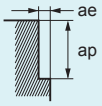
Recommended Cutting Conditions

Shoulder Milling

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.

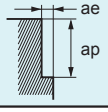
High Efficiency Cutting Conditions

(mm)

Work Material	Carbon Steel, Alloy Steel, Mild Steel					Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel					Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys					Precipitation Hardening Stainless Steel, Cobaly Chromium Alloy				
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae
1	130	40000	1800	1.5	0.3	120	38000	910	1.5	0.3	80	25000	500	1.5	0.2	75	24000	580	1.5	0.2
2	150	24000	2400	3	0.6	120	19000	1100	3	0.6	100	16000	830	3	0.6	75	12000	720	3	0.4
3	150	16000	2600	4.5	0.9	120	13000	1200	4.5	0.9	100	11000	880	4.5	0.9	75	8000	770	4.5	0.6
4	150	12000	2600	6	1.2	120	9500	1300	6	1.2	100	8000	900	6	1.2	75	6000	790	6	0.8
5	150	9500	2600	7.5	1.5	120	7600	1300	7.5	1.5	100	6400	900	7.5	1.5	75	4800	810	7.5	1
6	150	8000	2600	9	1.8	120	6400	1300	9	1.8	100	5300	1100	9	1.8	75	4000	810	9	1.2
8	150	6000	2500	12	2.4	120	4800	1300	12	2.4	100	4000	1200	12	2.4	75	3000	840	12	1.6
10	150	4800	2300	15	3	120	3800	1200	15	3	100	3200	1300	15	3	75	2400	770	15	2
12	150	4000	1900	18	3.6	120	3200	1200	18	3.6	100	2700	1200	18	3.6	75	2000	720	18	2.4
16	150	3000	1600	24	4.8	120	2400	960	24	4.8	100	2000	960	24	4.8	75	1500	600	24	3.2
20	150	2400	1300	30	6	120	1900	760	30	6	100	1600	770	30	6	75	1200	480	30	4
25	150	1900	1100	37.5	7.5	120	1500	600	37.5	7.5	100	1300	620	37.5	7.5	75	950	380	37.5	5
Depth of Cut																				

General Purpose Cutting Conditions

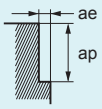
(mm)

Work Material	Carbon Steel, Alloy Steel, Mild Steel					Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel					Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys					Precipitation Hardening Stainless Steel, Cobaly Chromium Alloy				
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae
1	120	38000	1000	1.5	0.3	100	32000	560	1.5	0.3	80	25000	400	0.75	0.1	70	22000	390	1.5	0.2
2	120	19000	1300	3	0.6	100	16000	630	3	0.6	80	13000	450	1.5	0.2	70	11000	440	3	0.4
3	120	13000	1400	4.5	0.9	100	11000	700	4.5	0.9	80	8500	450	2.2	0.3	70	7400	470	4.5	0.6
4	120	9500	1400	6	1.2	100	8000	700	6	1.2	80	6400	470	3	0.6	70	5600	490	6	0.8
5	120	7600	1400	7.5	1.5	100	6400	710	7.5	1.5	80	5100	470	4.5	0.9	70	4500	500	7.5	1
6	120	6400	1400	9	1.8	100	5300	710	9	1.8	80	4200	580	6	1.2	70	3700	500	9	1.2
8	120	4800	1300	12	2.4	100	4000	740	12	2.4	80	3200	630	7.5	1.5	70	2800	520	12	1.6
10	120	3800	1200	15	3	100	3200	680	15	3	80	2500	660	9	1.8	70	2200	460	15	2
12	120	3200	1000	18	3.6	100	2700	640	18	3.6	80	2100	610	12	2.4	70	1900	450	18	2.4
16	120	2400	860	24	4.8	100	2000	530	24	4.8	80	1600	510	15	3	70	1400	370	24	3.2
20	120	1900	680	30	6	100	1600	420	30	6	80	1300	410	18	3.6	70	1100	290	30	4
25	120	1500	390	37.5	7.5	100	1300	340	37.5	7.5	80	1000	210	24	4.8	70	890	230	37.5	5
Depth of Cut																				

(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 alloys and heat-resistant alloys 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 revolution and feed rate should be reduced proportionately, or set a lower depth of cut.
(Note 4) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

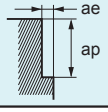
High Efficiency Cutting Conditions

(mm)

Work Material	Copper, Copper Alloy					Heat Resistant Alloys				
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae
1	130	40000	1800	1.5	0.3	40	13000	210	1.5	0.1
2	180	29000	2900	3	0.6	40	6400	230	3	0.2
3	180	19000	3000	4.5	0.9	40	4200	240	4.5	0.3
4	180	14000	3000	6	1.2	40	3200	240	6	0.4
5	180	11000	3000	7.5	1.5	40	2500	240	7.5	0.5
6	180	9500	3000	9	1.8	40	2100	250	9	0.6
8	180	7200	3000	12	2.4	40	1600	260	12	0.8
10	180	5700	2700	15	3	40	1300	290	15	1
12	180	4800	2300	18	3.6	40	1100	280	18	1.2
16	180	3600	1900	24	4.8	40	800	200	24	1.6
20	180	2900	1600	30	6	40	640	160	30	2
25	180	2300	1300	37.5	7.5	40	510	130	37.5	2.5
Depth of Cut										

General Purpose Cutting Conditions

(mm)

Work Material	Copper, Copper Alloy					Heat Resistant Alloys				
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	ae
1	130	40000	1300	1.5	0.3	30	9600	92	1.5	0.1
2	140	22000	1500	3	0.6	30	4800	110	3	0.2
3	140	15000	1600	4.5	0.9	30	3200	120	4.5	0.3
4	140	11000	1600	6	1.2	30	2400	120	6	0.4
5	140	8900	1600	7.5	1.5	30	1900	120	7.5	0.5
6	140	7400	1600	9	1.8	30	1600	130	9	0.6
8	140	5600	1600	12	2.4	30	1200	130	12	0.8
10	140	4500	1400	15	3	30	950	140	15	1
12	140	3700	1200	18	3.6	30	800	140	18	1.2
16	140	2800	1000	24	4.8	30	600	100	24	1.6
20	140	2200	780	30	6	30	480	81	30	2
25	140	1800	670	37.5	7.5	30	380	64	37.5	2.5
Depth of Cut										

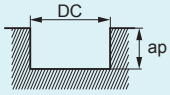
(Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
(Note 2) Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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 revolution and feed rate should be reduced proportionately, or set a lower depth of cut.
(Note 4) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

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.

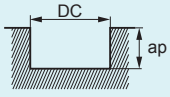
High Efficiency Cutting Conditions

(mm)

Work Material	Carbon Steel, Alloy Steel, Mild Steel				Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel				Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys				Precipitation Hardening Stainless Steel, Cobaly Chromium Alloy				Copper, Copper Alloy				Heat Resistant Alloys			
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap
2	150	24000	1200	2	120	19000	610	2	100	16000	640	2	60	9500	300	1	180	29000	1500	2	30	4800	130	0.6
3	150	16000	1500	3	120	13000	730	3	100	11000	660	3	60	6400	360	1.5	180	19000	1700	3	30	3200	150	0.9
4	150	12000	1900	4	120	9500	910	4	100	8000	700	4	60	4800	460	2	180	14000	2200	4	30	2400	170	1.2
5	150	9500	1900	5	120	7600	910	5	100	6400	720	5	60	3800	460	2.5	180	11000	2200	5	30	1900	170	1.5
6	150	8000	1900	6	120	6400	1000	6	100	5300	740	6	60	3200	510	3	180	9500	2300	6	30	1600	180	1.8
8	150	6000	1700	8	120	4800	960	8	100	4000	800	8	60	2400	480	4	180	7200	2000	8	30	1200	190	2.4
10	150	4800	1500	10	120	3800	840	10	100	3200	900	10	60	1900	420	5	180	5700	1800	10	30	950	210	3
12	150	4000	1300	12	120	3200	770	12	100	2700	860	12	60	1600	380	6	180	4800	1500	12	30	800	200	3.6
16	150	3000	1100	12	120	2400	670	12	100	2000	640	12	60	1200	340	8	180	3600	1300	12	30	600	150	4.8
20	150	2400	860	12	120	1900	530	12	100	1600	510	12	60	950	270	10	180	2900	1000	12	30	480	120	6
25	150	1900	760	12	120	1500	420	12	100	1300	420	12	60	760	210	12	180	2300	920	12	30	380	100	7.5
Depth of Cut	 DC : Dia.																							

General Purpose Cutting Conditions

(mm)

Work Material	Carbon Steel, Alloy Steel, Mild Steel				Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel				Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys				Precipitation Hardening Stainless Steel, Cobaly Chromium Alloy				Copper, Copper Alloy				Heat Resistant Alloys			
DC	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap	vc (m/min)	n (min^{-1})	vf (mm/min)	ap
1	100	32000	500	1	80	25000	250	1	80	25000	300	1	50	16000	150	0.5	120	38000	590	1	25	8000	67	0.3
2	100	16000	550	2	80	13000	270	2	60	9500	250	2	50	8000	170	1	120	19000	650	2	25	4000	74	0.6
3	100	11000	670	3	80	8500	310	3	60	6400	250	3	50	5300	200	1.5	120	13000	790	3	25	2700	86	0.9
4	100	8000	840	4	80	6400	410	4	60	4800	280	4	50	4000	250	2	120	9500	1000	4	25	2000	93	1.2
5	100	6400	840	5	80	5100	410	5	60	3800	280	5	50	3200	250	2.5	120	7600	1000	5	25	1600	95	1.5
6	100	5300	840	6	80	4200	440	6	60	3200	300	6	50	2700	290	3	120	6400	1000	6	25	1300	96	1.8
8	100	4000	740	8	80	3200	420	8	60	2400	320	8	50	2000	260	4	120	4800	890	8	25	990	100	2.4
10	100	3200	680	10	80	2500	360	10	60	1900	350	10	50	1600	230	5	120	3800	800	10	25	800	120	3
12	100	2700	570	12	80	2100	330	12	60	1600	340	12	50	1300	210	6	120	3200	680	12	25	660	110	3.6
16	100	2000	480	12	80	1600	300	12	60	1200	250	12	50	990	180	8	120	2400	570	12	25	500	84	4.8
20	100	1600	380	12	80	1300	240	12	60	950	200	12	50	800	150	10	120	1900	450	12	25	400	68	6
25	100	1300	340	12	80	1000	180	12	60	760	160	12	50	640	120	12	120	1500	400	12	25	320	50	7.5
Depth of Cut	 DC : Dia.																							

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