

P.F-S 系列 ROTARY HYDRAULIC CYLINDERS

(薄型) 高速中空油壓迴轉缸

SUPER HIGH SPEED HOLLOW
ROTARY HYDRAULIC CYLINDERS

操作說明書 INSTRUCTION MANUAL ORIGINAL INSTRUCTION

重要

機械操作人員在使用油壓缸前，請詳閱操作說明書，以確保操作安全。

Important

For ensuring correct and safe operation, read all operating instructions carefully before attempting to use the cylinder.

請詳閱手冊內容並善加保存
Please Read And Keep This Manual.

千島精密夾盤



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◎ 重要說明，請妥善保管

Please read and keep this manual for future reference.

當您在使用本項產品之前，請先詳細閱讀本文說明及注意事項，以確保您的安全和正確的使用，尤其特別標示之說明。

For ensuring the safe and correct use of this product, please read and pay attention to all the instructions and keep this manual with care so that it can be retrieved whenever needed.

警告標誌說明

Safety alert symbols and signal words



未依照此標示的說明，將產生立即的危險和重大的傷害或死亡。

Indicates an imminently hazardous situation of which, if not avoided, will result in death or serious injury.



未依照此標示的說明，將引起潛在的危險和重大的傷害或死亡。

Indicates a potentially hazardous situation of which, if not avoided, will result in death or moderate injury.



未依照此標示的說明，將引起潛在的危險和中度的傷害或死亡。

Indicates a potentially hazardous situation of which, if not avoided, may result in minor or moderate injury.

留意標誌說明

Important symbols and signal words



依照此標示的說明，充分了解本產品性能，可避免因誤解而產生錯誤的操作。

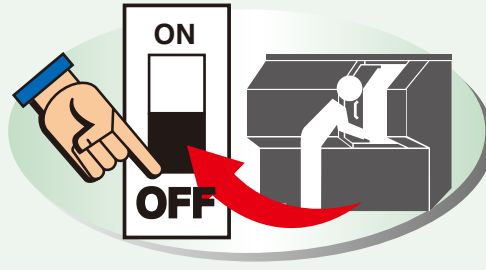
Instructions for chuck performance and avoiding errors or mistakes.

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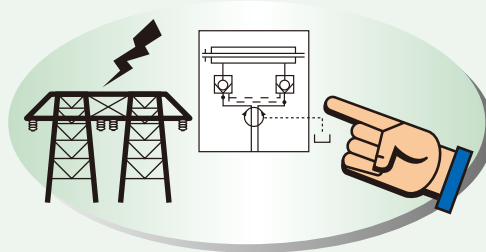
在安裝、檢查或維護保養油壓缸時，應關掉所有電源，確保操作者安全。
The power should be off to ensure the safety of the operator during the installation, inspection or maintenance of the cylinder.

電源未關閉
易發生人員身體傷害
及衣服被捲入的危險。
Danger of being caught
inside a machine.



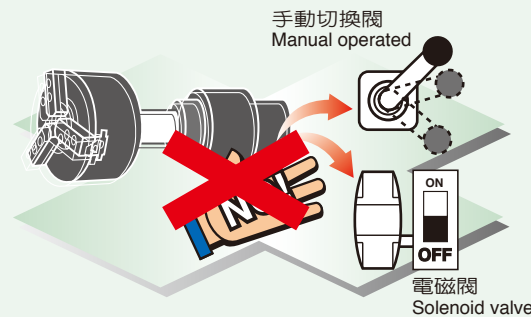
中空油壓缸的內藏式止逆閥，在停電情況下仍可保持夾持狀態，並請搭配使用停電仍可保持夾持迴路之電磁閥。
The built-in lock/relief valve of the hollow cylinder can keep the gripping force when power is interrupted, but the route solenoid valve needs to be installed as well.

使用無止逆閥裝置的油缸，
在斷電時易造成
工件瞬間飛散的危險。
Using the cylinder without lock/relief valve is
easy to cause the danger of the workpiece
scattering when the power is interrupted.



當主軸旋轉時，不可關掉泵浦的電源，更不可操作切換閥。
Do not turn off the power of the pump and operate the switch valve when the spindle rotating.

易造成
夾持力喪失，
工作物有飛散之危險。
The gripping force will lose and
clamped workpieces will scatter.

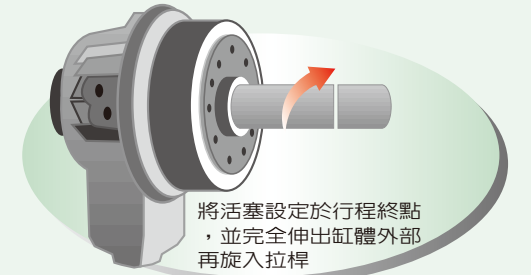


拉桿請依標準扭矩鎖緊。
Tighten the draw bar with the specified torque.

拉桿鬆脫
將導致工作物飛散之危險。
The loose draw bar
will induce the
danger of the
workpiece scattering.



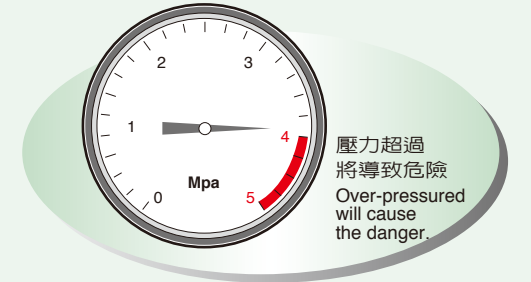
Cylinder Type	Clamping Torque
P0928	90N·m(9.18kgf·m)
P1036	100N·m(10.2kgf·m)
P1246	150N·m(15.3kgf·m)
P1552	280N·m(28.6kgf·m)
P1875	340N·m(34.7kgf·m)
P2091	380N·m(38.7kgf·m)
P2511	500N·m(50.9kgf·m)
P2916	700N·m(71.4kgf·m)
P3420	850N·m(86.7kgf·m)



將活塞設定於行程終點，
並完全伸出缸體外部
再旋入拉桿
Set the piston at the end of the stroke and
outside the cylinder, then tighten the draw bar.

請依照夾頭規格設定油壓壓力。
Set the hydraulic pressure to the chuck specification.

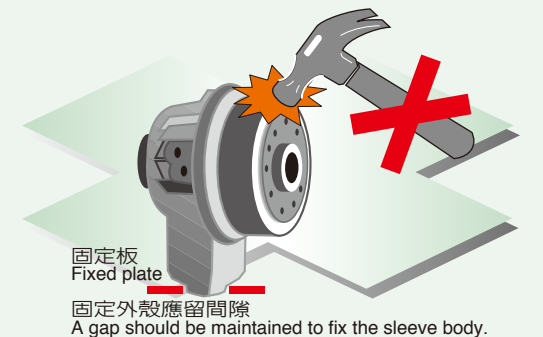
油壓壓力過大，
將導致夾頭破損，
工作物有飛散之危險。
Too much hydraulic pressure will cause the
damage of the chuck and the danger of the
workpiece scattering.



壓力超過
將導致危險
Over-pressured
will cause
the danger.

油壓缸請勿隨意敲擊或施加週邊任何外力。（外殼固定時，勿鎖死）
Do not strike or apply external force on the cylinder randomly. (do not fixed the sleeve body permanently)

敲擊油缸
將導致零件破損，
使油缸卡死造成人員傷害。
Strike on the cylinder will damage the parts,
and seize the cylinder to injure the operator.

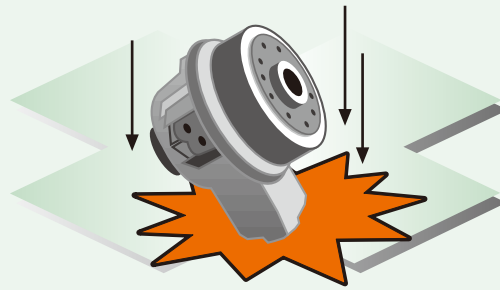


固定板
Fixed plate
固定外殼應留間隙
A gap should be maintained to fix the sleeve body.

油壓缸摔落或受到碰撞的損壞，勿再使用。
Do not use the cylinder damaged by dropping or striking.

油壓缸破損
將造成工作物飛散之危險。

The damage of the cylinder will cause
the danger of the workpiece scattering.



使用油壓缸需加防護罩。

A cover should be installed to use the cylinder.

迴轉中的油壓缸
易發生身體及衣物，
被捲入的危險。

The body and clothing can be engulfed
by the rotating cylinder.

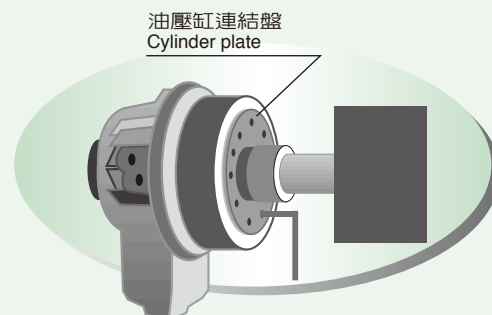


連結螺絲請依照標準扭矩鎖緊。（參照第廿一頁）

Tighten the mounting screws with the specified torque. (ref. to page 21)

鎖緊力太大或不足
將造成油壓缸損壞，
工作物有飛散之危險。

Too much or insufficient torque will cause
the damage of the cylinder and the
danger of the workpiece scattering.

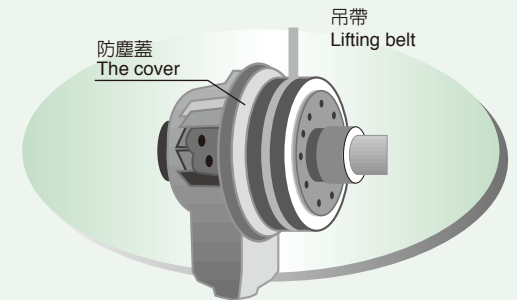


欲拆裝油壓缸時，請使用吊帶。

Use the lifting belt to disassemble the cylinder.

未使用吊帶，
掉落將造成危險。

Without using the lifting
belt can cause the danger
of dropping.

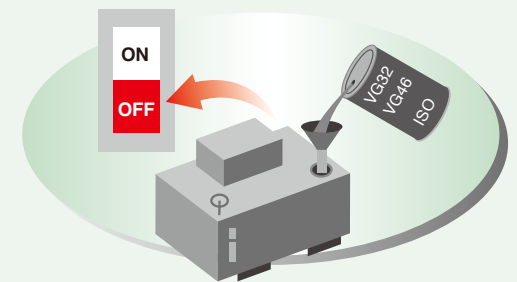


供應油壓油時，須先關掉電源。

Turn off the power before supplying the hydraulic oil.

油壓油供應不足時，
將造成油壓缸作動速度變慢、推力不足，
工作物有飛散之危險。

Insufficient hydraulic oil will reduce the operation
speed and input force of the cylinder, and cause
the danger of the workpiece scattering.

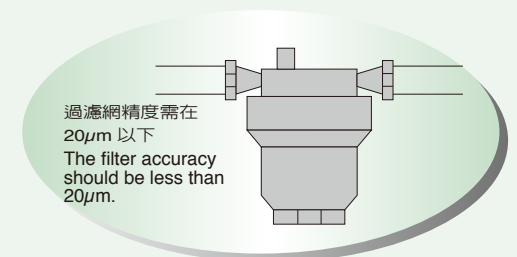


油壓系統需裝置過濾器。

A filter should be installed on the hydraulic system.

如果雜質進入，
將使油壓缸阻塞，喪失功能，
導致工作物飛散之危險。

The foreign object will seize the cylinder to
lose the function and cause the danger of
the workpiece scattering.



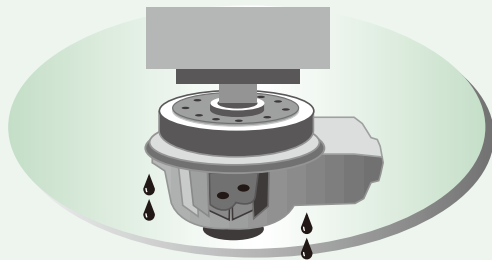


油壓缸勿倒立安裝。

Do not install the cylinder upsidedown.

倒立安裝會造成漏油現象，導致人員滑倒之危險。

Install upsidedown will cause the oil leakage and personnel slipped.

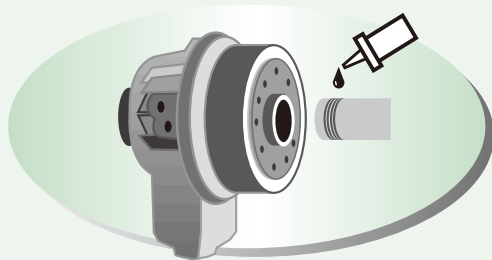


拉桿螺牙部位需塗上防鬆劑，並依照標準扭矩鎖緊。

Apply the loctite on the thread of the draw bar and tighten with the specified torque.

如拉桿鬆開造成夾頭行程不足，將導致工作物夾持不良造成危險。

The insufficient stroke of the chuck induced by the loose draw bar will cause the danger of gripping poorly.

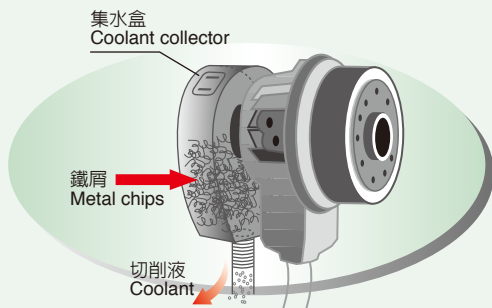


油壓缸後面加裝集水盒時，應定期檢查清除鐵屑，保持切削液的暢通。

When the coolant collector install at the rear of the cylinder, the metal chips should be cleaned periodically to keep the coolant unclogged.

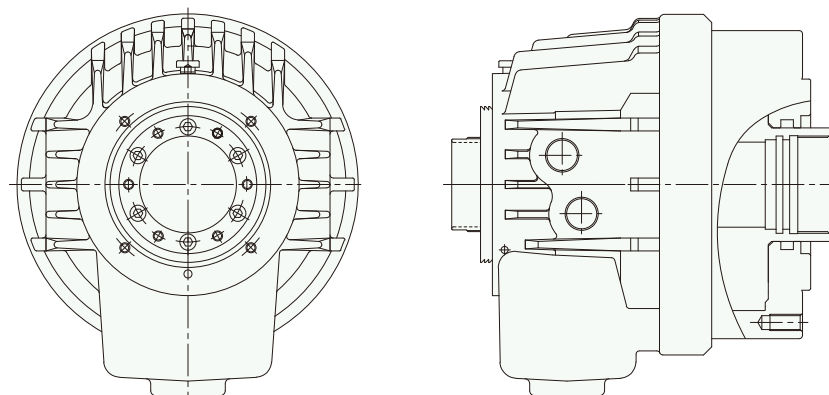
阻塞的切削液將溢入油壓缸，造成油壓箱內油水混合損壞機械。

The clogged coolant will spill into the cylinder, and cause the damage of the mechanism.



高速中空油壓迴轉缸

SUPER HIGH SPEED HOLLOW ROTARY HYDRAULIC CYLINDERS



規格表 (Specifications) :

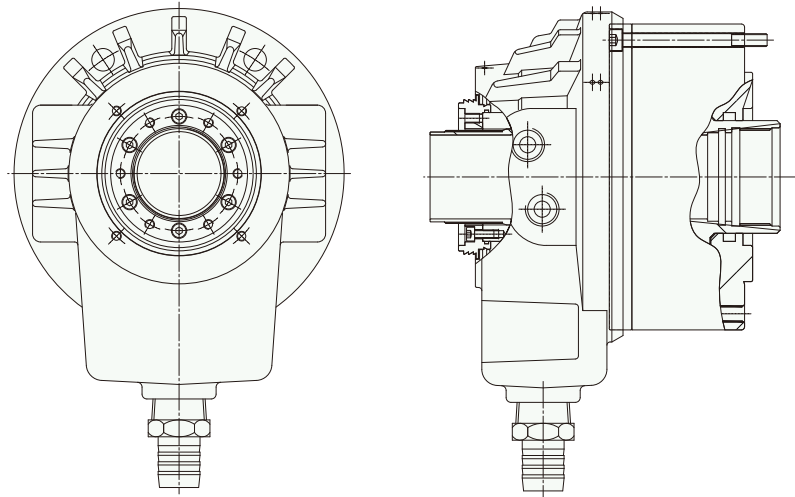
機型 Type	高速中空油壓迴轉缸 Super high hollow rotary hydraulic cylinders											
型式 Model	P0928	P1036	P1246	P1552	P1875	P1878	P2091	P2093	P2511	P2916	P3420	
活塞行程 Piston stroke (mm)	10	15	15	22	25	25	30	30	30	30	42	
活塞面積 Piston area (cm ²)	推力側 Pull side	54	70	100	160	198	198	252	252	348	391	510
	拉力側 Pull side	47.5	68	89	150	183	178	235	226	336	361	474
最大推(拉)力 Max. Operating force KN (kgf)	推力 Push side	19.6 (2000)	24.5 (2500)	36.2 (3700)	57.8 (5900)	67.6 (6900)	67.6 (6900)	80.4 (8200)	80.4 (8200)	115.7 (11800)	114.7 (11700)	140.2 (14300)
	拉力 Pull side	17.2 (1750)	23.5 (2400)	31.3 (3200)	53.9 (5500)	62.7 (6400)	60.8 (6200)	75.5 (7700)	72.5 (7400)	111.7 (11400)	103 (10500)	130.4 (13300)
最高使用壓力 Max. Pressure Mpa (kgf/cm ²)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.9 (40)	3.7 (38)	3.6 (35)	
流量 Oil leakage rate (l / min)	3.0	3.0	3.0	3.9	4.2	4.2	4.5	4.5	7.0	11	14	
最高迴轉數 Max. Speed r.p.m.(min ⁻¹)	8000	8000	7000	6200	4700	4700	3800	3800	2800	2000	1600	
淨重 Weight (kg)	6.5	9.0	11.9	17.3	26.4	25.5	37	32.9	56.1	96.1	138.5	
通孔直徑 Thru-hole (diameter) mm	28	36	46	52	75	78	91	93	120.1	166.5	205	
搭配夾頭型號 Matching chuck	OP-204 OPT-204	OP-205 OPT-205	OP-206 OPT-206	OP-208 OPT-208	OP-210 OPT-210	OP-210BH OPT-210BH	OP-212 OPT-212	OP-212BH OPT-212BH	OP-215 OPT-215	OPB-215 OPB-218	OP-221 OPT-224	
									OP-215 OPT-215		OP-218 OPT-218	

1KN=101.97kgf, 1Mpa=10.197 kgf/cm²

• 流量測試標準-壓力:30kgf/cm²(2.94Mpa) 油溫:50°C
• Test standard of oil leakage: Pressure-30 kgf/cm²(2.94Mpa), Oil temperature-50°C

薄型高速中空油壓迴轉缸

HIGH SPEED COMPACT HOLLOW ROTARY HYDRAULIC CYLINDERS



規格表 (Specifications) :

機型 Type		薄型高速中空油壓迴轉缸 High speed compact hollow rotary hydraulic cylinders				
型式 Model		F1033S	F1036S	F1246S	F1552S	F1875S
活塞行程 Piston stroke (mm)		15	15	15	22	25
活塞面積 Piston area (cm ²)	推力側 Push side	74	70	100	160	198
	拉力側 Pull side	70	68	89	150	183
最大推(拉)力 Max. Operating force KN (kgf)	推力 Push side	25.5 (2600)	24.5 (2500)	36.2 (3700)	57.8 (5900)	70.5 (7200)
	拉力 Pull side	24.5 (2500)	23.5 (2400)	31.3 (3200)	53.9 (5500)	65.6 (6700)
最高使用壓力 Max. Pressure	Mpa	3.9	3.9	3.9	3.9	3.9
	(kgf/cm ²)	(40)	(40)	(40)	(40)	(40)
流量 Oil leakage rate (l / min)		3.0	3.0	3.0	3.9	4.2
最高迴轉數 Max. Speed r.p.m.(min ⁻¹)		8000	8000	7000	6200	4700
淨重 Weight (kg)		8.2	8.4	11.5	15.4	22.9
通孔直徑 Thru-hole (diameter)mm		33	36	46	52	75
搭配夾頭型號 Matching chuck		OP-205 OPT-205	OP-205 OPT-205	OP-206 OPT-206 OPF-206	OP-208 OPT-208 OPF-208	OP-210 OPT-210 OPF-210

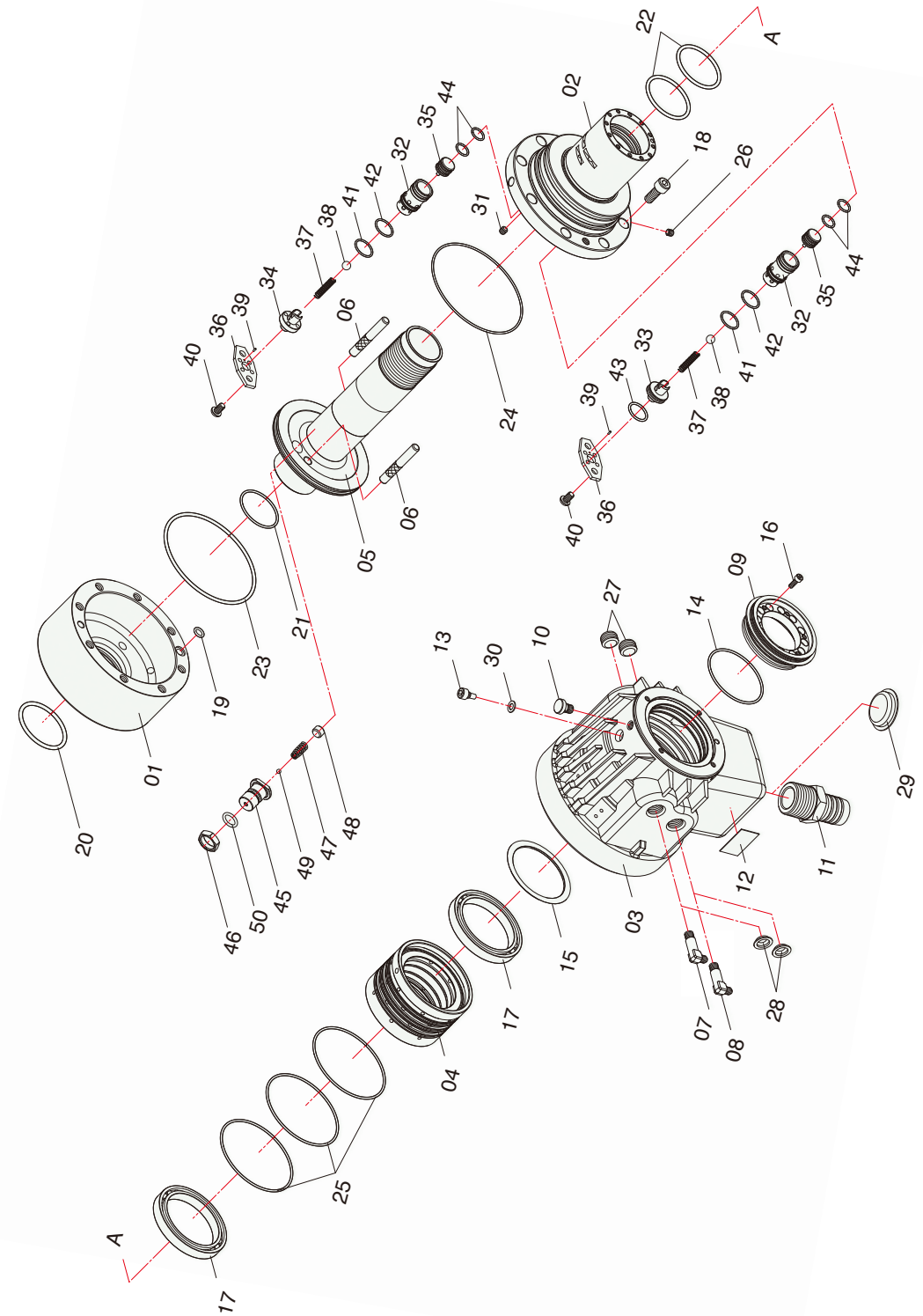
1KN=101.97kgf, 1Mpa=10.197 kgf/cm²

• 流量測試標準-壓力:30kgf/cm²(2.94Mpa) 油溫:50°C
• Test standard of oil leakage: Pressure-30 kgf/cm²(2.94Mpa), Oil temperature-50°C

中空油壓迴轉缸零件圖

Hollow rotary hydraulic cylinders detailed drawing

P type



中空油壓迴轉缸零件表

Super high speed hollow rotary hydraulic cylinders parts list

P type

零件表 (Parts list)

No. 零件名稱	Name	Q'ty							
		P0928	P1036	P1246	P1552	P1875 P1878	P2091 P2093	P2511 P2916	P3420
1 缸體	Cylinder	1	1	1	1	1	1	1	1
2 迴轉閥	Rotary valve	1	1	1	1	1	1	1	1
3 外殼	Sleeve body	1	1	1	1	1	1	1	1
4 套筒	Sleeve	1	1	1	1	1	1	1	1
5 活塞	Piston	1	1	1	1	1	1	1	1
6 導銷	Guide pin	2	2	2	2	2	2	2	2
7 油管接頭	Hose fitting	1	1	1	1	1	1	1	1
8 油管接頭	Hose fitting	1	1	1	1	1	1	1	1
9 後固定環	Stopper	1	1	1	1	1	1	1	1
10 導氣螺絲	Air breather	1	1	1	1	1	1	1	1
11 洩油接頭	Hose fitting	1	1	1	1	1	1	1	1
12 名牌	Name Plate	2	2	2	2	2	2	2	2
13 套筒固定螺絲	Plug	1	1	1	1	1	1	1	1
14 O型環	O-Ring	1	1	1	1	1	1	1	1
15 緩衝片	Flintier	1	1	1	1	1	1	1	1
16 固定環螺絲	Hexagon socket head cap screw	8	12	12	6	6	12	6	6
17 軸承	Bearing	2	2	2	2	2	2	2	2
18 缸體固定螺絲	Hexagon socket head cap screw	12	8	12	16	12	16	16	16
19 O型環	O-Ring	1	1	1	1	1	1	1	1
20 O型環	O-Ring	1	1	1	1	1	1	1	1
21 O型環	O-Ring	1	1	1	1	1	1	1	1
22 O型環	O-Ring	2	2	2	2	2	2	2	2
23 O型環	O-Ring	1	1	1	1	1	1	1	1
24 O型環	O-Ring	1	1	1	1	1	1	1	1
25 O型環	O-Ring	3	3	3	3	3	3	3	3
26 油栓螺絲	Plug	1	1	1	1	1	1	1	1
27 油栓螺絲	Plug	2	2	2	2	2	2	2	2
28 塑膠蓋	Nylon Cap	2	2	2	2	2	2	2	2
29 塑膠蓋	Nylon Cap	1	1	1	1	1	1	1	1
30 塑膠墊片	Seal Washer	1	1	1	1	1	1	1	1
31 油栓螺絲	Plug	4	4	4	4	4	4	4	4
32 引導止迴閥閥體	Housing	2	2	2	2	2	2	2	2
33 頂銷 A	Retainer(A)	1	1	1	1	1	1	1	1
34 頂銷 B	Retainer(B)	1	1	1	1	1	1	1	1
35 柱塞	Pilot spool	2	2	2	2	2	2	2	2
36 止推片	Plate	2	2	2	2	2	2	2	2
37 彈簧	Spring	2	2	2	2	2	2	2	2
38 鋼珠	Steel ball	2	2	2	2	2	2	2	2
39 固定銷	Spring pin	2	2	2	2	2	2	2	2
40 止推片固定螺絲	Hexagon socket head cap screw	4	4	4	4	4	4	4	4

No. 零件名稱	Name	Q'ty							
		P0928	P1036	P1246	P1552	P1875 P1878	P2091 P2093	P2511 P2916	P3420
41 O型環	O-Ring	2	2	2	2	2	2	2	2
42 O型環	O-Ring	2	2	2	2	2	2	2	2
43 O型環	O-Ring	1	1	1	1	1	1	1	1
44 O型環	O-Ring	4	4	4	4	4	4	4	4
45 安全閥閥體	Housing	--	--	--	--	2	2	2	2
46 安全閥螺母	Nut	--	--	--	--	2	2	2	2
47 安全閥彈簧	Spring	--	--	--	--	2	2	2	2
48 安全閥螺絲	Hexagon socket headless head set screw	--	--	--	--	2	2	2	2
49 鋼珠	Steel Ball	--	--	--	--	2	2	2	2
50 O型環	O-Ring	--	--	--	--	2	2	2	2

消耗零件 (Consumable parts)

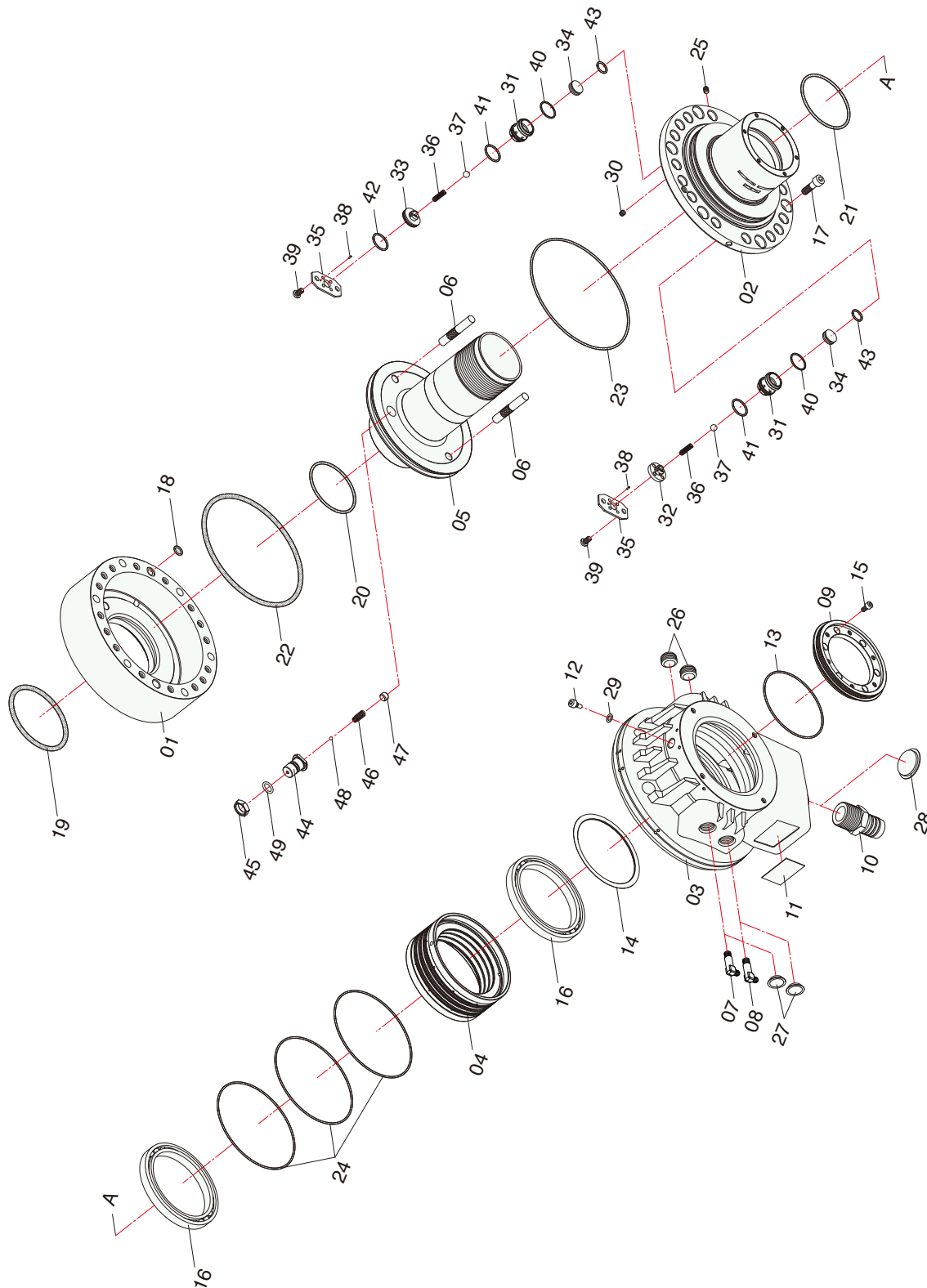
No.	Name	P0928	P1036	P1246	P1552	P1875	P1878
14	O-Ring	S50	S60	S70	S80	S105	S105
19	O-Ring	P7	P8	P8	P10	P10	P10
20	O-Ring	P45	P48	P65	P70	P95	AS568-344
21	O-Ring	S34	S38	G50	G55	G80	AS568-152
22	O-Ring	G35	G45	JASO 2053	G60	G85	G85
23	O-Ring	G85	G100	G120	P145	G170	G170
24	O-Ring	S85	AS568-45	G120	AN6230-34	AN6230-39	AN6230-39
25	O-Ring	S70	S80	S95	S105	G135	G135
41	O-Ring	S18	S18	S22	S22	S22	S22
42	O-Ring	S18	S18	JASO 1021	JASO 1021	JASO 1021	JASO 1021
43	O-Ring	JASC 1018	JASO 1018	JASO 1022	JASO 1022	JASO 1022	JASO 1022
44	O-Ring	S12	S12	JASO 1013	JASO 1013	JASO 1013	JASO 1013
50	O-Ring	--	--	--	--	P12	P12

No.	Name	P2091	P2093	P2511	P2916	P3420
14	O-Ring	S120	S120	AS568-164	G220	G260
19	O-Ring	P10	P10	P10	P11	P11
20	O-Ring	P110	P115	P140	P195	P235
21	O-Ring	G95	G100	G125	AS568-262	G210
22	O-Ring	G100	G100	G135	G185	G225
23	O-Ring	G195	G195	P235	P275	P325
24	O-Ring	AN6230-43	AN6230-43	AN6230-50	G280	G330
25	O-Ring	G150	G150	G200	G275	G325
41	O-Ring	S22	S22	JASO 1023	JASO 1023	JASO 1023
42	O-Ring	JASO 1021	JASO 1021	JASO 1023	JASO 1023	JASO 1023
43	O-Ring	JASO 1022	JASO 1022	S26	S26	S26
44	O-Ring	JASO 1013	JASO 1013	JASO 1015	JASO 1015	JASO 1015
50	O-Ring	P12	P12	P12	P12	P12

薄型中空油壓迴轉缸零件圖

High speed compact hollow rotary hydraulic cylinders detailed drawing

F-S type



薄型中空油壓迴轉缸零件表

High speed compact hollow rotary hydraulic cylinders parts list

F-S type

No.零件名稱	Name	Q'ty			No.零件名稱	Name	F1033S	
		F1033S	F1036S	F1552S			F1036S	F1875S
1 缸體	Cylinder	1	1	1	26 油栓螺絲	Plug	2	2
2 迴轉閥	Rotary valve	1	1	1	27 塑膠蓋	Nylon Cap	2	2
3 外殼	Sleeve body	1	1	1	28 塑膠蓋	Nylon Cap	1	1
4 套筒	Sleeve	1	1	1	29 塑膠墊片	Seal Washer	1	1
5 活塞	Piston	1	1	1	30 油栓螺絲	Plug	4	4
6 導銷	Guide pin	2	2	2	31 引導止迴閥閥體	Housing	2	2
7 油管接頭	Hose fitting	1	1	1	32 頂銷 A	Retainer(A)	1	1
8 油管接頭	Hose fitting	1	1	1	33 頂銷 B	Retainer(B)	1	1
9 後固定環	Stopper	1	1	1	34 柱塞	Pilot spool	2	2
10 洩油接頭	Hose fitting	1	1	1	35 止推片	Plate	2	2
11 名牌	Name Plate	2	2	2	36 彈簧	Spring	2	2
12 套筒固定螺絲	Plug	1	1	1	37 鋼珠	Steel ball	2	2
13 O 型環	O-Ring	1	1	1	38 固定銷	Spring pin	2	2
14 緩衝片	Flintier	1	1	1	39 止推片固定螺絲	Hexagon socket head cap screw	4	4
15 固定環螺絲	Hexagon socket head cap screw	6	12	6	40 O 型環	O-Ring	2	2
16 軸承	Bearing	2	2	2	41 O 型環	O-Ring	2	2
17 缸體固定螺絲	Hexagon socket head cap screw	12	12	16	42 O 型環	O-Ring	1	1
18 O 型環	O-Ring	1	1	1	43 O 型環	O-Ring	4	4
19 O 型環	O-Ring	1	1	1	44 安全閥閥體	Housing	--	2
20 O 型環	O-Ring	1	1	1	45 安全閥螺母	Nut	--	2
21 O 型環	O-Ring	1	1	1	46 安全閥彈簧	Spring	--	2
22 O 型環	O-Ring	1	1	1	47 安全閥螺絲	Hexagon socket headless head set screw	--	2
23 O 型環	O-Ring	1	1	1	48 鋼珠	Steel Ball	--	2
24 O 型環	O-Ring	3	3	3	49 O 型環	O-Ring	--	2
25 油栓螺絲	Plug	1	1	1				

消耗零件 (Consumable parts)

No.	Name	F1033S	F1036S	F1246S	F1552S	F1875S
13	O-Ring	S60	S60	S70	S80	S105
18	O-Ring	P8	P8	P8	P10	P10
19	O-Ring	P45	P48	P65	P70	P95
20	O-Ring	S35	S38	G50	G55	G80
21	O-Ring	G40	G45	JASO 2053	G60	G85
22	O-Ring	AS568-45	AS568-45	G120	P145	G170
23	O-Ring	G100	G100	G120	AN6230-34	AN6230-39
24	O-Ring	S80	S80	S95	S105	G135
40	O-Ring	S18	S18	S22	S22	S22
41	O-Ring	S18	S18	JASO 1021	JASO 1021	JASO 1021
42	O-Ring	JASO 1080	JASO 1080	JASO 1022	JASO 1022	JASO 1022
43	O-Ring	S12	S12	JASO 1013	JASO 1013	JASO 1013
49	O-Ring	--	--	--	--	P12

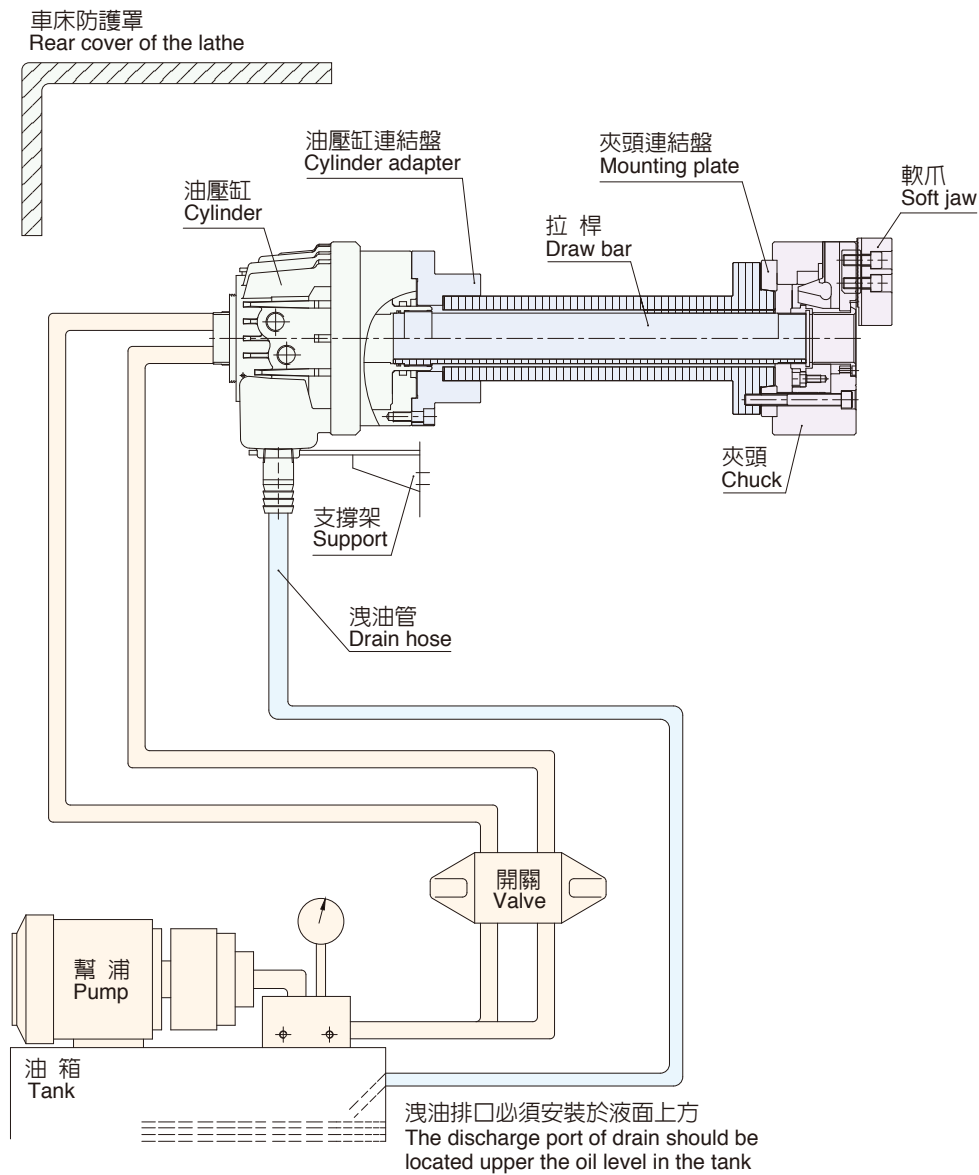
4-1 中空油壓迴轉缸安裝概要

The installation outline of the hollow rotary hydraulic cylinder

首先將中空油壓夾頭安裝於主軸的前端，高速中空油壓迴轉缸裝於後方，而二者以拉桿來連接。
Install the hollow hydraulic chuck to the front end of the lathe spindle first, then install the high speed rotary hydraulic cylinder to the rear end, and draw bar connects both units.

CAUTION
注意

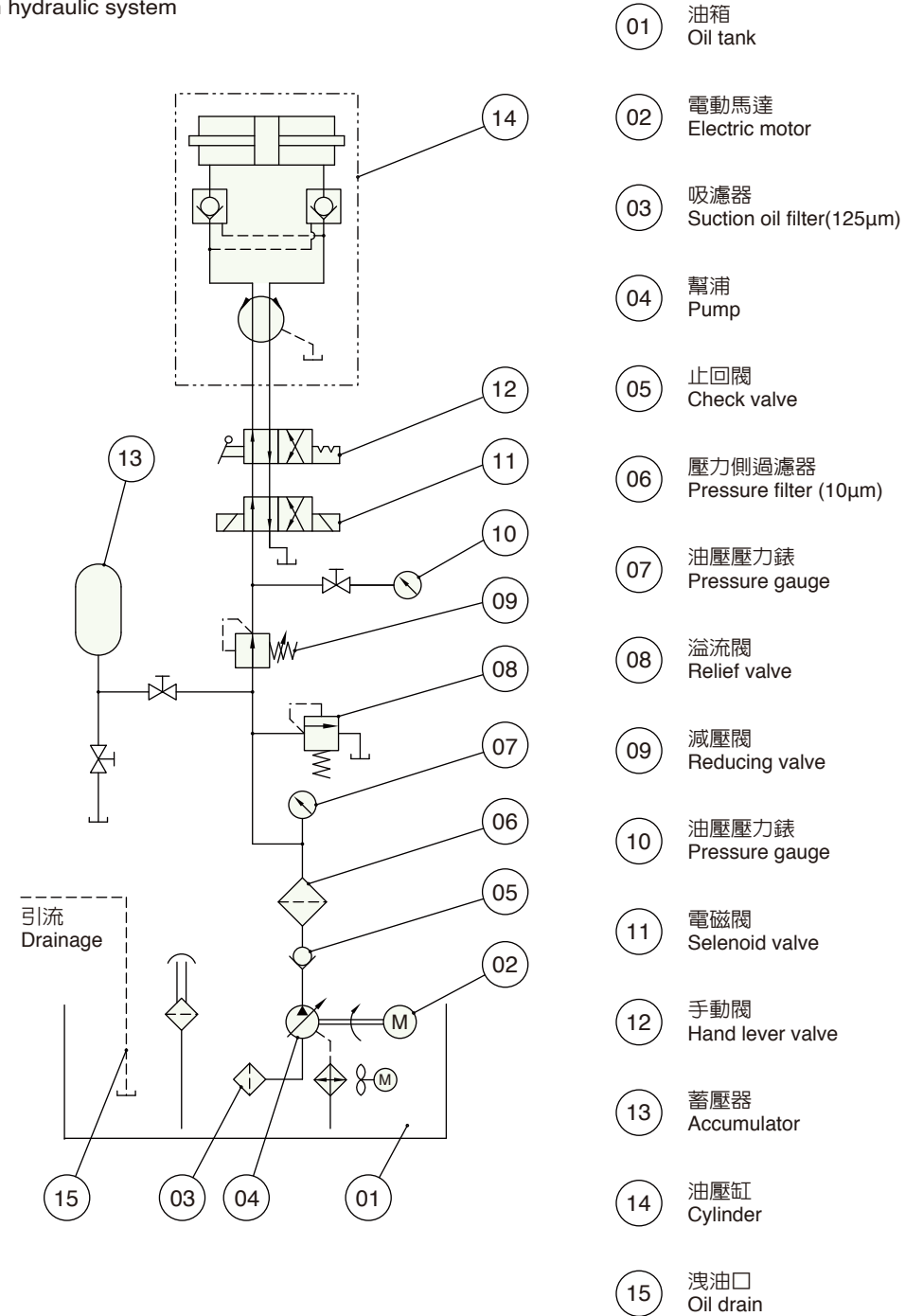
- 當油壓缸裝設於車床後方，車床的防護罩必須預留通風口，如此油壓缸產生的熱量可以由此散去。
- When the cylinder is installed to the rear end of the lathe, a ventilation exit should be provided on the cover for cooling.



4-1 中空油壓迴轉缸安裝概要

The installation outline of the hollow rotary hydraulic cylinder

油壓系統圖
diagram hydraulic system

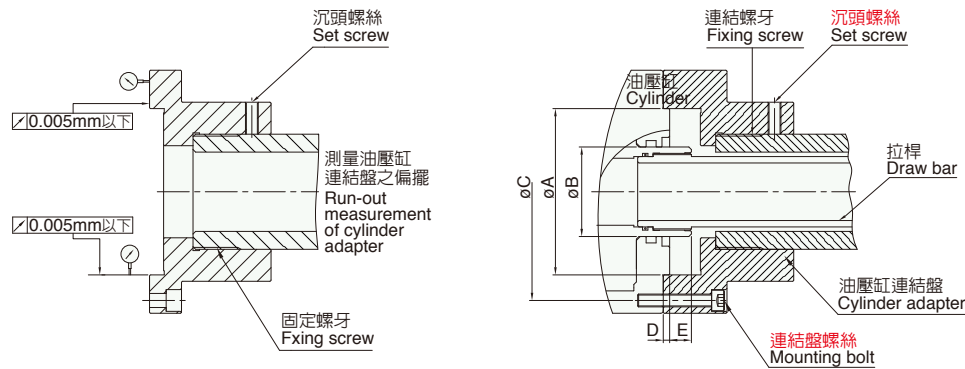


4-2 中空油壓迴轉缸連結盤的製作及安裝

The manufacture and installation of the hollow rotary hydraulic cylinder adapter

CAUTION
注意

- 校正油壓缸連結盤端面的偏擺及油壓缸連結盤外徑的偏擺在 0.005mm 以內，過多的偏擺會造成震動，而導致油壓缸的使用壽命減短。
- Adjust the run-out of the cylinder adapter end face and the outer diameter of cylinder adapter within 0.005mm, too much run-out will induce vibration, and cause the service life of the cylinder reduced.
- 把油壓缸裝在距離車床主軸托架愈近的地方越好，而油壓缸連結盤的安裝方式及量測偏擺的方式都在下表中表示出來。
- 一定要裝上沉頭螺絲才能防止連結盤的鬆動。
- Install the cylinder as close as possible to the spindle support of the lathe, the methods of the cylinder adapter installation and run-out measuring shown in the following diagram.
- The set screws should be installed to prevent adapter loosening.

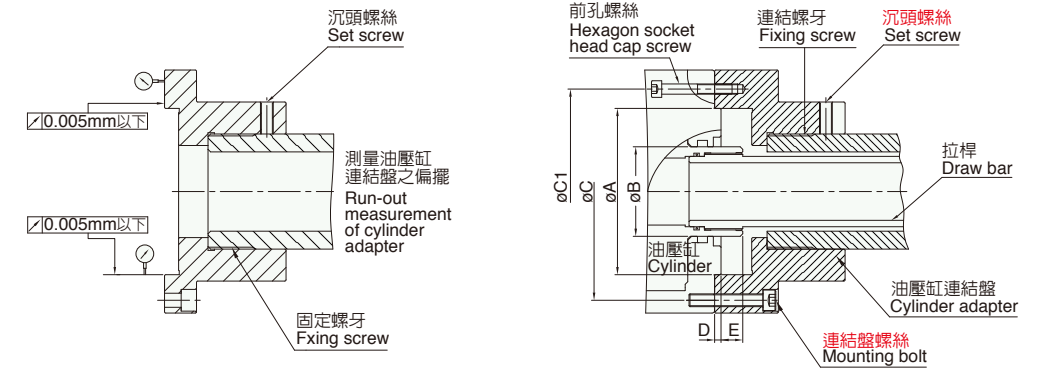


項目 Item	型式 Model	P0928	P1036	P1246	P1552	P1875	P1878
A(F7)		80	100	100	130	160	160
B		45	48	65	70	95	98.5
C		100	115	130	170	190	190
連結盤螺絲 Adapter mounting screw		6-M8	6-M10	12-M10	12-M10	12-M10	12-M10
D		5	5	5	5	5	5
E(MAX.)		9	10	10	17	20	20

項目 Item	型式 Model	P2091	P2093	P2511	P2916	P3420
A(F7)		180	180	230	260	320
B		110	115	140	195	235
C		215	215	275	298 305	360
連結盤螺絲 Adapter mounting screw		12-M12	12-M12	12-M16	12-M12 12-M16	12-M20
D		5	5	6	6	6
E(MAX.)		25	25	24	24	36

4-2 中空油壓迴轉缸連結盤的製作及安裝

The manufacture and installation of the hollow rotary hydraulic cylinder adapter

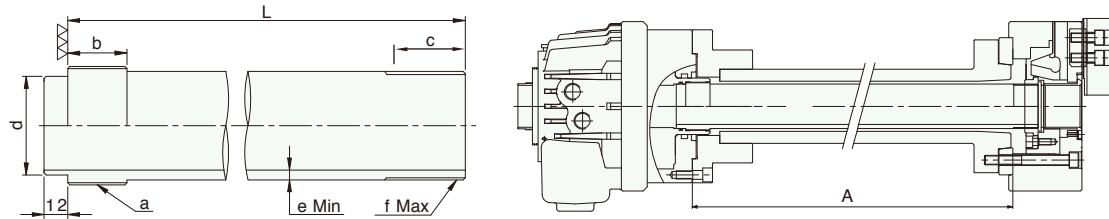


項目 Item	型式 Model	F1033S	F1036S	F1246S	F1552S	F1875S
A(F7)		110	100	100	130	160
B		45	48	65	70	95
C		125	115	130	170	190
C1		125	125	147	170	196
連結盤螺絲 Adapter mounting screw		6-M10	6-M10	12-M10	12-M10	12-M10
前孔螺絲 Hexagon socket head cap screw		6-M8	6-M8	6-M8	6-M8	6-M10
D		5	5	5	5	5
E(MAX.)		10	10	10	17	20

4-3 拉桿的製作

The manufacture of the draw bar

拉桿的長度請依下列計算 The length of the draw bar should be determined by following calculation.



型式 Model	油壓缸規格 Hydraulic cylinder	a	b	c	d(f7)	e Min	f Max	L
OP-204,OPT-204	P0928	M38x1.5P	25	25	34 ^{-0.025} _{-0.050}	3	M32x1.5P	A+28
OP-205,OPT-205	P1036 / F1036S	M42x1.5P	25	25	38 ^{-0.025} _{-0.050}	3.5	M40x1.5P	A+28
OP-205,OPT-205	F1033S	M38x1.5P	25	25	38 ^{-0.025} _{-0.050}	3.5	M40x1.5P	A+28
OP-206,OPT-206,OPF-206	P1246 / F1246S	M55x2P	30	25	50 ^{-0.025} _{-0.050}	5	M55x2P	A+41
OP-208,OPT-208,OPF-208	P1552 / F1552S	M60x2P	30	25	55 ^{-0.030} _{-0.060}	4	M60x2P	A+39
OP-210,OPT-210,OPF-210	P1875 / F1875S	M85x2P	35	30	80 ^{-0.030} _{-0.060}	5	M85x2P	A+38.5
OP-212,OPT-212,OPF-212	P2091	M100x2P	35	35	95 ^{-0.036} _{-0.071}	4.5	M100x2P	A+36
OP-215,OPT-215,OPF-215	P2511	M130x2P	45	50	125 ^{-0.043} _{-0.084}	6	M130x2P	A+59.5
OP-218,OPF-218	P2511	M130x2P	45	50	125 ^{-0.043} _{-0.084}	5	M130x2P	A+59.5
OPB-215	P2916	M180x3P	45	50	176.5 ^{-0.043} _{-0.084}	6	M155x2P	A+60
OPB-218	P2916	M180x3P	45	50	176.5 ^{-0.043} _{-0.084}	6.5	M180x3P	A+58.5
OP-221	P3420	M220x3P	45	50	210 ^{-0.043} _{-0.084}	7.5	M195x2P	A+50.5
OP-224	P3420	M220x3P	45	50	210 ^{-0.043} _{-0.084}	7.5	M220x3P	A+52
OP-206L,OPT-206L	P1246 / F1246S	M55x2P	30	25	50 ^{-0.025} _{-0.050}	5	M55x2P	A+41
OP-208L,OPT-208L	P1552 / F1552S	M60x2P	30	25	55 ^{-0.030} _{-0.060}	4	M60x2P	A+39
OP-210L,OPT-210L	P1875 / F1875S	M85x2P	35	30	80 ^{-0.030} _{-0.060}	5	M85x2P	A+38.5
OP-210BH	P1878	M87x2P	35	30	83 ^{-0.036} _{-0.071}	4.5	M87x2P	A+38.5
OP-212BH	P2093	M103x2P	35	35	100 ^{-0.036} _{-0.071}	5	M103x2P	A+34.5

4-3 拉桿的製作

The manufacture of the draw bar



WARNING
警告

- 拉桿厚度增加方能有足夠之強度。若拉桿之強度不足會使其斷裂而喪失夾持力，同時工件飛出，產生危險。
- The higher strength is provided by thickness of the draw bar increased. the insufficient strength will induce the chuck broken and the gripping force lost, the danger of workpieces scattering can be caused.

IMPORTANT
留意事項

螺牙鬆動是造成振動的主要原因

- 拉桿厚度 e 為最小極限值，加工螺牙 f 部份時最好選用大直徑，使 e 值儘可能最大。
 - 以抗拉強度 580Mpa(58kg/mm²) 以上之材料來製作拉桿。
 - 螺紋 a,d,f 同心度需在 0.05mm T. I. R 以內。
- The key factor of vibration is the loose screws.
- The thickness of the draw bar "e" is the minimum limit value, used big diameter value to manufacture the thread in order to get "e" value as high as possible.
 - Using the material of tensile strength of 580Mpa(58kg/mm²) or higher to manufacture the draw bar.
 - The concentricity of thread "a", "d" and "f" should be within 0.05mm T.I.R.

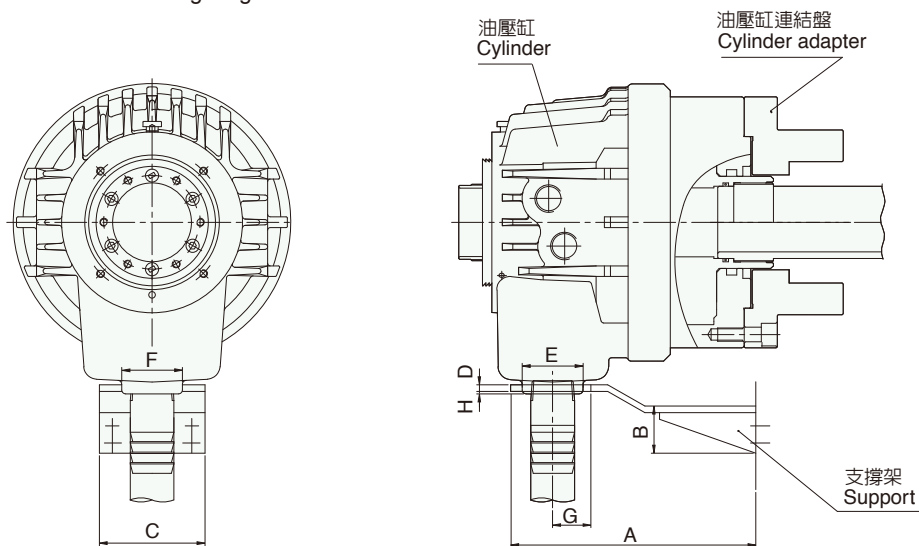
4-4 支撐架的製作及安裝

The manufacture and installation of the support

- 安裝油壓缸時必須使洩油口在最底部，否則由於油壓缸的結構，將使得液壓油在罩殼的兩端溢出來。
- The drainage port should be on the bottom when the cylinder installed, otherwise, the hydraulic oil will overflow from the both side of the sleeve body due to the cylinder structure.

IMPORTANT
留意事項

- 為了防止油壓缸的罩殼主體發生旋轉現象，可以在罩殼洩油口的突起部位安裝一個支撐架。
- In order to prevent the cylinder sleeve body rotating, a support can be installed at the protruding area of the drainage port.
- 在支撐架安裝於車床上時，必須將罩殼洩油口突出部位與支撐架之間保持一定的間隙，使罩殼本體不受其它的外力。
- 當安裝油壓缸時，除了安裝固定罩殼本體的支撐架（防止旋轉的托架）之外，並且需注意油壓缸外徑的偏擺及罩殼主體後端的上、下偏擺，必須比在下圖所示的標準值要來的小。
- A clearance should be kept in between the sleeve body and the support when installing the support to the lathe, in order to prevent the sleeve body taking the load.
- When installing the cylinder, except to install the support to the sleeve body (a support to prevent rotating), the upper and lower run-out of the cylinder outer diameter and the sleeve body rear end should be smaller than the specified values in the following diagram.

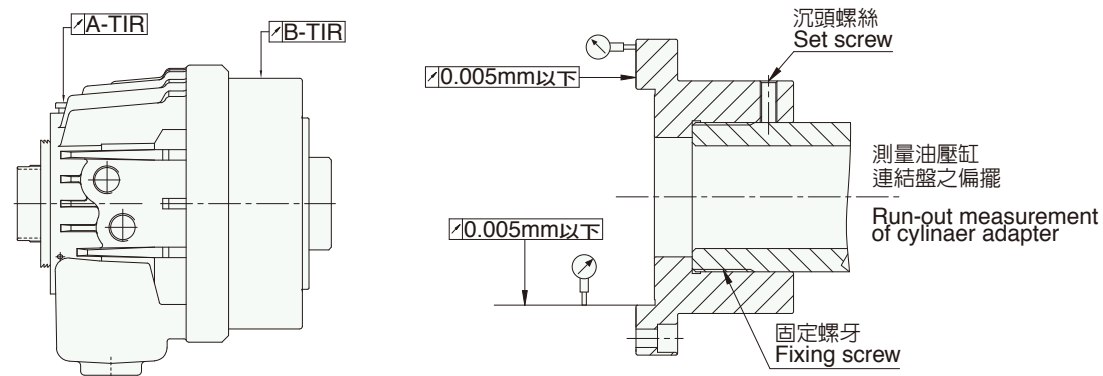


型式 Model	尺寸 Size	A	B	C	D	E	F	G	H
P0928				75	4.5	ø46	50	30	1
P1036, F1033S, F1036S				75	4.5	ø46	50	30	1
P1246, F1246S				75	4.5	ø46	50	30	1
P1552, F1552S	依車床的長度來決定			75	6	ø46	50	30	1
P1875, F1875S, P1878	To be determined depending on the lathe.			80	6	ø46	50	30	1
P2091, P2093				80	6	ø46	50	30	1
P2511				80	6	ø46	50	30	1
P2916				100	10	ø60	65	40	1
P3420				100	10	ø60	65	40	1

測量油壓缸及連結盤的偏擺

Measure the run-out of the cylinder and the adapter.

為了能夠得到下列所需的數值，油壓缸連結盤前端的偏擺必須為最小 (0.005 mm 以下)。
In order to get the required values following below, the run-out of the cylinder adapter front end should be less than 0.005mm.

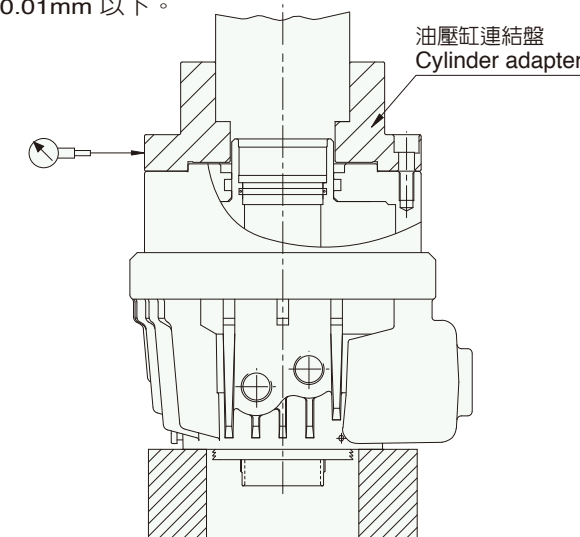


型式 Model	P0928	P1036	P1246	P1552	P1875 P1878	P2091 P2093
A	0.015	0.015	0.015	0.015	0.020	0.025
B	0.010	0.010	0.010	0.010	0.010	0.010

型式 Model	P2511	P2916	P3420	F1033S F1036S	F1246S F1552S	F1875S
A	0.030	0.035	0.035	0.015	0.015	0.020
B	0.010	0.010	0.010	0.010	0.010	0.010

安裝油壓缸連結盤
Installation of cylinder adapter

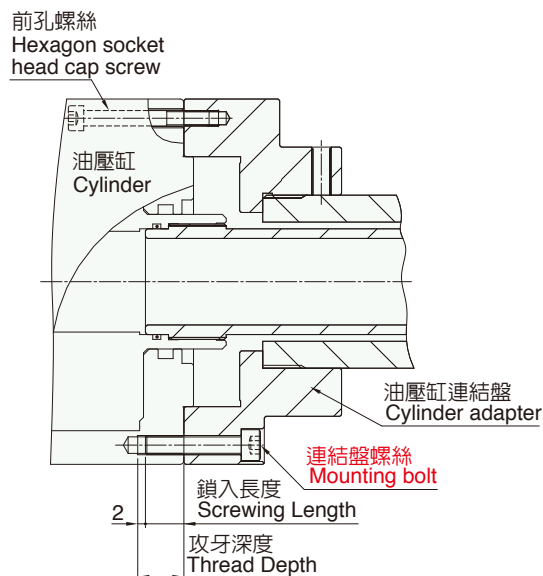
- 當安裝油壓缸連結盤於車床後端之前，應垂直放置連結盤如圖示。
- 須先校正油壓缸外徑及連結盤外徑之偏擺量於 0.01mm 以下。
- When installing the cylinder adapter in front of the lathe rear end, the adapter should be placed vertically as shown in the figure.
- The run-out of the cylinder outer diameter and the adapter outer diameter should be corrected under 0.01mm.



4-5 連結盤螺絲的鎖緊扭矩

Tightening torque of the adapter mounting bolts

- 將安裝油壓缸於油壓缸連結盤時，鎖緊固定螺絲如下圖所示，儘量越深越好。
- When installing the cylinder to the adapter, tighten the mounting screws as deep as possible as shown in the following figure.



型式 Model	P0928	P1036	P1246	P1552	P1875 P1878	P2091 P2093	P2511	P2916	P3420	
連結盤螺絲 Adapter mounting bolt	M8	M10	M10	M10	M10	M12	M16	M12	M16	M20
攻牙深度 Thread depth	15	17	20	20	20	23	23	23	28	32
前孔螺絲 Hexagon socket head cap screw	--	--	--	--	--	--	--	--	--	--

型式 Model	F1033S	F1036S	F1246S	F1552S	F1875S
連結盤螺絲 Adapter mounting bolt	M10	M10	M10	M10	M10
攻牙深度 Thread depth	17	17	20	20	20
前孔螺絲 Hexagon socket head cap screw	M8	M8	M8	M8	M10

螺絲規格 Bolt size	鎖緊扭矩 Tightening torque
M8	31N·m(3.1kgf·m)
M10	60N·m(6.1kgf·m)
M12	87N·m(8.9kgf·m)
M16	205N·m(20.9kgf·m)
M20	327N·m(33.4kgf·m)

因為油壓缸是鋁合金的材質，其鎖緊扭矩約為本公司油壓夾頭(同規格螺絲)的80%
Because the material of the cylinder is the aluminum alloy, its tightening torque should be 80% of hydraulic chucks (for the same specified screws).

5-1 油壓回路設計說明

Design description of the hydraulic pressure circuit

油壓回路的設計是基於操作簡便和安全的原則，並且提供失效的安全回路，以防止停電時所產生的危險。

- 油壓缸之油壓回路含有自鎖機構當工作進行加工時，發生停電或壓力源故障所產生的壓力異常降低時，自鎖的機構產生效用，將夾持力維持固定狀態讓工作物不致飛出而產生危險。

The design of the hydraulic pressure circuit is based on the principle of simplified operation and safety, and provides the fail-safe circuit to prevent the danger when the power is interrupted.

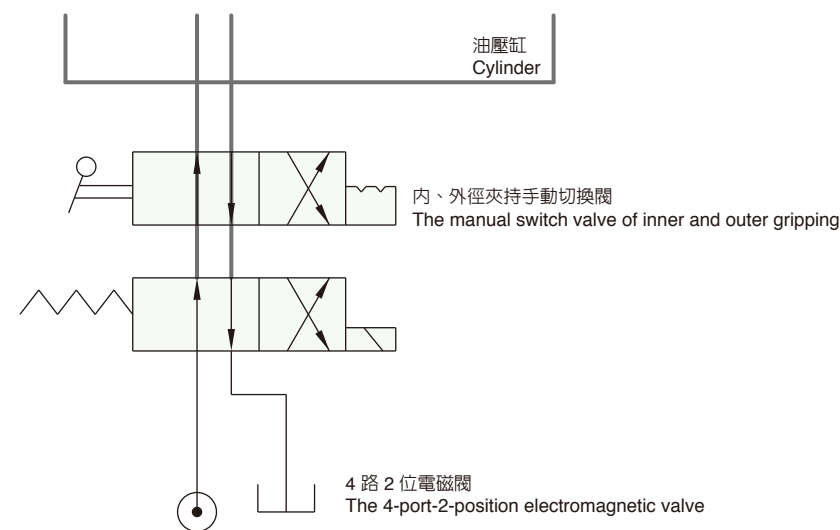
- The hydraulic pressure circuit has the self-locking mechanism, when pressure reduced due to the power is interrupted during the operation, the self-locking mechanism will activate to maintain the gripping force and not to cause the danger of the workpiece scattering.

DANGER
危險

- 如果使用 4 路 2 位電磁閥作油壓缸之切換作用，那麼油壓回路就必須設計承當脫磁狀態時，工作物仍處於被夾持狀態。
- If the 4-port-2-position electromagnetic valve is used for switching, the hydraulic circuit should be designed as demagnetized when the workpiece is under gripping condition.

CAUTION
注意

- 為了防止由內徑夾持切換至外徑夾持所產生的錯誤操作，必須提供一個內外徑夾持的切換閥。
- To prevent the operating error of changing the inner gripping to outer gripping, a switch valve of inner and outer gripping should be provided.



5-2 油壓油 Hydraulic oil

為了能順暢的操作油壓缸，我方推薦使用黏性在 30~50 cSt (溫度 40°C) 的油壓油(相當於ISO VG32和VG46)
In order to operate the cylinder smoothly, it is recommended to use the hydraulic oil whose viscosity is 30~50 cSt at 40°C. (equivalent to ISO VG32 and VG46)

IMPORTANT 留意事項

- 油壓油必須有抗磨損及不起泡的特質，為了保持油壓缸良好的運作，在油壓供應系統中必須安裝20 μ m 的濾油網。
- The hydraulic oil should have the characteristic of abrasion resistance and non-foaming, a filter of 20 μ m should be installed in the hydraulic pressure supply system in order to keep cylinder operating smoothly.

油壓油的品質將影響油壓缸的溫升，洩油量，作動速度，因此請參考幫浦的使用說明來調整油壓油。
The quality of the hydraulic oil will affect the temperature rise, drainage volume and operating speed of the cylinder, therefore, please refer to the instruction manual of the pump to adjust the hydraulic pressure.

5-3 安裝控制閥、油壓系統及管路 Installation of control valve, hydraulic system and piping

- 在便於手動操作的地方，安裝一個手動的切換控制閥來控制夾頭的開啓 / 關閉。
- 盡量將油壓系統安裝於靠近油壓缸的地方注意洩油管要保持平直，而且油壓錶能夠清楚的被看見。
- 盡量使用內徑大的油管。
- Install a manual switching valve at the place where easy to handle to control the clamp/unclamp of the chuck.
- Install the hydraulic system to the cylinder as near as possible and keep the drainage pipe straight, and the pressure gauge can be observed clearly.
- Use the pipe with the inner diameter as large as possible.

CAUTION 注意

- 將油管內部的雜物灰塵盡量清出後再安裝，如果油管內部有雜物將導致油壓缸的過熱，十分的危險。
- Install the pipe after cleaning the dust in the pipe completely, it is dangerous that the dust in the pipe will cause the cylinder over-heat.

IMPORTANT 留意事項

油壓缸的配管必須使用撓性油管，可以防止油管的彎曲阻礙了油壓缸的作動。
配管時的注意事項：

- 使用內徑 ϕ 32的洩油管。
 - 為了檢查油壓油是否停滯使用透明乙炔基的洩油管或透明材質的洩油管。
 - 必須有一定的斜度以利油壓油的流動及排除空氣。
 - 油箱的洩油口必須於油面以上。
 - 使用於油壓油的幫浦必須至少有20 l/min的流出量，然而油壓壓力的控制必需由幫浦的控制器或減壓閥分開來控制。
- The piping of the cylinder should be flexible, it can prevent the bended pipe interfering with the movement of the cylinder. Cautions for piping:
- Use the drainage pipe of 32 inner diameter.
 - In order to check the stagnation of the hydraulic oil, a transparent vinyl or transparent material pipe should be used.
 - An inclination should be incorporated to make the oil flow and expel the air.
 - The drainage port of the tank should be above the oil level.
 - Use the pump of 20 l/min flow rate at least, but hydraulic pressure should be controlled by the pump controller or the pressure reducing valve separately.

5-4 運轉測試 Test run

- 確認所輸入的電壓與所指定的相同。
- 試運轉時，先將油壓壓力調整到最小的位置，而後迅速切換開關一次，檢查油壓幫浦的旋轉方向是否正確，如果是以相反方向來旋轉應更換三相電源中的二條線後，啓動開關以全速來運轉。
- 首先將油壓的壓力設定於低壓，此低油壓力要足夠使夾頭產生作動 (0.35~0.5Mpa)，設定完畢後，依下列步驟檢查。
 - 檢查夾頭的作動是否順暢。
 - 檢查作動方向是否正確 (夾爪的開合)。
 - 檢查作動行程是否足夠 (夾爪的行程)。
 - 檢查各部位的管路有無漏油的現象。依照上敘的事項檢查正確後，慢慢的增加壓力直到所需要的油壓力時，再檢查一次，同時檢查洩油管是否順暢的流下。
- 將車床主軸的轉速設定於最小值，檢查油壓缸的偏擺狀況及管路有無異常，若一切正常則再慢慢的增加速度。一旦有震動的情況發生，必須再次檢查油壓缸連結盤的偏擺狀況。
- 如果油壓油的油溫不高時 (低於30°C)，以最大速度的 1/3 來運轉溫機。

- Confirm the input voltage is same as specified voltage.
- During test run, adjust the hydraulic pressure to the minimum position first, then switch the valve once rapidly to check if the rotating direction is correct, if want to reverse the direction, the two wires in the three-phase power should be switched, then turn on the power and operate at the maximum speed.
- First, set the hydraulic pressure to low pressure which should be enough to activate the chuck (0.35~0.5Mpa), then follow the checking procedure below to check.
 - Check if the chuck work smoothly.
 - Check if the direction of the movement is correct (chuck clamping direction).
 - Check if the operating stroke is enough (stroke of the chuck).
 - Check if there is any oil leakage on the pipes.After checking, increase the hydraulic pressure to the required pressure slowly, then check it again and check if the oil flows from the drainage pipe smoothly.
- Set the speed of the lathe spindle to the minimum value, then check if the run-out of the cylinder and the piping are normal, if everything is normal then increase the speed slowly. once there is vibration occurred, the run-out of the cylinder adapter should be checked again.
- If the temperature of the hydraulic oil is not high (below 30 degree C), operate with 1/3 of the maxmum speed to warm up.

DANGER 危險

當油壓缸於長時間連續高速運轉且沒有執行前推/後拉動作時，可能造成油壓缸內部壓力升高及油壓缸過熱，進而可能導致縮缸鎖死及連帶造成相關部件損壞之危險。
因此，當油壓缸於長時間連續高速運轉時，必須定時執行前推/後拉動作，建議每3~5分鐘執行一次。

When the cylinder is running at high speed for long period and does not perform a clamping and unclamping, It will cause the internal pressure of cylinder rised and over-heated.
And may cause the cylinder to lock and cause damage to the associated parts.
Therefore, the cylinder (clamping/unclamping) have to be switched regularly.(Suggestion:per 3-5 minutues)

- 當油壓缸運轉逐漸變得不正常，請採取下列步驟：
 - 如果主軸仍在運轉中，立即停止運轉。
 - 增加油壓壓力大約 0.5Mpa，重覆油壓缸切換的動作測試油壓缸的運動是否順暢。
- When the operation of the cylinder becomes abnormal gradually, please use the following procedure:
 - Stop the operation immediately if the spindle is operating.
 - Increase the hydraulic pressure approx. 0.5Mpa, switch the movement of the cylinder repeatly to test if the movement of the cylinder is smooth.

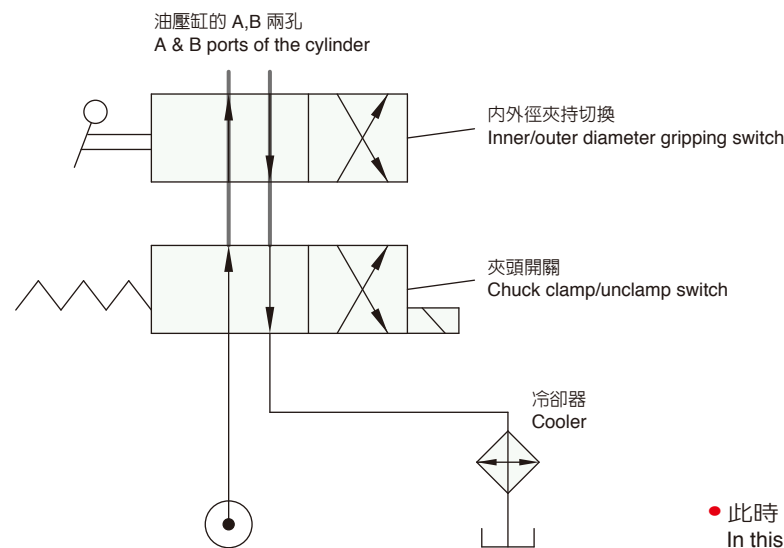
3. 如果油壓缸的運轉仍然不正常，逐步的增加油壓的壓力每次約 0.5Mpa，再重覆上述(2)的過程來測試油壓缸的運動。然而增加的預設壓力不可超過夾頭最大油壓力的30%。
當油壓缸的運轉回復到正常時，將預設壓力回復到原來的程度。
 4. 如果油壓缸的運轉雖然經過上(3)的方法操作許多次而且預設壓力已達到最大值，仍然無法恢復正常，那將夾頭預設壓力回復到正常程度，將電源關掉等到油壓缸的表面溫度回降與室溫相當時，重覆(2)和(3)的方法來測試油壓缸的運動。
油壓缸的溫度可以用風槍或類似的裝置將空氣吹到油壓缸上來降低。
 5. 當溫度降低後油壓缸的運動仍然無法恢復正常，將夾頭的拉桿螺帽鬆開，取下夾頭確認油壓缸的運動。
3. If the cylinder operation is still abnormal, gradually increase the hydraulic pressure 0.5Mpa each time, then repeat the procedure of the item (2) to test the cylinder operation. but the increment of the pre-set pressure should not exceed 30% of the maximum chuck hydraulic pressure.
When cylinder operation is back to normal, the pre-set pressure should be recovered to original level.
4. If the cylinder operation still can not back to normal after repeating the process of item (3) several times and the pre-set pressure reach the maximum value already, then recover the pre-set pressure to normal level, shut down the power to lower the surface temperature of the cylinder to room temperature, then repeat the process of the item (2) and (3) to test the cylinder operation.
The cylinder temperature can be lowered by air gun or similar equipments.
5. If the cylinder operation is still abnormal after reducing the temperature, loosen the draw nut of the chuck and remove the chuck to confirm the cylinder operation.

5-5 油壓油的溫度上升 Temperature rise of the hydraulic oil

連續高速的使用將導致油溫的升高而造成油封材質及油壓油的快速惡化，使用冷卻裝置，保持溫度低於 60°C

Continuous high speed operation will cause the temperature rise and induce the sealing material and hydraulic oil deteriorated rapidly. use a cooler to keep the temperature below 60°C.

例 Example



6 維護 Maintenance

- 當漏油的情況出現時，分解油壓缸清洗和更換O型環，此時在處理油壓缸時必須很小心，因為它一部份是由鋁合金製造。
油壓系統
 - 清潔吸油口過濾網，約 2~3 個月一次。
 - 檢查油壓油約半年一次，如果已經變質，請更換。
- When the leakage occurred, disassemble the cylinder to clean and replace the O-ring carefully because a part of the cylinder is made of aluminum alloy.
- Hydraulic system
- Clean the oil suction filter every 2~3 months.
 - Check the hydraulic oil every half year, and replace it when it is deteriorated.

WARNING 警告

當操作機械使用最大油壓力及最高轉速時，每年必須分解檢查內部零件，並更換油封。
當突壓力過大時，會造成油壓缸的作動不良及損壞，所以必須調整節流閥來降低突壓力。

If the machine operating under maximum hydraulic pressure and maximum speed, disassemble and check the parts should be performed and replace the oil seal every year.

The surge pressure is too high will cause cylinder failure and damage, therefore, adjust the throttle valve to reduce the surge pressure.

WARNING 警告

每星期檢查止逆閥之斷電裝置是否正常，檢查方法：先讓夾頭夾持一圓棒後關掉電源，查看工件是否會脫落，不會鬆脫表示功能正常，如鬆動表示功能失效，須立刻送廠檢修。

Check the disconnect power control of the check valve if is normal. the checking procedure is to grip a workpiece first, then turn off the power to check if the workpiece will drop or not, it is normal for the workpiece is gripped tightly, if not means the function is failed, please call your local distributor for repair service.

7 故障排除

如油壓缸故障，請停下來檢查，依下列狀況來處理

不正常情況	原因	對策
活塞不作動	油壓系統停止運作	檢視油壓系統是否屬於正常運作中
活塞不作動	管路連接錯誤	確認所有管路皆連接正確
活塞不作動	油壓幫浦方向錯誤	依運轉中測試步驟重新修正
油壓缸推力不足	壓力不在正常值	裝置一個壓力計於油壓缸入油口處，以確認其壓力是否達到正常值
油壓缸推力不足	回油管之壓力太高或洩油量多於正常值	O型環損壞所導致，須更換O型環
油壓缸推力不足	吸油口過濾網阻塞	清洗濾網及油箱內雜質及更換液壓油
溫度上升	油之黏度不符	確認液壓油之黏度是否正確並更正
溫度上升	油箱之油量不足	補充油箱內的油
溫度上升	高溫使油箱溫度升高	使用冷卻器或電扇控制油溫
溫度上升	液壓油變質	清洗油箱更換液壓油
溫度上升	油壓壓力過高	調整壓力至正常值
幫浦之噪音	空氣或雜質進入	避免空氣及異物進入
幫浦之噪音	油箱內油量不足	補充液壓油
幫浦之噪音	堆積過多的雜質或液壓油品質已經惡化	清洗油路系統及油箱更換液壓油
幫浦之噪音	油壓幫浦磨損	立即修理或更換
不明之漏油現象	洩油管不能順暢洩油	檢查洩油通路是否太小或彎曲阻礙洩油
不明之漏油現象	油封硬化或破損	更換油封或O型環組
不明之漏油現象	油壓缸導氣螺絲或油缸中有雜質阻塞	清除油壓缸通氣栓或油缸中之雜質異物

備註：

簡單之故障請自行處理，如無法自行處理或特殊狀況時，可通知各地經銷商或與本公司連繫。

我們將於接到問題後立即為客戶服務。

7 Troubleshooting

If the cylinder is malfunctioned, stop to inspect the following condition

Abnormal conditions	Causes	Solutions
Piston is not working	Hydraulic system stop working	Check the hydraulic system is working normally
Piston is not working	Pipe routing error	Confirm the pipes routed correctly
Piston is not working	Pump arranging error	Correct the arrangement by the procedure of the test run
Input force of the cylinder is insufficient	Abnormal pressure value	Place a pressure gauge at the entrance of the cylinder to confirm the pressure is normal
Input force of the cylinder is insufficient	The pressure of returning pipe is too high or the amount of the leakage is higher than standard	The o-ring should be replaced
Input force of the cylinder is insufficient	Oil suction filter is blocked	Clean the foreign object out off the filter and tank, and replace the hydraulic oil
Temperature rised	The viscosity of the hydraulic oil is incorrect	Check the viscosity of the hydraulic oil is incorrect and replace it
Temperature rised	Insufficient hydraulic oil in the tank	Refill the hydraulic oil in the tank
Temperature rised	Tank temperature rised due to the high temperature	Use the cooler or fan to control the oil temperature
Temperature rised	The hydraulic oil is deteriorated	Clean tank and replace the hydraulic oil
Temperature rised	The hydraulic oil pressure is too high	Correct the pressure to the standard value
Pump noise	The air or forein object into the oil	Avoid the air and foreign object into the oil
Pump noise	Insufficient hydraulic oil in the tank	Refill the hydraulic oil
Pump noise	Too many forein object in the oil or the hydraulic oil is deteriorated	Clean piping system and tank, and replace the hydraulic oil
Pump noise	Pump worn down	Repair or replace immediately
Unknown leakage	The drainage pipe can not dump oil smoothly	Check if the drainage path is too small or too curved to block the oil
Unknown leakage	Harden or broken of the oil sael	Replace the oil seal or o-ring
Unknown leakage	The air breather or cylinder is blocked	Clean the foreign object out off the air breather or the tank

NOTE:

Please handle the simple malfunction by yourself, if the problem is too complicated,

please contact the local distributor or CHANDOX Taiwan.

We will serve you right after the problem received.