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CKD

SM-228844-A

INSTRUCTION MANUAL

SELEX CYLINDER

SCS-W (Duplex type)

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

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For Safety Use

To use this product safely, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, read this instruction manual carefully for proper operation.

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ Precautions

- Before performing an overhaul inspection on the actuator, deactivate residual pressure completely.
- While the actuator is operating, do not step into or place hands in the driving mechanism.
- To prevent an electric shock, do not touch the electric wiring connections (exposed live parts) of the actuator equipped with a solenoid valve or switch.
  Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

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NOTE : Letters & figures enclosed within Gothic style bracket (examples such as [C2-4PP07] · [V2-503-B] etc.) are editorial symbols being unrelated with contents of the book.

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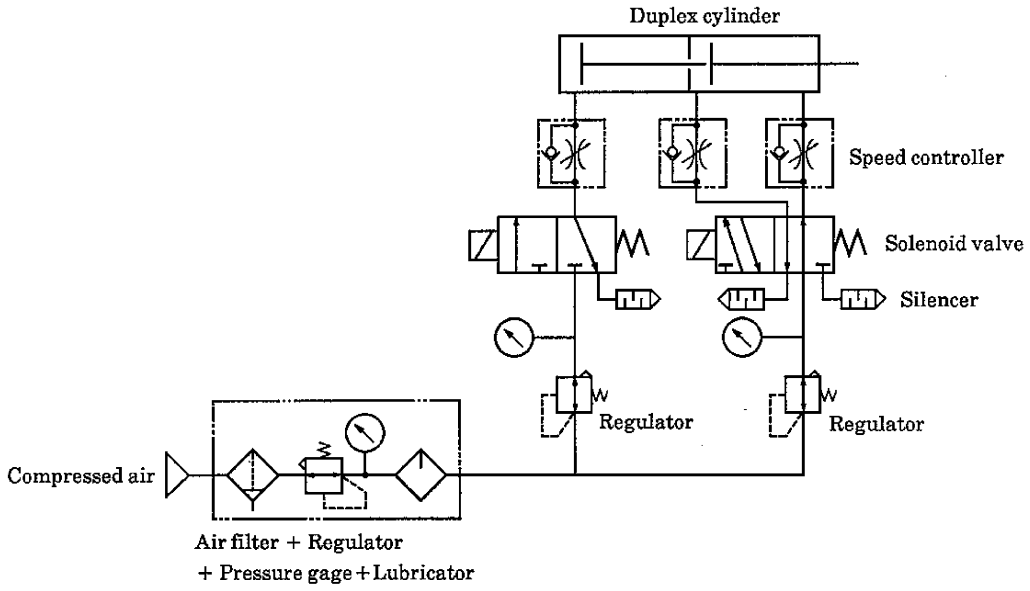
1. PRODUCT

1.1 Specifications

Item		Specification
Media		Compressed air
Maximum working pressure	MPa	1.0
Minimum working pressure	MPa	0.05
Proof pressire	MPa	1.6
Ambient temperature range	℃	-5~60 (Not be frozen)
Lubrication		Use turbine oil class 1, ISO VG32, if and when reqired.
Working piston speed	mm/s	20 to 1000 (Use it within the range of energy absorption.)
Cushion		Air cushion

1.2 Basic Circuit Diagram

The following is a basic circuit diagram.



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1.3 Selection of Related Equipment with the Basic Circuit Diagram

The related equipment depends on the tube bore diameter and speed of the driving cylinder. Select equipment out of the Selection Guide Table. (The table provided here is an example of related equipment.)

Bore (mm)	Theoretical standard speed (mm/s)	Required flow rate (ℓ/min)	Effective sectional area (mm^2)	Appropriate standard system No.
φ 125	250	1,100	16.1	C3
	500	2,200	32.2	C4
	750	3,300	48.2	D1
	1,000	4,400	64.4	D1
φ 140	250	1,400	20.2	C3
	500	2,800	40.4	C4
	750	4,200	60.5	D1
	1,000	5,500	80.8	D3
φ 160	250	1,800	26.3	C4
	500	3,600	52.6	D1
	750	5,400	79.0	D2
φ 180	250	2,300	33.3	C4
	500	4,600	66.6	D2
	750	6,900	100.0	D3
φ 200	250	2,800	41.2	D1
	500	5,600	82.4	D3
φ 250	250	4,400	64.3	D2
	400	7,000	103.0	D3

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Cylinder bore (mm)	Appropriate standard system No.	4・5 port solenoid valve, pneumatic pressure regulating		Auxiliary pneumatic equipment		Pipes
		Single solenoid valve	Double solenoid valve	Speed controller	Silencer	Pipes (For solenoid valve and cylinder)
φ 125	C3	4F510-15	4F520-15	SC1-15	SLW-15	Rc1/2 Steel pipe
	C4	4F510-15	4F520-15	SC-20A	SL-15A	Rc1/2Steel pipe
	D1	4F610-20	4F620-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D1	4F610-20	4F620-20	SC-20A	SL-20A	Rc3/4Steel pipe
φ 140	C3	4F510-15	4F520-15	SC1-15	SLW-15	Rc1/2Steel pipe
	C4	4F510-15	4F520-15	SC-20A	SL-15A	Rc1/2Steel pipe
	D1	4F610-20	4F620-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D3	4F710-25	4F720-25	SC-25A	SL-25A	Rc 1Steel pipe
φ 160	C4	4F510-15	4F520-15	SC-20A	SL-15A	Rc1/2Steel pipe
	D1	4F610-20	4F620-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D2	4F710-20	4F720-20	SC-20A	SL-20A	Rc3/4Steel pipe
φ 180	C4	4F510-15	4F520-15	SC-20A	SL-15A	Rc1/2Steel pipe
	D2	4F710-20	4F720-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D3	4F710-25	4F720-25	SC-25A	SL-25A	Rc 1Steel pipe
φ 200	D1	4F610-20	4F620-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D3	4F710-25	4F720-25	SC-25A	SL-25A	Rc 1Steel pipe
φ 250	D2	4F710-20	4F720-20	SC-20A	SL-20A	Rc3/4Steel pipe
	D3	4F710-25	4F720-25	SC-25A	SL-25A	Rc 1Steel pipe

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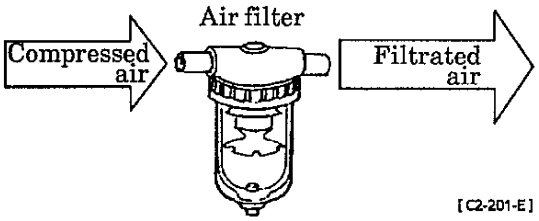
2. CAUTION

2.1 Fluid

1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rate (5μm or lower preferred), flow rate and its mounting location (as closest to directional control valve as possible).

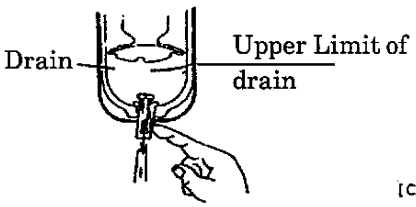


[C2-201-E]

2) Be sure to unload drain in filter periodically.

3) Note that the intrusion of carbide of compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of solenoid valve and cylinder. Be sure to carry out thorough inspection and maintenance of compressor.

4) Operate the cylinder of this type with lubrication. Turbine oil class 1, ISO VG32 is recommended.



[C2-201-F]

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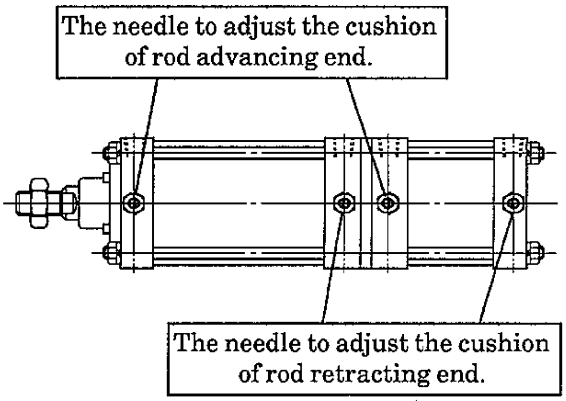
3. OPERATION

1) The cylinder feed pressure is 0.05 to 1MPa ; hence regulate the pressure within this pressure range.

2) Though the cushion has been adjusted at no load when delivered, adjust the cushion needle when the change of cushion effect is required.

Tightening the needle (clockwise) makes cushion more effective. Tighten the needle lock nut all the way after adjustment.



However, if kinetic energy such as load is heavy or speed is too fast, exceeding the values given in Table 1, consider of providing a shock absorber.

Table 1 : Cushion characteristics

Tube bore (mm)	Tolerable energy absorption J		
	Effective cushion length (mm)	With cushion	Without cushion
ϕ125	21.6	63.5	0.1
ϕ140	21.6	91.5	0.1
ϕ160	21.6	116	1.5
ϕ180	21.6	152	2.1
ϕ200	26.6	233	2.8
ϕ250	26.6	362	3.9

3) Install a speed controller as shown in "Basic Circuit Diagram" on the page 1 to control the piston speed.

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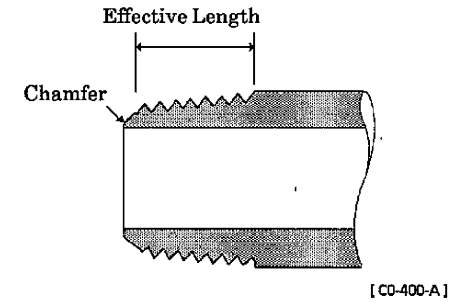
4. INSTALLATION

4.1 Piping

1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc. (It is also recommended to use galvanized pipes for the portion preceding to Filter.)
2) See to it that the pipe connecting cylinder and solenoid valve has effective sectional area needed for the cylinder to drive at specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.
5) Flush air into the pipe to blow out foreign substances and chips before piping.



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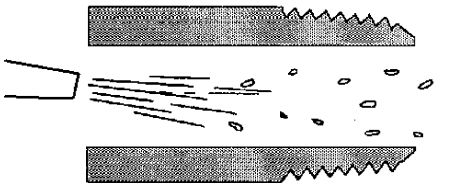
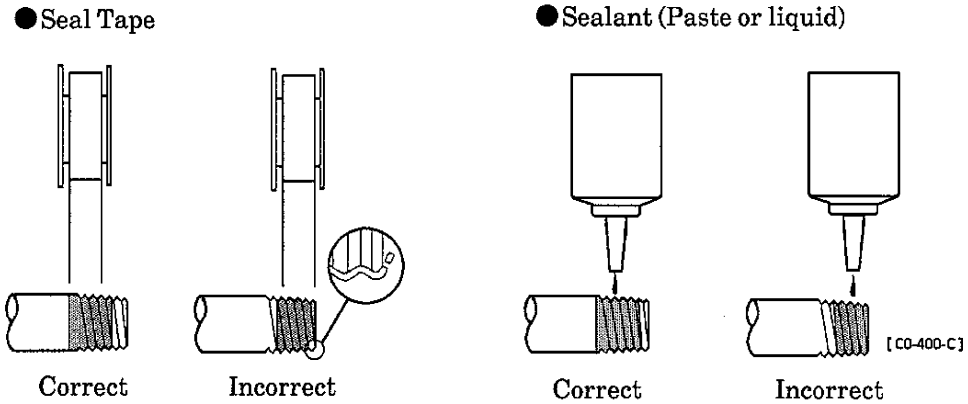

[C0-400-B]

6) Refrain applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



[C0-400-C]

7) Inspect against any external leakage at each threaded joint, upon completion of piping, by applying soapy water over it. Wipe solusion well after inspection is completed.

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4.2 Installation

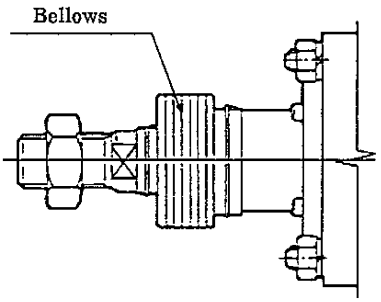
1) The most preferable range of ambient temperature is -5 to 60°C.
2) Use cylinder with bellows over its rod within the area with much dust.

◦ Working temperature of bellows

Unit : °C

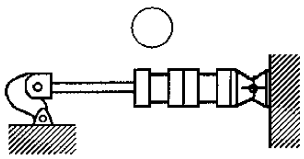
Material of bellows	Max. ambient temperature	Momentary Max. temp.
Nylon tarpaulin	60	100
Neoplane sheet	100	200
Silicon rubber glass cloth	250	400

Note : Momentary max. temperature is the temperature as sparks or welding spatter hitting bellows momentarily.

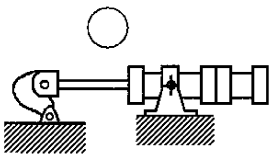


[C2-409-A]

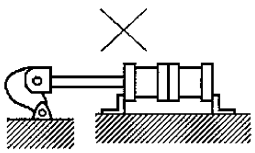
3) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.
4) When cylinder is fixed and rod end is guided :
   In case the piston rod of cylinder and the load are misaligned, the bushes and packings of the cylinder are extremely worn out. Hence, connect them with CKD floating connector (spherical bearing).
5) When the load acting direction changes with the cylinder operation :
   Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle. Furthermore, install the rod and connecting metal (knuckle) so that it moves in the same direction as the cylinder main body does.



Clevis type



Trunnion type



Foot mount type

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5. MAINTENANCE

5.1 Periodic Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items
   ⓐ Check the mounting bolts and nuts to the piston rod end fittings and supporting fittings for slackening.
   ⓑ Check that the cylinder operates smoothly.
   ⓒ Check any change of the piston speed and cycle time.
   ⓓ Check for internal and/or external leakage.
   ⓔ Check the piston rod for flaw (scratch) and deformation.
   ⓕ Check the stroke for abnormality.
   Refer to the "5-2. Trouble shooting" should there be any trouble found upon inspecting items as listed above and also carry out additional tightening if bolts, nuts, etc. are slackened.
3) Inspect the following items.
   ⓐ Scratch marks on internal surface of tube, peeling plate off and/or rust scale.
   ⓑ Scratch marks, wear and cracks of piston surface.
   ⓒ Scratch marks and wear inside of the bushing
   ⓓ Scratch marks on the surface of piston rod, peel-off of plating and rusting.
   ⓔ Loosened connection of piston and rod.
   ⓕ Corrosion or cracks on either end cover.
   ⓖ Scratch marks and wear of packing in sliding part. (Dust wiper, rod packing, cushion packing and piston packing)
   Check all of above items. If any abnormality is found, repair it or replace the parts, when defective.

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5.2 Trouble Shooting

Trouble	Cause	Countermeasure
Does not operate	No pressure or inadequate pressure	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve	Correct the control circuit.
	Improper or misalignment of installation	Correct the installation state and/or change the supporting system.
	Broken piston packing	Replace the packing.
Does not function smoothly	Lower speed than rated	Reduce the load.
	Improper or misalignment of installation	Consider the use of hydraulic cylinder. Correct the installation state and/or change the supporting system.
	Exertion of transverse (lateral) load	Install a guide. Revise the installation state and/or change the supporting system.
	Excessive load	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit	Change the installation direction of the speed control valve.
Breakage and/or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load. Install cushion device with more efficiency. (External cushion)
	Exertion of transverse load	Install a guide. Revise the installation state and/or change the supporting system.

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5.3 Disassembling

Should any trouble occur, take the following corrective actions.

1) Prepare the following tools for disassemling

Name	Qty	Ref. No.	Place of use	Applicable tube ID (mm)
Hex. bar spanner (Nominal 5)	1	22	Socket headed bolt	ϕ125, ϕ140
Hex. bar spanner (Nominal 6)	1	22	Socket headed bolt	ϕ160, ϕ180
Hex. bar spanner (Nominal 8)	1	22	Socket headed bolt	ϕ200
Hex. bar spanner (Nominal 10)	1	22	Socket headed bolt	ϕ250
Spanner (Nominal 22)	2	24	Hexagonal Nut (Tie rod)	ϕ125, ϕ140
Spanner (Nominal 24)	2	24	Hexagonal Nut (Tie rod)	ϕ160
	1	27	Needle nut	All tube bores
Spanner (Nominal 27)	2	24	Hexagonal Nut (Tie rod)	ϕ180
Spanner (Nominal 30)	2	24	Hexagonal Nut (Tie rod)	ϕ200
Spanner (Nominal 36)	2	24	Hexagonal Nut (Tie rod)	ϕ250
⊖ tip screw driver	1	8 14 28	Cushion Needle, Piston Packing, Cushion packing disassembling	All tube bores
Wooden hammer	1	6 10 17 18 20 21	Cover and tube disassembling	All tube bores
Ice pick	1		Packings other than piston packing	All tube bores
Press jig	1	6 8 17 21	Assembling cushion packing	All tube bores

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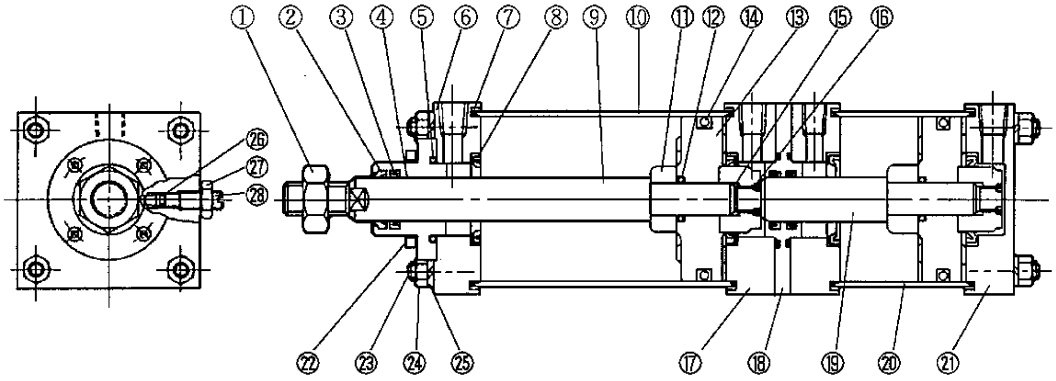
2) Internal structure drawing



Item No.	Parts Name	Material	Qty	Remarks
1	Rod nut	Carbon Steel	1	Zinc chromate
2	Dust wiper	Nitril Rubber	1	
3	Rod packing	Nitril Rubber	3	
4	Rod metal	Casted Iron	1	Painted
5	Metal gasket	Nitril Rubber	3	
6	Rod cover	Rolled Steel	1	Painted
7	Cylinder gasket	Nitril Rubber	4	
8	Cushion packing	Nitril Rubber	4	
9	Piston rod (1)	Carbon Steel	1	Industrial chromium plating
10	Cylinder tube (1)	Carbon Steel pipe	1	Painted Industrial chromium plating
11	Cushion ring A	Carbon Steel	2	Zinc chromate
12	Piston gasket	Nitril Rubber	2	
13	Piston	Casted Iron	2	
14	Piston packing	Nitril Rubber	2	
15	Cushion ring B	Carbon Steel	2	Zinc chromate
16	Hexagon socket set screw	Alloy Steel	2	Black Oxide finish
17	Intermediate cover	Rolled Steel	2	Painted
18	Intermediate plate	Casting	1	
19	Piston rod (2)	Carbon Steel	1	Industrial chromium plating
20	Cylinder tube (2)	Carbon Steel pipe	1	Industrial chromium plating
21	Head cover	Rolled Steel	1	Painted
22	Hexagon socket head cap screw	Alloy Steel	4	Black Oxide finish
23	Tie rod	Carbon Steel	4	Painted
24	Hexagon nut	Carbon Steel	8	Painted
25	Spring washer	Steel	8	Painted
26	Needle gasket	Nitril Rubber	4	
27	Needle nut	Carbon Steel	4	Zinc chromate
28	Cushion needle	Carbon Steel	4	Zinc chromate

Note : Parts ⑧, ㉖, ㉗, ㉘ are not required when it is without cushion.

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3) Disassembling (Refer to "Internal Structure Drawing" page 11)

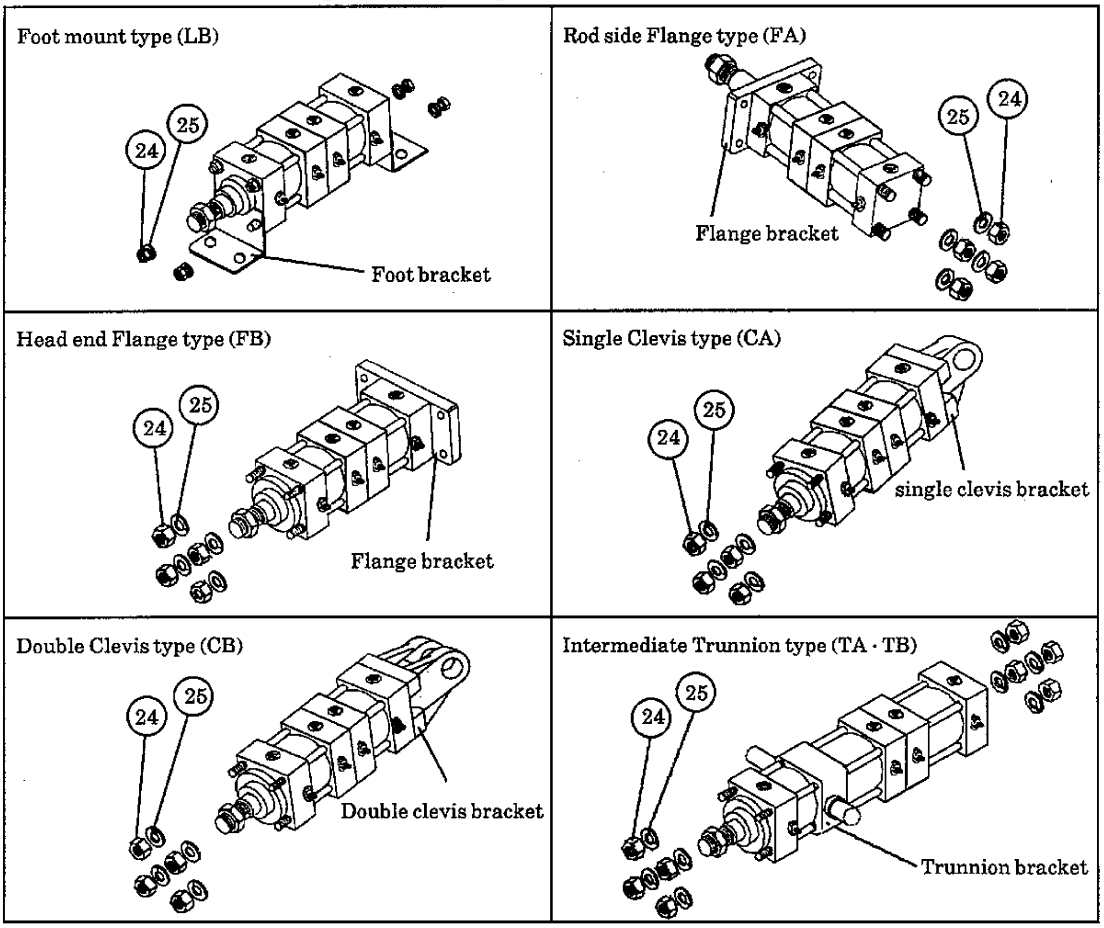
(a) Shut off media and remove residual pressure from a system.

(b) Disconnect pipes from cylinder.

(c) Take out rod metal ④ by removing hexagon socket head cap screw ㉒.

(d) As the hexagon nuts ㉔ are removed, each mounting bracket, that is, foot bracket, flange bracket, single clevis bracket, double clevis bracket, or trunnion bracket, and tie rods ㉓ can be removed. As the tie rods ㉓ are removed, the rod cover ⑥, intermediate covers ⑰, and piston Assy (⑨, ⑪ - ⑯) can then be removed.

Bracket Disassembling or Assembling Procedures



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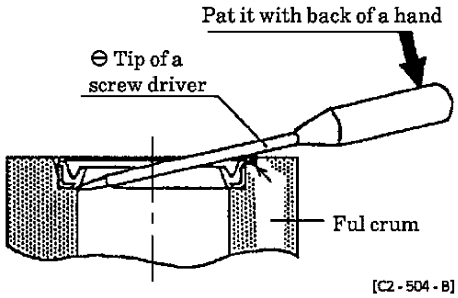
(e) Cushion needle ㉘ comes out when Needle nut ㉗ is removed.

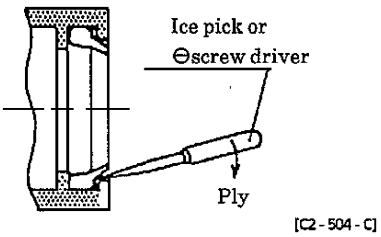
(f) Disassembling Cushion packing ⑧

- Clamp the cover in a vise.
- Place the ⊖ tip of a screw driver underneath of lip of packing, then ply the screw driver making the corner of the spot facing a fulcrum. Patting the driver handle with the back of hand will let the packing come out of its spot facing on the cover.



(g) Removal of Dust Wiper ② and Rod packing ③

Stab the Dust wiper ② with a sharp tip of an Ice pick or ⊖screw driver and ply it out of its spot facing. Apply same procedures over Packing ③ Avoid reusing removed packing. (This procedure is practically adopted because the once removed packing should not be re-used.



4) Assembling

(a) Clean and wash every part.

(b) Carefully assemble them in the reversed procedure of disassembling, particularly, to prevent any damage to lips of packings and seals as it causes malfunction and/or air leakage when it is placed back to service.

(c) Assembling the cushion packing

Use special jig to press the packing into the spot facing on the cover to avoid its tilting and also its damage. Press it down to the point that lip tip of packing settle approx. 0.1 to 0.2mm below the surface of the cover. Table 2 and drawing are for a couple of examples of press jigs.

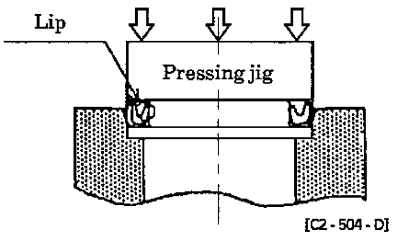
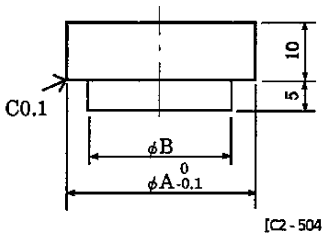


Table 2. Dimensions of press jigs

Tube bore (mm)	A	B
ϕ125, ϕ140	55	45
ϕ160, ϕ180	67	55
ϕ200	72	60
ϕ250	87	75



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(d) Apply a film of high grade grease (such as No. 1 or No. 2, Lithium base saponaceous grease) over the bore surface of Cylinder tube ⑩, circumference surface of Piston ⑬ and packings ②, ③, ⑤, ⑦, ⑧, ⑫, ⑭ and ㉒.

(e) When tightening the nuts on tie rods, gradually tighten each nut on diagonal location to each other respectively, instead of tightening one nut all the way up. The table right displays the recommended range of torque for tightening.

Table 3. Tightening torque

Tube bore (mm)	Torque N · m
φ125, φ140	61
φ160	92.5
φ180	125
φ200	172
φ250	297

5) Inspection

(a) Function Test

After a couple of trial running, the piston should reciprocate smoothly when pressure is charged alternately to each end of cylinder respectively.

· Inspection terms

Pressure supplied	0.05MPa and working pressure
Average speed	Set it to 20 mm/s
Cushion needle	Fully open

(b) Leakage test

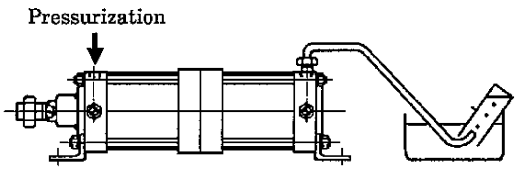
When compressed air is charged from head end and rod end alternately while holding piston in one position, the leakage should be held less than the followings :

Internal leakage	$3+0.15\times D$ cm³/min. (Standard condition)
External leakage	$3+0.15\times d$ cm³/min. (Standard condition)

Whereas D = Cylinder bore dia. (mm)
d = OD of piston rod (mm)

· Procedures of inspection

· Substitution with water



· Soapy water bubble balloon method

It only displays whether there is air leakage or not, while it is unable to decide the volume of leakage.

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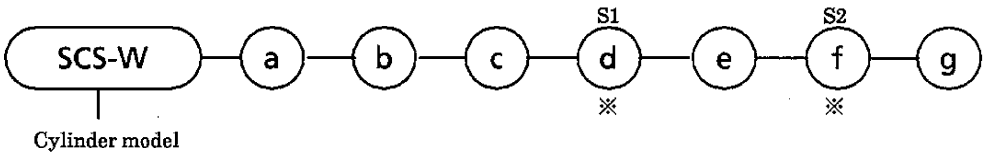
6. HOW TO ORDER

6.1 Model code of cylinder

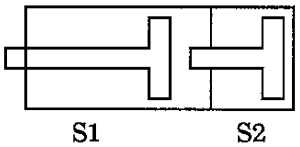


ⓐ Mountingstyle		ⓑ Tube bore (mm)		ⓒ Cushion	
LB	Foot mount type, along axis	125	ϕ 125	B	Cushion, both ends
FA	Rod side Flange type	140	ϕ 140	R	Cushion, rod end
FB	Head end Flange type	160	ϕ 160	H	Cushion, head end
CA	Single Clevis type	180	ϕ 180	N	No cushion
CB	Double Clevis type	200	ϕ 200		
TA	Rod side Trunnion type	250	ϕ 250		
TB	Head end Trunnion type				

ⓓ Stroke			ⓔ Options & accessories	
Standard stroke	Maximum stroke		I	Single knuckle
			Y	Double knuckle
25	ϕ40	600	B1	Single bracket
50	ϕ50	600	B2	Double bracket
75	ϕ63	600	J	Bellow: Nylon tarpaulin
100	ϕ80	700	K	Bellow: Neoprene sheet
150	ϕ100	800	L	Bellow: Silicone rubber glass cloth
200	※ The maximum stroke of S2 (1st stroke) is 200mm.		M	Piston rod, Stainless steel
250			N	Revised length of piston rod extension and
300			No code	threaded portion
350			S	Cushion needle position, standard
400			T	Cushion needle position, 90° off set
450			C2	Cushion needle position, 180° off set
500				

● Example of modelcode disigration SCS - W - 00 - 125 - B150 - B50

1st stroke	50mm	Indicatde as S2
2st stroke	100mm	
Total stroke	150mm	Indicatde as S1



Discontinue

6.2 Model code of parts

1) Expendable parts

Specify the kit No. when purchasing the following parts.

Tube bore (mm) / Parts name / Parts No. / Kit No.		②	③	⑤	⑦
		Dust wiper	Rod packing	Metal gasket	Cylinder gasket
125	SCS-W-125K	SFR-35K	PNY-35	RG-53	H4-543103
140	SCS-W-140K	SFR-35K	PNY-35	RG-53	H4-543104
160	SCS-W-160K	SFR-40K	PNY-40	RG-63	H4-543105
180	SCS-W-180K	SFR-45K	PNY-45	RG-63	H4-543106
200	SCS-W-200K	SFR-50K	PNY-50	RG-70	H4-543107
250	SCS-W-250K	SFR-60K	PNY-60	RG-85	F4-668619

Tube bore (mm) / Parts name / Parts No. / Kit No.		⑧	⑭	㉘
		Cushion packing	Piston packing	Needle gasket
125	SCS-W-125K	PCS-45	P-115	P-9
140	SCS-W-140K	PCS-45	P-130	P-9
160	SCS-W-160K	PCS-55	P-150	P-9
180	SCS-W-180K	PCS-55	P-165	P-9
200	SCS-W-200K	PCS-60	P-185	P-9
250	SCS-W-250K	PCS-75	P-235	P-9