DH		DH	
					x=.039	x=.079	Min.	Max.	Min.	
WJX14UR2.000	2.000	1.338	.079	4.3	.524	1.048	3.285	3.901	2.919	.082
WJX14UR2.500	2.500	1.887	.079	3°	.752	1.503	4.283	4.901	3.912	.082
WJX14UR3.000	3.000	2.387	.079	2.2°	1.025	2.050	5.283	5.901	4.909	.082
WJX14UR4.000	4.000	3.386	.079	1.5°	1.504	3.007	7.282	7.901	6.906	.082
WJX14UR5.000	5.000	4.386	.079	1.1°	2.051	4.101	9.281	9.901	8.904	.082
WJX14UR6.000	6.000	5.386	.079	0.9°	2.507	5.013	11.281	11.901	10.903	.082
WJX14R50	1.969	1.358	.079	4.4°	.512	1.024	3.228	3.819	2.874	.082
WJX14-050	1.969	1.358	.079	4.4	.512	1.024	3.228	3.819	2.874	.082
WJX14R050	1.969	1.358	.079	4.4	.512	1.024	3.228	3.819	2.874	.082
WJX14-052	2.047	1.437	.079	4.1	.551	1.102	3.386	3.976	3.031	.082
WJX14-063	2.480	1.870	.079	3°	.752	1.504	4.252	4.843	3.898	.082
WJX14R063	2.480	1.870	.079	3°	.752	1.504	4.252	4.843	3.898	.082
WJX14-066	2.598	1.984	.079	2.8°	.807	1.610	4.488	5.079	4.134	.082
WJX14-080	3.150	2.535	.079	2.1°	1.075	2.150	5.591	6.181	5.236	.082
WJX14R080	3.150	2.535	.079	2.1°	1.075	2.150	5.591	6.181	5.236	.082
WJX14-100	3.937	3.323	.079	1.5°	1.504	3.008	7.165	7.756	6.811	.082
WJX14R100	3.937	3.323	.079	1.5°	1.504	3.008	7.165	7.756	6.811	.082
WJX14-125	4.921	4.307	.079	1.2°	1.882	3.760	9.134	9.724	8.780	.082
WJX14R125	4.921	4.307	.079	1.2°	1.882	3.760	9.134	9.724	8.780	.082
WJX14-160	6.299	5.685	.079	0.8°	2.823	5.642	11.890	12.480	11.535	.082
WJX14R160	6.299	5.685	.079	0.8°	2.823	5.642	11.890	12.480	11.535	.082

DCX = Cutting Dia. Max. **DC** = Cutting Dia. **DH** = Desired Hole Dia.
APMX = Depth of Cut Max. **RMPX** = Ramping Angle Max. **AZ** = Plunge Depth Max.

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 center 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 .008 IPR or less.