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SM－6160－A

INSTRUCTION MANUAL

SELEX CYLINDER
(Low Hydraulic Type)

SCS-H (φ125～φ250)

- 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
The 4th edition

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For Safety Use

To use this product safety, 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 operation manual carefully for proper operation.**

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

⚠ CAUTION :

- 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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1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Selex Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.
3) Stop up the piping port with a sealing plug to prevent the entry of foreign substances into the cylinder. Remove the sealing plug before piping.

2. INSTALLATION

2.1 Installation

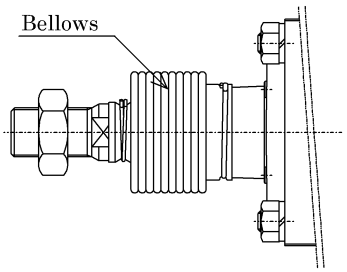
1) The ambient temperature for this cylinder is 5 to 50℃.

2) Use cylinder with bellows over its rod within the area with much dust.

Ambient temperature of bellows Unit : ℃

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

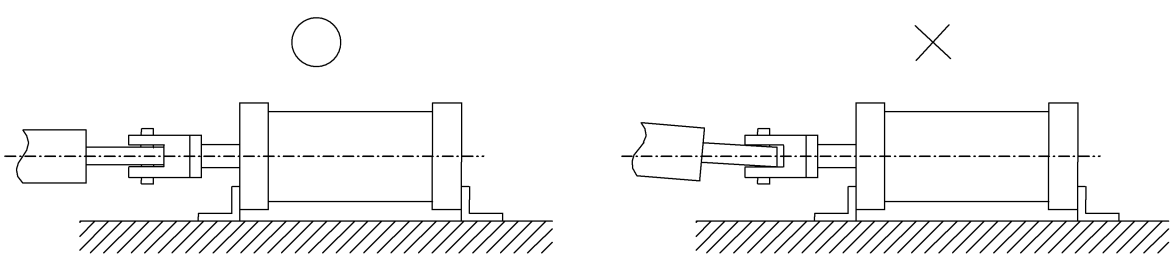
Note : Momentary max. temperature is the temperature as sparks or welding spatter hitting bellows momentarily.



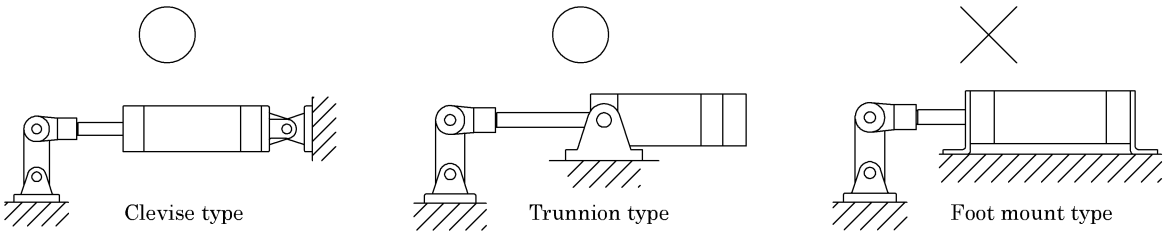
3) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.

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 free joint (spherical bearing).

5) When cylinder is fixed and rod end is connected with pin joint:
In case the load acting direction is not parallel with the rod axial center, the rod and tube may get entangled causing seizure,etc. Hence, make sure that the rod axial center and the load transfer direction are aligned to each other.

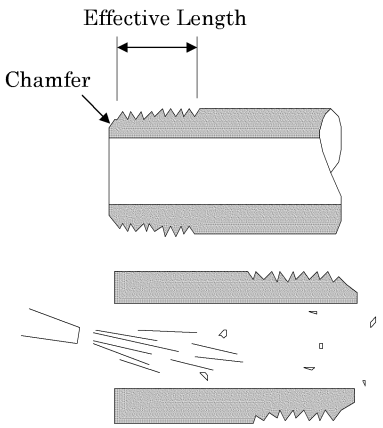


6) When the load acting direction changes with the cylinder operation:
Use an oscillating type (clevis type or trunnion type) capable of making revolution to a certain angle. Furthermore, install the rod and connecting metal (knuckle) so that it moves in the same direction as the cylinder main body does.

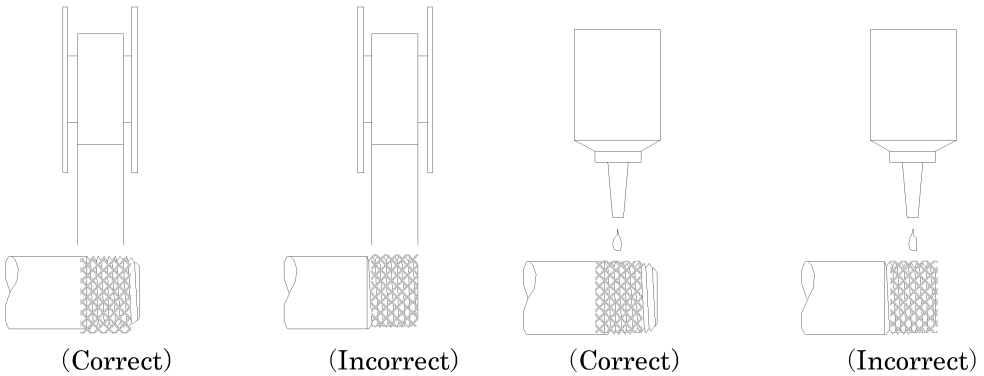


2.2 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area which is needed for the cylinder to drive at the specified speed.
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.
4) Be sure 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.



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



7) Carefully avoid placing an extreme ID difference within piping system which causes unstable flow speed.
8) Choking the ID at joint or 90° curvature will hinder expected flow speed.
9) Lay converter unit and /or control unit in the way of "Mater out" toward driving unit.
10) Inspect and confirm upon completion of piping that there is no leakage at each joint.

2.3 Working fluid

1) Use petroleum family hydraulic fluid, viscosity 20～100mm²/s within the temperature range of 5～50℃.
Slow combustion hydraulic fluid, machine oil and spindle oil are unsuitable for use.
2) Recommended fluid
The hydraulic fluid which viscosity remains in 40mm²/s at operating temperature such as follow are recommended.

Fuji Kosan Co.	: Fucoil hydroil × 22
Nisseki Co.	: Highlandwide 22
Mitsubishi Petro Co.	: Diamond powerfluid 18
Shell Oil Co.	: Sheltellus C22
ESSO Co.	: Univis J26
Mobil Oil Co.	: Bellecity No.10
Maruzen Oil Co.	: Swafluid 22

2.4 Cautions for design and selection

Warnings for design and selection

1) Do not use this product in a place close to a fire, and in equipment or machine at an ambient temperature exceeding 50℃.
● Doing so may cause a fire since the low hydraulic cylinder uses flammable working oil.
2) This product cannot be used in a clean room.

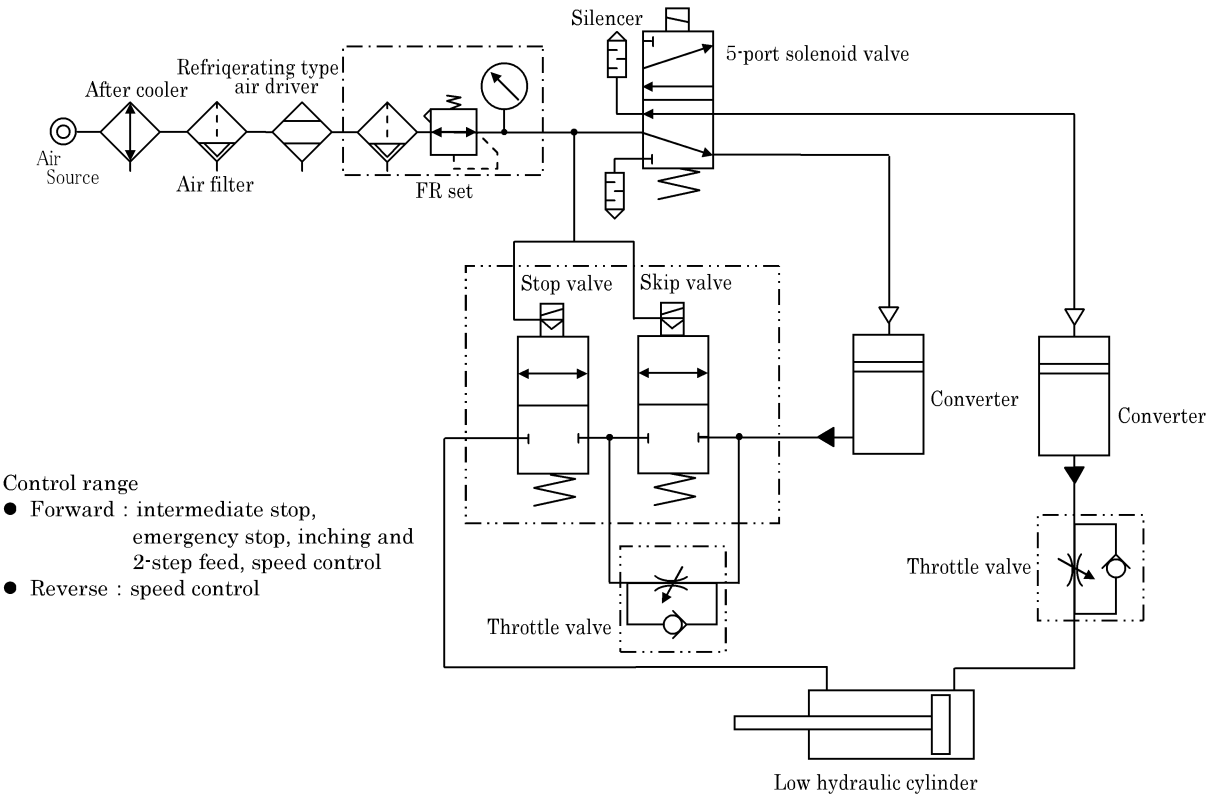
Cautions for design and selection

1) A small amount of the oil may ooze from the packing sliding part or gasket fixing part of the low hydraulic cylinder. Do not use this product in a vacuum container or a place where oozed oil needs to be eliminated.
2) Always attach an exhaust cleaner to the directional control valve for the low hydraulic cylinder.
A small amount of the working oil may be discharged from the exhaust port of the directional control valve in the low hydraulic cylinder, causing the work place around the product to be contaminated.

3) Always install the low hydraulic cylinder in a place where the maintenance work can be carried out easily. Keep a sufficient maintenance space since the low hydraulic cylinder requires several kinds of the maintenance work, such as working oil supply or air removal.
4) Select an optimal combination of the low hydraulic cylinder and converter unit. Proper operation is obtained by combining the low hydraulic cylinder with an appropriate converter unit. Always select an appropriate converter unit.
5) The load to the low hydraulic cylinder is designed to be 50% or less of the theoretical output. To obtain the performance close to that of the hydraulic cylinder, such as constant speed operation and stop a accuracy, the load to the low hydraulic pressure cylinder needs to be 50% or less of the theoretical output.
6) Avoid the inching feed.
If the inching feed of the low hydraulic pressure cylinder is performed, the oil level exceeds the upper limit of the converter and the oil may overflow.
Do not perform the inching feed of the low hydraulic cylinder.

3. FUNDAMENTAL CIRCUIT DIAGRAM AND SELECTION OF RELATED EQUIPMENT

3.1 Fundamental Circuit Diagram



3.2 Related equipment

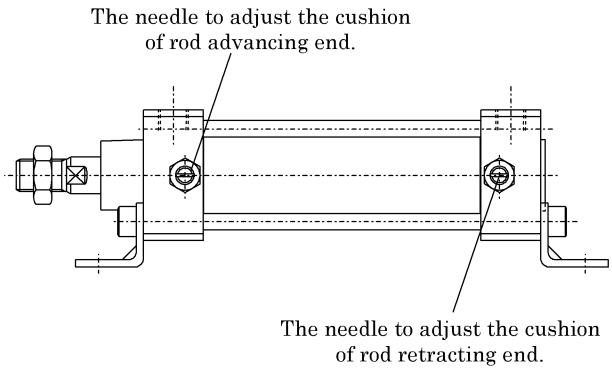
The low hydraulic cylinder combindly uses an air-hydro converter.

4. OPERATION

4.1 Operation

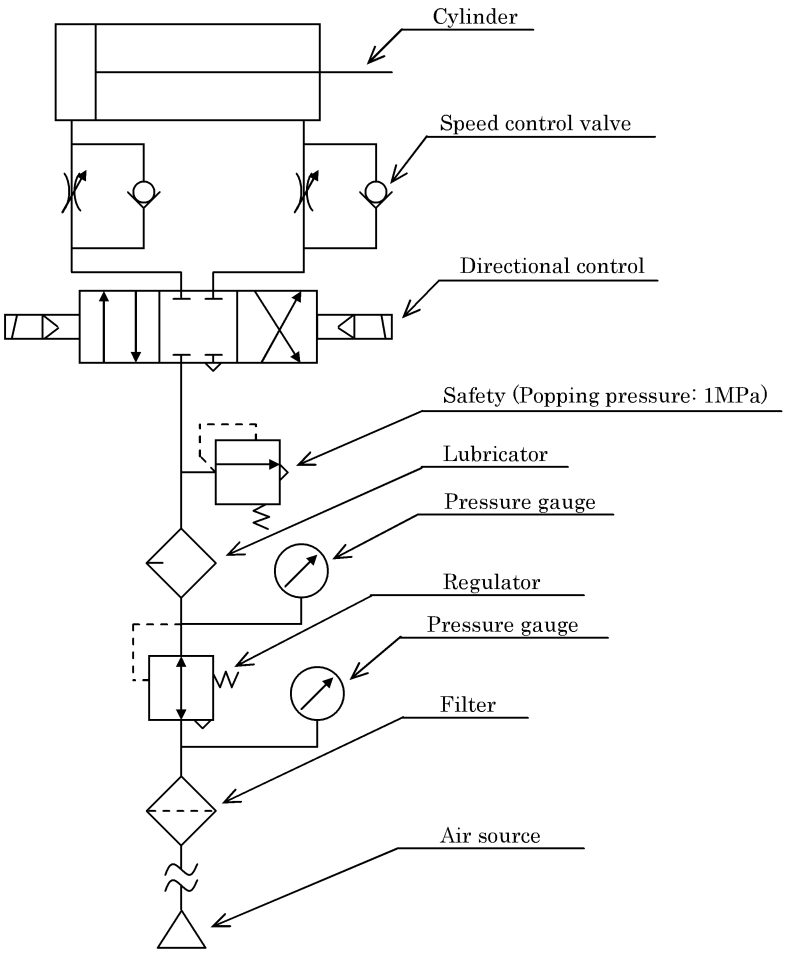
1) The working pressure for this type of cylinder is specified in “Product Specifications”. Operate the system within this range.

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.



4.2 About the system applicable to class 2 pressure vessel

If the system is applicable to class 2 pressure vessel, install a safety valve while referring to the fundamental pneumatic circuit diagram shown below. (The following diagram shows an example of the safety valve mounting orientation.)



<Fundamental pneumatic circuit diagram>

5. MAINTENANCE

5.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.

2) Inspection items
   (a) Check the bolts and nuts fitting the piston rod end brackets and mounting brackets for slackening.
   (b) Check to see that the cylinder operates smoothly.
   (c) Check any change of the working piston speed and cycle time.
   (d) Check for internal and/or external leakage.
   (e) Check the piston rod for flaw (scratch) and deformation.
   (f) Check the stroke for abnormality.

   See "Trouble shooting", 5-2 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

3) Inspect the following items.
   (a) Scratch marks on the boar surface of the tube
   (b) Scratch marks on the surface of piston rod, peel-off of plating and rusting
   (c) Scratch marks and wear inside of the bush
   (d) Scratch marks, wear and crack of the surface of piston
   (e) Loosened connection of piston and rod
   (f) Crack of both end covers
   (g) 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.

4) Followings are expendable parts.

No.	Name \ Bore size (mm) / Kit No.	ϕ 125	ϕ 140	ϕ 160	ϕ 180	ϕ 200	ϕ 250
		SCS-H-125K	SCS-H-140K	SCS-H-160K	SCS-H-180K	SCS-H-200K	SCS-H-250K
②	Dust wiper	SDR-35	SDR-35	SDR-40	SDR-45	SDR-50	SDR-60
③	Rod packing	SKY-35	SKY-35	SKY-40	SKY-45	SKY-50	SKY-60
⑤	Metal gasket	RG-53	RG-53	RG-63	RG-63	RG-70	RG-85
⑦	Cylinder gasket	P12115 -12150200	P12115 -13450200	H4-543105	H4-543106	P12115 -19450200	P12115 -24097262
⑧	Cushion packing	PCS-45	PCS-45	PCS-55	PCS-55	PCS-60	PCS-75
⑭	Piston packing	P-115	P-130	P-150	P-165	P-185	P-235
㉒	Needle gasket	P-9	P-9	P-9	P-9	P-9	P-9

Note : Packings are stocked as a kit. This kit basically contains parts necessary for replacement. It is recommended not only to replace the defective parts, but also to replace the complete parts with ones included in the kit.
Specify the kit No. when ordering.

5.2 Trouble Shooting

Trouble	Causes	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 mounting status. Connect the floating connector. Change the mounting style.
	Broken piston packing	Replace the cylinder.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation
	Improper or misalignment of installation.	Correct the mounting status. Connect the floating connector. Change the mounting style.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the mounting style.
	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 meter-out circuit of the speed control valve.
Breakage and/or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state and/or change the mounting style.

5.3 Disassembling

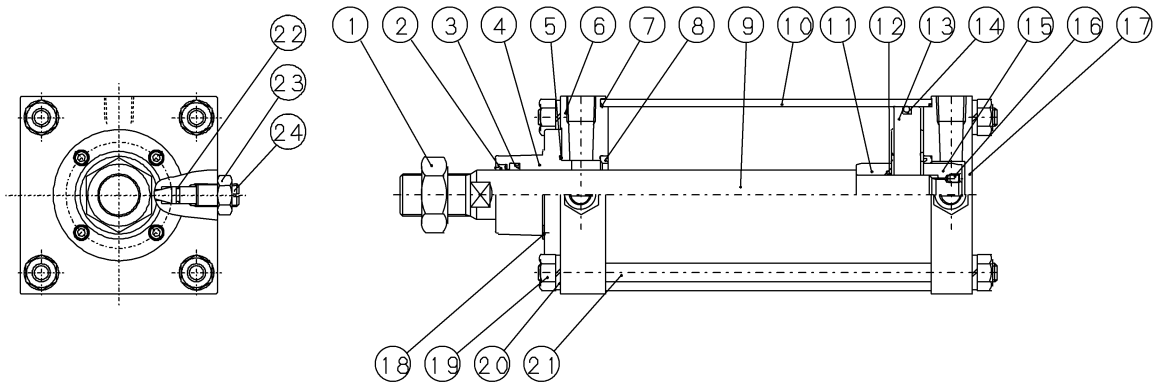
Should any trouble occur, tale the following corrective actions.

1) Prepare the following tools for disassembling.

Disassembling tools

Name	Qty	Part No.	Place of use	Applicable tube ID (mm)
Hex. bar spanner (Nominal 3)	1	18	Hexagon socket set screw	For all tube
Hex. bar spanner (Nominal 5)			Hexagon socket head cap screw	ϕ 125, ϕ 140
Hex. bar spanner (Nominal 6)				ϕ 160, ϕ 180
Hex. bar spanner (Nominal 8)				ϕ 200
Hex. bar spanner (Nominal 10)				ϕ 250
Wrench (Nominal 22)	2	19	Hex. nut (Tie rod)	ϕ 125, ϕ 140
Wrench (Nominal 24)	2 1	19 23	Hex. nut (Tie rod) Needle nut	ϕ 160 For all tube ID
Wrench (Nominal 27)	2	19	Hex. nut (Tie rod)	ϕ 180
Wrench (Nominal 30)				ϕ 200
Wrench (Nominal 36)				ϕ 250
Standard driver	1	8 14 24	Cushion needle, Piston packing, Cushion packing disassembling	For all tube ID
Marret hammer	1	6 10 17	For disassembling Cover and Tube	For all tube ID
Ice pick	1		Packing other than piston packing	For all tube ID
Press jig	1	6 8 17	Cushion packing assembly	For all tube ID

2) Internal structure drawing



Part No.	Part Name	Material	Qty	Note
1	Rod nut	Carbon steel	1	Zinc chromate
2	Dust wiper	Nitril rubber	1	
3	Rod packing	Nitril rubber	1	
4	Rod metal	Cast iron	1	Paint
5	Metal gasket	Nitril rubber	1	
6	Rod cover	Rolled steel	1	Paint
7	Cylinder gasket	Nitril rubber	2	
8	Cushion packing	Nitril rubber	2	
9	Piston rod	Carbon steel	1	Industrial chrome plating
10	Cylinder tube	Carbon steel pipe	1	Paint, Industrial chrome plating
11	Cushion ring A	Carbon steel	1	Zinc chromate
12	Piston gasket	Nitril rubber	1	
13	Piston	Cast iron	1	
14	Piston packing	Nitril rubber	1	
15	Cushion ring B	Carbon steel	1	Zinc chromate
16	Hexagon socket set screw	Alloy steel	1	Black oxide finish
17	Head cover	Rolled steel	1	Paint
18	Hexagon socket head cap screw	Alloy steel	4	Black oxide finish
19	Hexagonal nut	Carbon steel	8	Paint
20	Spring washer	Steel	8	Paint
21	Tie rod	Carbon steel	4	Paint
22	Needle gasket	Nitril rubber	2	
23	Needle nut	Carbon steel	2	Zinc chromate
24	Cushion needle	Carbon steel	2	Zinc chromate

Note : Parts 8, 22, 23, 24 are not required when it is without cushion.

3) Disassembly (Refer to “Internal Structure Drawing” page 11)

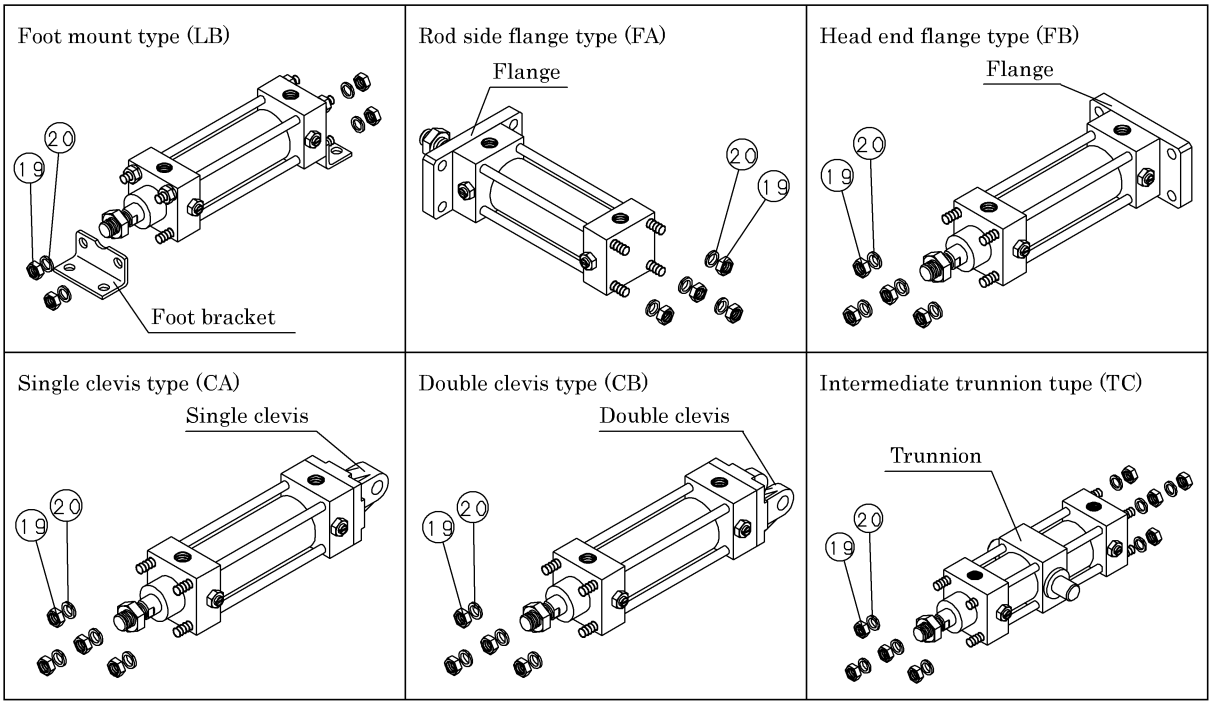
(1) Shut off the fluid and remove the residual pressure.

(2) Disconnect pipes and remove the oil filled in the converter. Then remove the oil filled in the cylinder.

(3) Take out rod metal ④ by removing hexagon socket head cap screw ⑱.

(4) As the hexagon nut ⑲ is removed, each mounting bracket and tie rod ㉑ can be removed. As the tie rod ㉑ is removed, the rod cover ⑥, head cover ⑰, and piston assembly (⑨, ⑪ to ⑯) can then be removed.

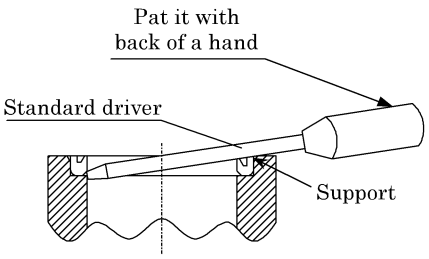
Bracket disassembling or assembling procedures



(5) Cushion needle ㉓ comes out when needle nut ㉔ is removed.

(6) Disassembling cushion packing ⑧

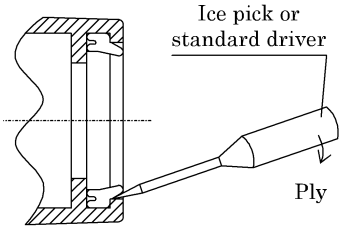
- Clamp the cover in a vise.
- Place the standard driver underneath of lip of packing, then ply the shuttle driver making the corner of the spot facing a fulcrum. Patting the driver handle with the back of hand will let the packing come out of its spot facing on the cover.



(7) Disassembling dust wiper ② and disassembling rod packing ③

Pry the packing off with a tool having the sharp tip, such as standard screwdriver or ice pick.

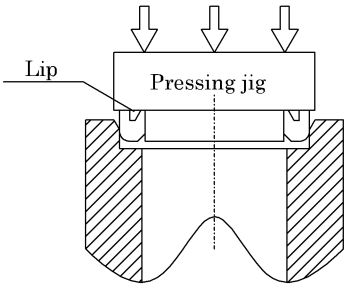
(Do not reuse the detached packing.)



4) Assembly

(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.

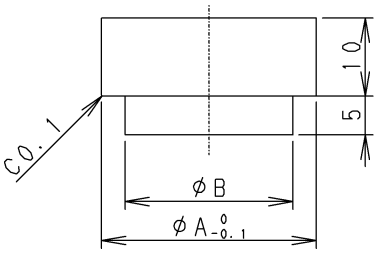


(c) Assembling the cushion packing.
Use special jig to press the packing into the spot facing on the cover to avoid its tilting and also its damage. Press it down to the point that lip tip of packing settle approx. 0.1 to 0.2mm below the surface of the cover.

Table 2 and drawing are for a couple of examples of press jigs.

Table 2. Dimensions of press jigs

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



(d) Apply a film of high grade grease (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

Bore size (mm)	Torque (N·m)
ϕ125, ϕ140	22
ϕ160	34
ϕ180	49
ϕ200	69
ϕ250	123

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6. HOW TO ORDER

SCS-H – a – b c – d – e f

(Low Hydraulic type)

An example coding shown to the left refers to selex cylinder, low hydraulic type(SCS-H), tube bore (125), stroke(200), foot mounting type(LB), with cushion at both ends (B), with single knuckle (I).

(a) Mounting style (Note 1)		(b) Bore size (mm) (Note 2)		(c) Cushion	
LB	Foot mount type, along axis	125	ϕ 125	B	With cushion at both ends
FA	Rod side flange type	140	ϕ 140	R	With cushion at rod side
FB	Head end flange type	160	ϕ 160	H	With cushion at head side
CA	Single clevis type	180	ϕ 180	N	Without cushion
CB	Double clevis type	200	ϕ 200		
TC	Intermediate trunnion type	250	ϕ 250		
TA	Rod side trunnion type				
TB	Head end trunnion type				

(d) Stroke (mm)		(e) Options (Note 3)		(f) Accessories	
50	50	C2	Cushion with a check valve	I	Single knuckle
75	75	J	Bellow: Nylon tarpaulin	Y	Double knuckle
100	100	K	Bellow: Neoprene sheet	B1	Single bracket
150	150	L	Bellow: Silicone rubber glass cloth	B2	Double bracket
200	200	M	Alteration in piston rod material		
250	250	No code	Cushion needle position R (Standard)		
300	300	S	Cushion needle position S		
		T	Cushion needle position T		

Note 1 : Please contact CKD when ordering the hole-type trunnion.
Note 2 : Refer to catalog as for cylinder exceeding max. stroke.
Note 3 : To check the cushion needle position marking, refer to the dimensioned outside drawing.

7. PRODUCT SPECIFICATIONS

Model code / Item		SCS-H					
Bore size	mm	φ125	φ140	φ160	φ180	φ200	φ250
Actuation		Double-acting type					
Working fluid		Hydraulic oil					
Max. working pressure	MPa	1.0					
Min. working pressure	MPa	0.1					
Proof pressure	MPa	1.6					
Ambient temperature	℃	5 to 50 (No freezing)					
Port size		Rc1/2	Rc3/4				Rc1
Stroke tolerance	mm	$^{+1.0}_{0}$ (300 or less), $^{+1.4}_{0}$ (over than 300 and 500 or less), $^{+1.8}_{0}$ (over than 500 and 1000 or less)					
Cushion		Option					
Copper and PTFE free specification		Standard					