

RECOMMENDED CUTTING CONDITIONS

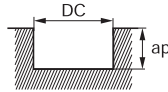
Slotting

When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

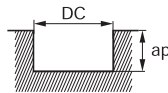
Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
6	150	8000	1400	6	120	6400	770	6	100	5300	560	6	60	3200	380	3	180	9500	1700	6	30	1600	130	1.8
8	150	6000	1300	8	120	4800	720	8	100	4000	600	8	60	2400	360	4	180	7200	1500	8	30	1200	140	2.4
10	150	4800	1200	10	120	3800	630	10	100	3200	670	10	60	1900	310	5	180	5700	1400	10	30	950	160	3
12	150	4000	960	12	120	3200	580	12	100	2700	650	12	60	1600	290	6	180	4800	1200	12	30	800	150	3.6
16	150	3000	810	12	120	2400	500	12	100	2000	480	12	60	1200	250	8	180	3600	970	12	30	600	120	4.8



DC : Dia.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (mirr ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
6	100	5300	630	6	80	4200	330	6	60	3200	220	6	50	2700	210	3	120	6400	760	6	25	1300	72	1.8
8	100	4000	550	8	80	3200	320	8	60	2400	240	8	50	2000	200	4	120	4800	670	8	25	990	78	2.4
10	100	3200	510	10	80	2500	270	10	60	1900	260	10	50	1600	170	5	120	3800	600	10	25	800	89	3
12	100	2700	430	12	80	2100	250	12	60	1600	250	12	50	1300	150	6	120	3200	510	12	25	660	84	3.6
16	100	2000	360	12	80	1600	220	12	60	1200	190	12	50	990	140	8	120	2400	430	12	25	500	63	4.8



DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient.

In these cases the feed and speed should be reduced proportionately.

Note 4) When the depth of cut is smaller than shown the feed rate can be increased.

SMART MIRACLE END MILLS

VQMZHVOH

End mill, Medium cutting length, 3 flute for drilling and slotting with thru-coolant

CARBIDE

SQUARE

BALL

RADIUS

TAPER

ROUGHING BARREL

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

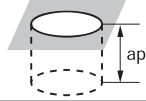
Plunging

The rigidity of the machine or work material and chip discharge are sufficient at high efficiency conditions.
The rigidity of the machine or work material or chip discharge is insufficient at general-purpose conditions.

High efficiency conditions

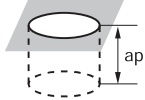
Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	100	5300	950	9	3	70	3700	440	9	1.2	60	3200	100	6	0.6	40	2100	60	6	0.6
8	100	4000	720	12	4	70	2800	340	12	1.6	60	2400	70	8	0.6	40	1600	50	8	0.6
10	100	3200	580	15	5	70	2200	260	15	2.5	60	1900	60	10	0.6	40	1300	40	10	0.6
12	100	2700	490	18	5	70	1900	230	18	3	60	1600	50	12	0.6	40	1100	30	12	0.6
16	100	2000	360	24	5	70	1400	170	24	4	60	1200	40	16	0.6	40	800	20	16	0.6

Depth of cut



Work Material		Copper, Copper alloy				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	
6	120	6400	1200	9	3	
8	120	4800	860	12	4	
10	120	3800	680	15	5	
12	120	3200	580	18	5	
16	120	2400	430	24	5	

Depth of cut



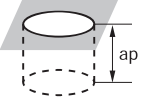
Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.

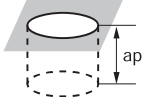
Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient.

In these cases the feed and speed should be reduced proportionately.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	100	5300	950	9	0.6	70	3700	440	9	0.6	60	3200	100	6	0.3	40	2100	60	6	0.3
8	100	4000	720	12	0.7	70	2800	340	12	0.7	60	2400	70	8	0.3	40	1600	50	8	0.3
10	100	3200	580	15	0.75	70	2200	260	15	0.75	60	1900	60	10	0.3	40	1300	40	10	0.3
12	100	2700	490	18	0.75	70	1900	230	18	0.75	60	1600	50	12	0.3	40	1100	30	12	0.3
16	100	2000	360	24	0.75	70	1400	170	24	0.75	60	1200	40	16	0.3	40	800	20	16	0.3
Depth of cut																				

Work Material	Copper, Copper alloy				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	120	6400	1200	9	0.6
8	120	4800	860	12	0.7
10	120	3800	680	15	0.75
12	120	3200	580	18	0.75
16	120	2400	430	24	0.75
Depth of cut					

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