



Chapter of the reference mill

Milling—side in the issue and countermeasures

Problems	Reason	Countermeasures
1. Cutter blade small rapid collapse occurred	1. Improper installation tool	1. Suspended the installation of a minimum amount of stretching 2. Spring check whether Bush or Chuck aging wear, precision is not good, bad clip, Whether there is a glitch. The replacement of normal goods.
	2. Workpiece methods or tools to install anti-seismic measures are not taken into full proper installation tool	1. Enhance the work of the installation of rigid (the use of top oil, block, gaskets and so on, so that the workpiece or cutting under non-slip) 2. Sliding table to adjust the gap (to confirm whether the good side fixed block). 3. Check up and down the main shaft, the drive platform in the fixed-cutting in the reliability. 4. Survey of the machine tools used to avoid gear, shaft vibration system to produce the type of speed, appropriate adjustments to speed.
2. Breakdown of the cutting edge, severe damage	1. With the same edge of collapse small impact on larger, more superficial.	1. Lower feed, but also improve the speed will be better.
	2. Comparative load (to cut deep into ×), the cutter is too long	1. Increase the diameter of the cutter (by hanging under the stretch)
	3. Workpiece or tool to install unstable.	1. Is hanging tool to install the smallest stretch 2. Workpiece and the machine to install high-accuracy rigid as far as possible.
	4. Naked eye can hardly see the ground when the crack	1. With sharp resin binders diamond grinding wheel with not too high speed (1500m/min below) Wet grinding, with more than 10 times the microscope of scrutiny.
	5. Has not carbide cutter-side experience, have a primary error.	1. Downtime in the difficult conditions, to stop feeding, and then stop rotating (or lack of power tools as a result of load trip, should stop feeding). 2. Forget to check tightening screws and pressed Lease block. 3. Cutting edge wear too serious before replacement. 4. Special attention to fast-forward, can not go wrong. 5. Please note that folder machine tool rotary direction is correct. 6. Do not single-handedly arrested several at the same time, with the knife blade between the collision can not be prudent not to fall at the end of the loading and unloading.
3. Cutting in a serious impairment	1. Workpiece cut, cut out, feel all of a sudden change in direction, and so on, caused by the impact of changes in the load.	1. Lower feed (to local) 2. To reduce the installation time suspended the amount of stretch. 3. Necessary, to reduce the maximum length Duanren. 4. Bushing on. The holding chuck of the inspection.
	2. Cutting load is too large	1. To prevent the occurrence of excessive wear, the tool change in a timely manner. 2. To the cost of each and every blade into the volume. 3. To enter the same amount, to increase speed. 4. Reduce the depth of cut. 5. To raise or reduce speed to avoid a number of cutting-edge plug and eating crumbs. 6. Without cutting edge chamfering, corner of the neck to avoid cutting tools to reduce stress concentration. 7. To reduce the installation of hanging stretch, to avoid bad set of gripping chuck 8. Increase the cutting fluid cluster of compressed air to enhance the ability Chip 9. Milling into the inverse cis-milling.
	3. Fatigue damage	1. Cutter cutting force cause the whole side of the bending stress, when more than 90kg/m m, welding-end steel cutter body stress over 50kg/m m occasion of the recutting, after a total of 10 (2000 to x 8 hours) over the use of the possibility of a fatigue failure, should be the replacement of the previous blade.
4. Poor surface	1. Cutter cutting force changes in the flexibility to restore or change is intermittent and the edge of the state of stress differences	1. Lower feed. 2. Reduce the depth of cut. 3. Shun the milling milling try to reverse. 4. Helix angle increased. 5. Increase the number edge. 6. Reduce the long edge. 7. Enhance the cutting edge of precision beat. 8. Edge in sharp decline over time prior to the ATC
	2. Have a flutter	1. Lower speed (speed). But there are also some increase in speed will be good. 2. Enhance the feed but 0.04mm/blade to be lowered more than try. 3. Workpiece increase in the installation of rigid. 4. Tool to improve the installation of rigid (reducing stretch Suspended, firmly clamp). 5. Ranging from sub-tool use.
5. Machining accuracy bad	1. Radial cutting volume settings, took place to eat edge	1. Allowance reduced. 2. Inverse change for the milling milling-shun. 3. Speed increases to improve the sharp edge of reality. 4. Tool to improve the installation of rigid (reducing stretch suspended, firmly clamp), suspended, firmly clamp). 5. Ranging from sub-tool use.
	2. Cutter-side tilt, the vertical surface difference. Let occurred knife	1. Allowance reduced. 2. Speed to raise 3. Reduce feed 4. Blade increase in the number 5. Tool to improve the installation of rigid (reducing stretch suspended, firmly clamping) 6. Edge in sharp decline over time prior to the Attached. 7. Was for the actual processing side of the inclined to choose the appropriate amount of the cone back, on the peripheral edge tool for grinding.

480

580

600

650

600G

650G

铝用
500铝用
600

参数

Tool Material

UFM
ultra-fine particles

Ultra-fine particles
88.3 percent cobalt tungsten steel 10.2% other 1.5%
Hardness of 93.0±0.5
Bending strength > 4200Mpa
Grain size of 0.5µm

SMG

ultra-fine particles

Ultrafine particles
90% of the cobalt-tungsten steel 10%
Hardness of 92.0±0.5
Bending strength > 3800Mpa
Grain size of 0.8µm

Processing materials

<35HRC Ordinary steel
cast steel S45C, S50C, S55C, S5400, SCM
<52HRC Pre-hardening steel
hardening steel NAK hardening steel SKD, SKS SKH51, Dc53

<45HRC Ordinary steel
pre-hard steel S45C, S50C, S55C, S5400, SCM


ALU aluminum alloy
C/B Copper
GG(G) cast iron
SUS300 stainless steel
SUS400 stainless steel
Titanium alloy
Plastic hard plastic




銑刀篇之參考資料-切削數據表

Chapter of the reference mill-cutting data specification

1) 側面銑削 加長型2刃, 4刃 Side Milling-Extra Length Type 2/4 Flutes

加工形態 Shape of cut	 $A_e \leq 0.1D (D \leq \Phi 3)$ $A_e \leq 0.2D (D > \Phi 3)$ $A_p \leq 1.5D$						$A_e \leq 0.05D$ $A_p \leq 1.00D$		
	碳素鋼,鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼, 預硬鋼 Alloy steel, Die steel, Pre-hardened steel AISI H13, NAK (<45HRC)		淬火鋼 Hardened steel AISI H13 (<52HRC)		
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)	
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes
1	15000	300	450	10000	200	300	7500	60	90
2	7500	300	450	5000	200	300	4000	60	90
3	5000	300	450	3500	200	300	2500	60	90
4	3750	300	450	2600	200	300	2000	60	90
5	3000	300	450	2100	200	300	1600	60	90
6	2500	300	450	1750	200	300	1350	60	90
8	2000	260	390	1400	175	260	1000	55	80
10	1600	225	340	1100	150	225	800	50	70
12	1350	205	310	950	135	205	650	50	60
16	1000	180	275	700	115	175	500	65	85
20	800	160	245	550	110	170	400	55	70

2) 溝槽銑削 加長型2刃, 4刃 Slot Milling-Extra Length Type 2/4 Flutes

加工形態 Shape of cut	 $A_e = D (D \leq \Phi 3)$ $A_p \leq 0.1D (D < \Phi 2)$ $A_p \leq 0.2D (D \geq \Phi 2)$						$A_e = D$ $A_p \leq 0.05D (\Phi 0.5 \leq D \leq \Phi 2)$ $A_p \leq 0.10D (D > \Phi 2)$		
	碳素鋼,鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼, 預硬鋼 Alloy steel, Die steel, Pre-hardened steel AISI H13, NAK (<45HRC)		淬火鋼 Hardened steel AISI H13 (<52HRC)		
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)	
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes
1	15000	240	360	10000	160	240	7500	48	72
2	7500	240	360	5000	160	240	4000	48	72
3	5000	240	360	3500	160	240	2500	48	72
4	3750	240	360	2600	160	240	2000	48	72
5	3000	240	360	2100	160	240	1600	48	72
6	2500	240	360	1750	160	240	1350	48	72
8	2000	208	312	1400	140	208	1000	44	64
10	1600	180	272	1100	120	180	800	40	56
12	1350	164	248	950	108	164	650	40	48
16	1000	144	220	700	92	140	500	52	68
20	800	128	196	550	88	136	400	44	56

使用中的注意事項

1. 如果加工機械或工件安裝的剛性太差或在操作時會發出雜音, 請適度調降轉速或進給速度
2. 如果是突進方式加工, 請調降至1/3進給速度以下。
3. 切削不銹鋼時請用濕式加工, 如切削奧氏體不銹鋼時, 使用非水溶性切削液最有效果

Matters need attention in usage

1. If no good rigidity of the work piece, or noise happens when operating, please reduce the rotation rate or feed rate moderately.
2. If processing with sudden feed way, please reduce the feed rate to 1/3.
3. Please take the wet-type processing when cutting stainless steel. E.g. when cutting stainless steel of Austenite, the most efficient way is to use non-water-soluble cutting fluid.



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1) 側面銑削 標準型2刃, 4刃 Side Milling-Standard Type 2/4 Flutes

加工形態 Shape of cut	 $A_e \leq 0.1D (D \leq \Phi 3)$ $A_e \leq 0.2D (D > \Phi 3)$ $A_p \leq 1.5D$						$A_e \leq 0.05D$ $A_p \leq 1.00D$		
	加工材料 Work material		碳素鋼, 鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼, 預硬鋼 Alloy steel, Die steel, Pre-hardened steel AISI H13, NAK (<45HRC)		淬火鋼 Hardened steel AISI H13 (<52HRC)
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)	
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes
1	24000	480	720	16000	320	480	12000	96	144
2	12000	480	720	8000	320	480	6400	96	144
3	8000	480	720	5600	320	480	4000	96	144
4	6000	480	720	4160	320	480	3200	96	144
5	4800	480	720	3360	320	480	2560	96	144
6	4000	480	720	2800	320	480	2160	96	144
8	3200	416	624	2240	280	416	1600	88	128
10	2560	360	544	1760	240	360	1280	80	112
12	2160	328	496	1520	216	328	1040	80	96
16	1600	288	440	1120	184	280	800	104	136
20	1280	256	392	880	176	272	640	88	112

480

580

600

650

600G

2) 溝槽銑削 標準型2刃, 4刃 Slot Milling-Standard Type 2/4 Flutes

加工形態 Shape of cut	 $A_e = D (D \leq \Phi 3)$ $A_p \leq 0.1D (D < \Phi 2)$ $A_p \leq 0.2D (D \geq \Phi 2)$						$A_e = D$ $A_p \leq 0.05D (\Phi 0.5 \leq D \leq \Phi 2)$ $A_p \leq 0.10D (D > \Phi 2)$		
	加工材料 Work material		碳素鋼, 鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼, 預硬鋼 Alloy steel, Die steel, Pre-hardened steel AISI H13, NAK (<45HRC)		淬火鋼 Hardened steel AISI H13 (<52HRC)
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)	
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes
1	24000	384	576	16000	256	384	12000	77	116
2	12000	384	576	8000	256	384	6400	77	116
3	8000	384	576	5600	256	384	4000	77	116
4	6000	384	576	4160	256	384	3200	77	116
5	4800	384	576	3360	256	384	2560	77	116
6	4000	384	576	2800	256	384	2160	77	116
8	3200	333	500	2240	224	333	1600	71	103
10	2560	288	436	1760	192	288	1280	64	90
12	2160	363	397	1520	173	263	1040	64	77
16	1600	231	352	1120	148	224	800	84	109
20	1280	205	314	880	141	218	640	71	90

650G

鋁用
500

鋁用
600

参数

使用中的注意事項

1. 如果加工機械或工件安裝的剛性太差或在操作時會發出雜音, 請適度調降轉速或進給速度
2. 如果是突進方式加工, 請調降至1/3進給速度以下。
3. 切削不銹鋼時請用濕式加工, 如切削奧氏體不銹鋼時, 使用非水溶性切削液最有效

Matters need attention in usage

1. If no good rigidity of the work piece, or noise happens when operating, please reduce the rotation rate or feed rate moderately.
2. If processing with sudden feed way, please reduce the feed rate to 1/3.
3. Please take the wet-type processing when cutting stainless steel. E.g. when cutting stainless steel of Austenite, the most efficient way is to use non-water-soluble cutting fluid.



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1) 側面銑削 加長型2刃, 4刃 Side Milling-Extra Length Type 2/4 Flutes

加工材料 Work material	加工形態 Shape of cut														
	 $A_e \leq 0.1D (D \leq \Phi 3)$ $A_e \leq 0.2D (D > \Phi 3)$ $A_p \leq 1.5D$														
	鋁合金, 銅 Aluminum Alloy, cuprum				碳素鋼, 鑄鐵 Carbon steel, Castiron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼 Alloy steel, Die steel (<35HRC)				不銹鋼 Stainless steel AISI1304, AISI1316		
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)				
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes			
1	19000	50	300	10000	60	120	6000	35	70	5000	30	60			
2	11000	220	400	5500	90	135	3600	55	85	3000	45	70			
3	8500	240	435	4250	100	150	2650	65	100	2200	55	85			
4	7000	365	550	3600	180	270	2200	110	165	1850	90	135			
5	6000	430	650	3000	190	185	1800	115	175	1500	95	145			
6	5500	495	750	2650	210	315	1600	120	180	1350	105	160			
8	4000	500	750	2000	225	340	1200	120	180	1000	110	165			
10	3200	450	675	1600	195	295	950	95	145	800	95	145			
12	2560	370	550	1350	165	250	800	80	120	650	75	115			
16	2000	280	420	1000	120	180	600	60	90	500	60	90			
20	1600	225	340	800	100	150	500	50	75	400	48	70			

2) 溝槽銑削 加長型2刃, 4刃 Slot Milling-Extra Length Type 2/4 Flutes

加工材料 Work material	加工形態 Shape of cut														
	 2刃 $A_e=D$ $A_p \leq 0.1D (D < 2)$ $A_p \leq 0.3D (\Phi 2 \leq D \leq \Phi 3)$ $A_p \leq 0.5D (D > \Phi 3)$ 4刃 $AE=D$ $A_p \leq 0.3D (D \leq \Phi 3)$ $A_p \leq 0.5D (D > \Phi 3)$														
	鋁合金, 銅 Aluminum Alloy, cuprum				碳素鋼, 鑄鐵 Carbon steel, Castiron AISI1049, SCM, FC250 (~30HRC)				合金鋼, 模具鋼 Alloy steel, Die steel (<35HRC)				不銹鋼 Stainless steel AISI1304, AISI1316		
直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)		轉速 Rev(min ⁻¹)	切削速度Cutting speed(mm/min)				
		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes		2刃 2 Flutes	4刃 4 Flutes			
1	19000	150	240	10000	60	96	6000	35	56	5000	30	48			
2	11000	220	320	5500	90	108	3600	55	68	3000	45	56			
3	8500	240	350	4250	100	120	2650	65	80	2200	55	68			
4	7000	290	440	3600	145	216	2200	90	132	1500	55	108			
5	6000	345	520	3000	150	228	1800	90	140	1200	55	116			
6	5500	395	600	2650	170	252	1600	95	144	1100	65	128			
8	4000	400	600	2000	180	272	1200	95	144	800	65	132			
10	3200	360	540	1600	155	236	950	75	116	650	55	116			
12	2650	295	440	1350	130	200	800	65	96	500	45	92			
16	2000	225	336	1000	95	144	600	50	72	400	35	72			
20	1600	180	272	800	80	120	500	40	60	320	30	56			

使用中的注意事項

1. 如果加工機械或工件安裝的剛性太差或在操作時會發出雜音, 請適度調降轉速或進給速度
2. 如果是突進方式加工, 請調降至1/3進給速度以下。
3. 切削不銹鋼時請用濕式加工, 如切削奧氏體不銹鋼時, 使用非水溶性切削液最有效果

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加工形態 Shape of cut	 $Ae \leq 0.1D (D \leq \Phi 3)$ $Ae \leq 0.2D (D > \Phi 3)$ $Ap \leq 1.5D$											
	直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	鋁合金, 銅 Aluminum Alloy, cuprum		碳素鋼, 鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)		合金鋼, 模具鋼 Alloy steel, Die steel (<35HRC)		不銹鋼 Stainless steel AISI1304, AISI1316			
			2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes
1	30400	240	480	16000	96	192	9600	56	112	8000	48	96
2	17600	352	640	8800	144	216	5760	88	136	4800	75	112
3	13600	384	696	6800	160	240	4240	104	160	3520	88	136
4	11200	584	880	5760	288	432	3520	176	264	2960	144	216
5	9600	688	1040	4800	304	456	2880	184	280	2400	152	232
6	8800	792	1200	4240	336	504	2560	192	288	2160	168	256
8	6400	800	1200	3200	360	544	1920	192	288	1600	176	264
10	5120	720	1080	2560	312	472	1520	152	232	1280	152	232
12	4240	592	880	2160	264	400	1280	128	192	1040	120	184
16	3200	448	672	1600	192	288	960	96	144	800	96	144
20	2560	360	544	1280	160	240	800	80	120	640	76	112

480


580

600

650

600G

2) 溝槽銑削 標準型2刃, 4刃 Slot Milling-Standard Type 2/4 Flutes

加工形態 Shape of cut	 2刃 $Ae = D$ $Ap \leq 0.1D (D < 2)$ $Ap \leq 0.3D (\Phi 2 \leq D \leq \Phi 3)$ $Ap \leq 0.5D (D > \Phi 3)$ 4刃 $AE = D$ $Ap \leq 0.3D (D \leq \Phi 3)$ $Ap \leq 0.5D (D > \Phi 3)$											
	直徑 ΦD (mm)	轉速 Rev(min ⁻¹)	鋁合金, 銅 Aluminum Alloy, cuprum		碳素鋼, 鑄鐵 Carbon steel, Cast iron AISI1049, SCM, FC250 (~30HRC)		合金鋼, 模具鋼 Alloy steel, Die steel (<35HRC)		不銹鋼 Stainless steel AISI1304, AISI1316			
			2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes	4刃 4 Flutes	轉速 Rev(min ⁻¹)	2刃 2 Flutes
1	30400	240	384	16000	96	154	9600	56	90	8000	48	77
2	17600	352	512	8800	144	173	5760	88	109	4800	72	90
3	13600	384	560	6800	160	192	4240	104	128	3520	88	109
4	11200	464	704	5760	232	346	3520	144	212	2400	88	173
5	9600	552	832	4800	240	365	2880	144	224	1920	88	186
6	8800	632	960	4240	272	404	2560	152	231	1760	104	205
8	6400	640	960	3200	288	436	1920	152	231	1280	104	212
10	5120	576	864	2560	248	378	1520	120	186	1040	88	186
12	3200	472	704	2160	208	320	1280	104	154	800	72	148
16	2560	360	538	1600	152	231	960	80	116	640	56	116
20	2000	288	736	1280	128	192	800	64	96	512	48	90

650G

鋁用
500鋁用
600

参数

使用中的注意事項

1. 如果加工機械或工件安裝的剛性太差或在操作時會發出雜音, 請適度調降轉速或進給速度
2. 如果是突進方式加工, 請調降至1/3進給速度以下。
3. 切削不銹鋼時請用濕式加工, 如切削奧氏體不銹鋼時, 使用非水溶性切削液最有效

Others need attention in usage

1. If no good rigidity of the work piece, or noise happens when operating, please reduce the rotation rate or feed rate moderately.
2. If processing with sudden feed way, please reduce the feed rate to 1/3.
3. Please take the wet-type processing when cutting stainless steel. E.g. when cutting stainless steel of Austenite, the most efficient way is to use non-water-soluble cutting fluid.