CKD Corporation

SM-
213671-A

# INSTRUCTION MANUAL

## SELEX CYLINDER
## (HEAT-RESISTANT SWITCH)

## SCA 2-L2T

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.

# 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.

# INDEX

SCA2-L2T
SELEX Cylinder (Heat-resistant switch)
Manual No. SM 213671-A



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.

# 1. PRODUCT

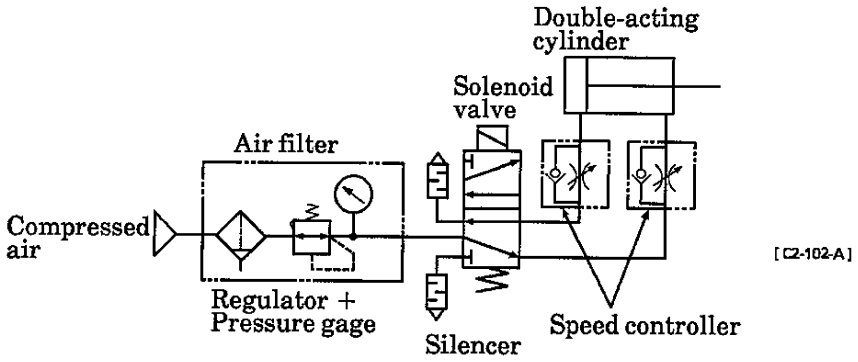
## 1.1 Cylinder

### 1) Specifications

| Model code / Item | SCA2-L2T | | | | |
|---|---|---|---|---|---|
| Action | Double - acting type | | | | |
| Media | Compressed Air | | | | |
| Maximum working pressure MPa {kgf/cm²} | 1.0 {10.2} | | | | |
| Minimum working pressure MPa {kgf/cm²} | 0.05 {0.5} | | | | |
| Proof pressure MPa {kgf/cm²} | 1.6 {16.3} | | | | |
| Ambient tempreature °C | 5~120 | | | | |
| Tube bore mm | φ40 | φ50 | φ63 | φ80 | φ100 |
| Port size Rc | 1/4 | 3/8 | 3/8 | 1/2 | 1/2 |
| Stroke tolerance mm | $^{+1.0}_{0}$ (~300), $^{+1.4}_{0}$ (~500), $^{+2.0}_{0}$ (1000) | | | | |
| Working piston speed mm/s | 50~1000 (Set the speed within the range of energy absorption.) | | | | |
| Cushioning | Be able to select "have cushioning" or "no cushioning | | | | |

### 2) Fundamental Circuit Diagram

Fundamental Circuit Diagram of Double-acting Cylinder
The following is the fundamental circuit diagram.



## 1.2 Switch

### 1) Specifications

| Kind and Model code / Item | Contact point switch<br>E0 |
|---|---|
| Application | For Relay or Programmable controller |
| Load voltage and current | DCV12/24V, 5~50mA<br>AC100V, 7~20mA<br>AC200V, 7~10mA |
| Internal voltage drop | 4V or lower |
| Lamp | LED (Lights while power is ON) |
| Current leak | 0mA |
| Electrical wiring pipe screw | G1/2 |
| Max. shock | 294m/s² {30G} |
| Insuration resistance | 100MΩ or more by DC 500V megger |
| Insuration voltage | No abnormalities upon charging AC1500V for one minute. |
| Ambient temperature | 5~120°C |
| Protective structure | IEC Standard IP67, JIS C0920 (Intrusion type without water), Oil proof |

Note : The heat-resistant switch is not interchangeable with a normal cylinder switch.
The E-type switch is a special switch for the heat-resistant cylinder (SCA2-L2T).
Please use this combination.

### 2) Switch configuration and operation principle

The lead switch is an electric contact made from magnetic material and is enclosed together with inert gas inside a glass tube. If the magnetic flux of the piston magnet is exerted on this, the contact that matches the direction will be magnetized and the magnetic pulling force will close the contact. (Figure 1)

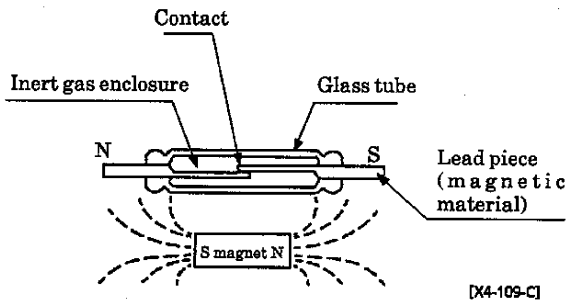



Fig 1. Lead switch configuration

### 3) Internal circuit diagram

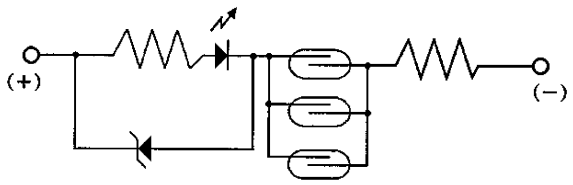



図2

## 4) Switch unit outer dimensions

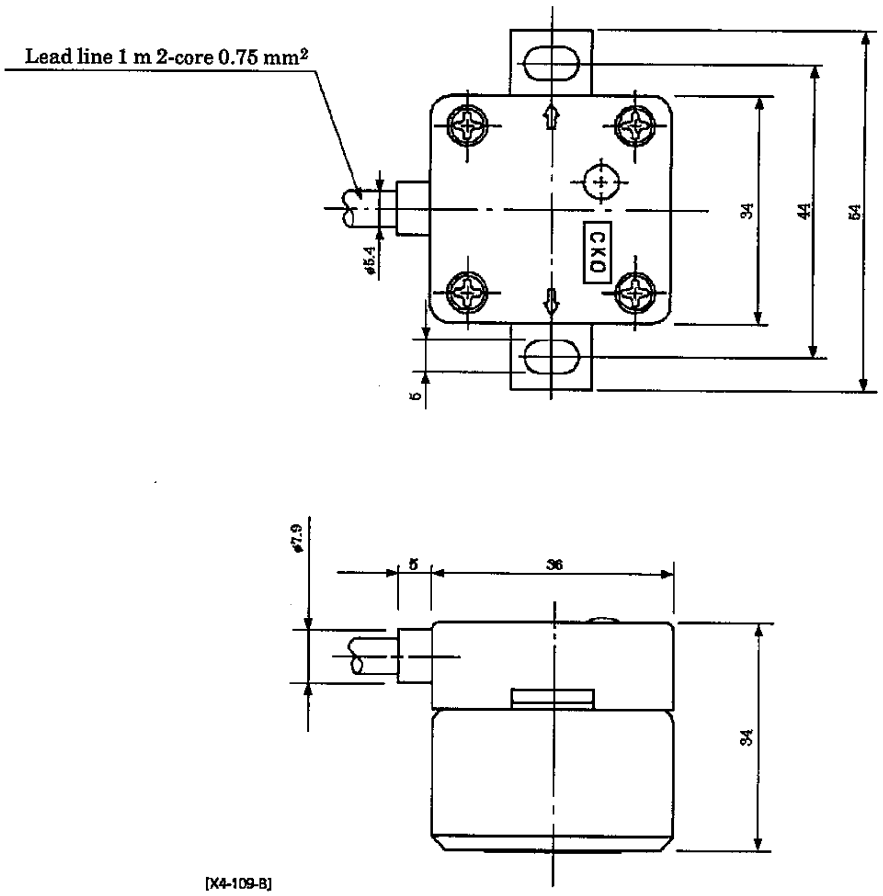


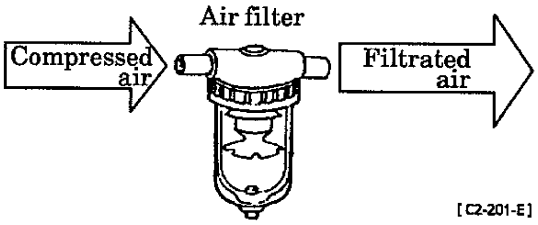

図3

2
CAUTION

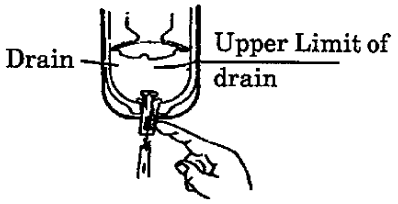
# 2. CAUTION

## 2.1 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5$\mu$m or less), flow rate and its mounting location (as nearest to the directional control valve as possible).
2) Be sure to drain out the accumulation in the filter periodically.
3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.



[C2-201-E]



[C2-201-F]

## 2.2 Regarding the product

1) Avoid using in the vicinity of a strong magnetic field or large electrical current ( near a large scale magnet or spot welding machine for example). If switch included cylinders are installed in a row in close proximity to one another or if magnetic materials are moved close to the cylinder(s), there are cases where this causes mutual interference and influences the detection accuracy.
2) Use within a temperature range of between 5 and 120℃.
Furthermore if the surrounding temperature rises the cylinder temperature will also rise. Do not touch the cylinder under high temperature as it will cause a burn injury.
3) As there is a strong built-in magnet in the inside of the cylinder, do not handle products such as magnetic disks, magnetic cards, or magnetic tape that will be affected by the magnet in the vicinity of the cylinder.
4) When the cylinder is being installed or transported do not subject the switch to large vibrations or impact.

## 2.3 Switch connection procedure and connection load

1) Lead line connection procedure

Do not connect the lead line of the switch directly to the power source. Always connect the load in series.

When the AC relay is connected to the programmable controller input, if half-wave rectification is carried out using the circuits, there are cases where the switch lamp does not light up.

In such a case, the switch lamp can be lit up by reversing the poles of the switch lead line connection.

2) Contact protective measures

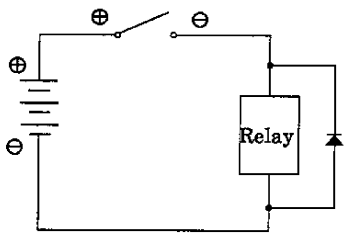
If the inductive load of the relay for example is used or the length of wiring exceeds that given in table 1, a contact protection circuit should always be set up.

Table 1

| Voltage | Wire length[m] |
|---|---|
| DC | 100 |
| AC | 10 |

a. Protection when the inductive load is connected

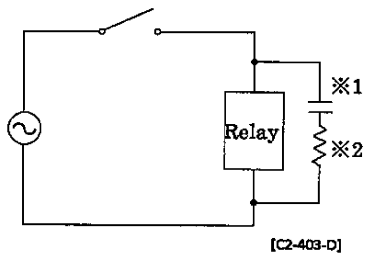
Example of the use of a surge absorbing device (diode) using the DC relay load




[C2-403-C]

Use a Hitachi V06C or comparable product as the diode. (Be careful of the poles.)

Using a surge absorbing circuit via the AC relay load




[C2-403-D]

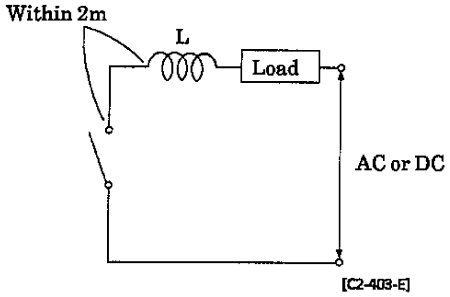
※1 Capacitor
0.03~0.1μF

※2 Resistance
1~3kΩ

2
CAUTION

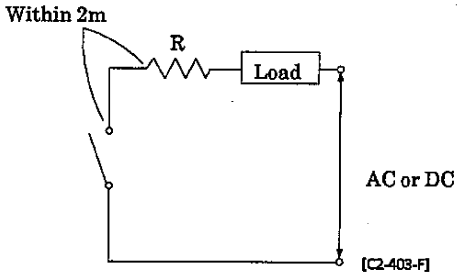
b. Protection when the length of the wiring exceeds that given in table 1

<When a choke coil is employed>




- Choke coil
  L=Hundreds of $\mu$H~Number of mH
  Superior high frequency characteristic coil
- Wire close to the switch (Within 2m)

<When resistance is used>




- Restricted rush current resistance
  R=Large resistance limited to the load circuit side
- Wire close to the switch (Within 2m)

3) Contact capacity

Avoid using a load that exceeds the maximum contact capacity of the switch. In addition, if the rated current is less than the maximum capacity there are instances when the lamp does not light up.

4) Relay

Choose a relay from among the following.

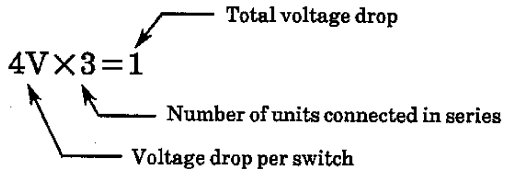
| | |
|---|---|
| OMRON Corporation ..... | Model MY |
| FUJI ELECTRIC CORP ..... | Model HH5 |
| Tokyo Electric ..... | Model MPM |
| Matsushita Electric Works Ltd. ..... | Model HC |

5) In series connection

In the case that multiple E0 switches are connected in series, the voltage drop in the switches will be the sum of the voltage drop of all of the switches that are connected.

The amount of voltage drop in the switches must be deducted from the power supply voltage to determine the voltage exerted on the load side, so be careful of the minimum operation voltage load.

Example : Voltage drop used by the switches if three switches are connected in series




6) Parallel connection

When multiple switches are connected in parallel there is no limit as to the number of switches that can be connected.

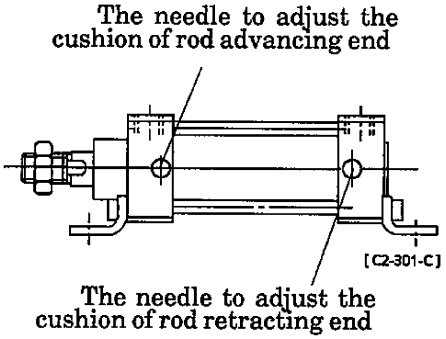
However, in the case of E0 switches, if multiple switches are ON at the same time, the lamp may become dimmer or not light up at all.

# 3. OPERATION

## 3.1 Regarding cylinder operation

1) The cylinder feed pressure is 0.05~1.0 MPa {0.5~10.2kgf/cm$^2$}; 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 2, consider of providing a shock absorber.

Table 2: Table of cushion characteristics

| Tube bore (mm) | Absorbable energy J {kgf · m} | | |
|---|---|---|---|
| | Effective cushion length (mm) | With cushion | Without cushion |
| $\phi$ 40 | 14.6 | 4.29 {0.437} | 0.15 {0.015} |
| $\phi$ 50 | 16.6 | 8.37 {0.854} | 0.24 {0.024} |
| $\phi$ 63 | 16.6 | 15.8 {1.62} | 0.24 {0.024} |
| $\phi$ 80 | 20.6 | 27.9 {2.85} | 0.54 {0.055} |
| $\phi$100 | 23.6 | 49.8 {5.08} | 0.87 {0.089} |

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

## 3.2 Switch actuation range and hysteresis

The characteristic values indicating the operation of cylinder switch detection such as the actuation range, hysteresis, and switch installation position are published in the catalog. The meanings of these values are explained here.

1) Actuation range

In the middle of the cylinder stroke when the piston moving in one direction is detected, the distance that the piston moves from the time the cylinder switch comes ON to when it goes OFF is referred to as the actuation range of the switch.

2) Hysteresis

The amount of hysteresis of the switch is indicated by the distance the piston moves in one direction from the OFF position to the movement to the ON position in the opposite direction. (Figure 4)

The switch actuation range and hysteresis are given in the table below.

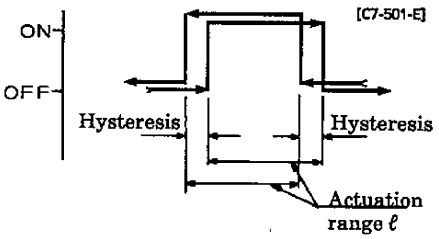



Fig. 4. Actuation range and Hysteresis

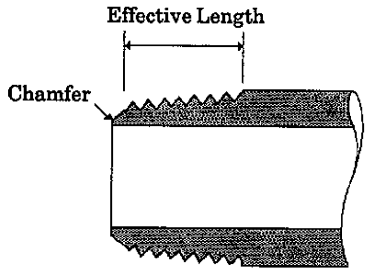
Table 3. Actuation range and Hysteresis

| Tube bore [mm] | Actuation range [mm] | Hysteresis [mm] |
|---|---|---|
| $\phi$40 | 20~23 | 3 or less |
| $\phi$50 | 21~25 | 3 or less |
| $\phi$63 | 23~27 | 3 or less |
| $\phi$80 | 23~27 | 3 or less |
| $\phi$100 | 24~28 | 3 or less |

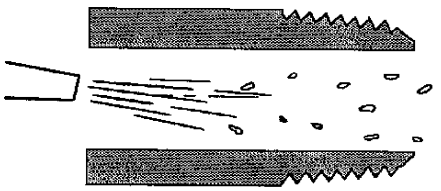
# 4. INSTALLATION

## 4.1 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc. (Refer to Selection Guide Table for Related Equipment.)
2) See to it that the pipe connecting cylinder and solenoid valve has an effective sectional area which is needed for the cylinder to drive at the specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust and foreign substances in the drain of the pipe.
4) Be sure to adhere to the effective thread length of gas pipe and make 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.

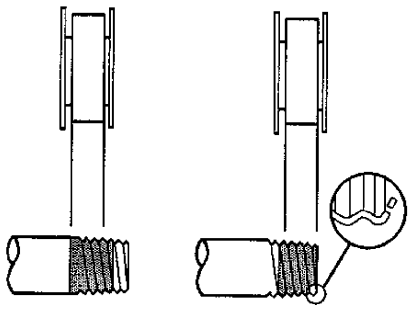


[CD-400-A]

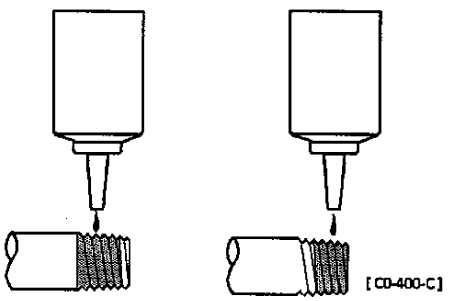

[CD-400-B]

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

● Seal Tape


Right False

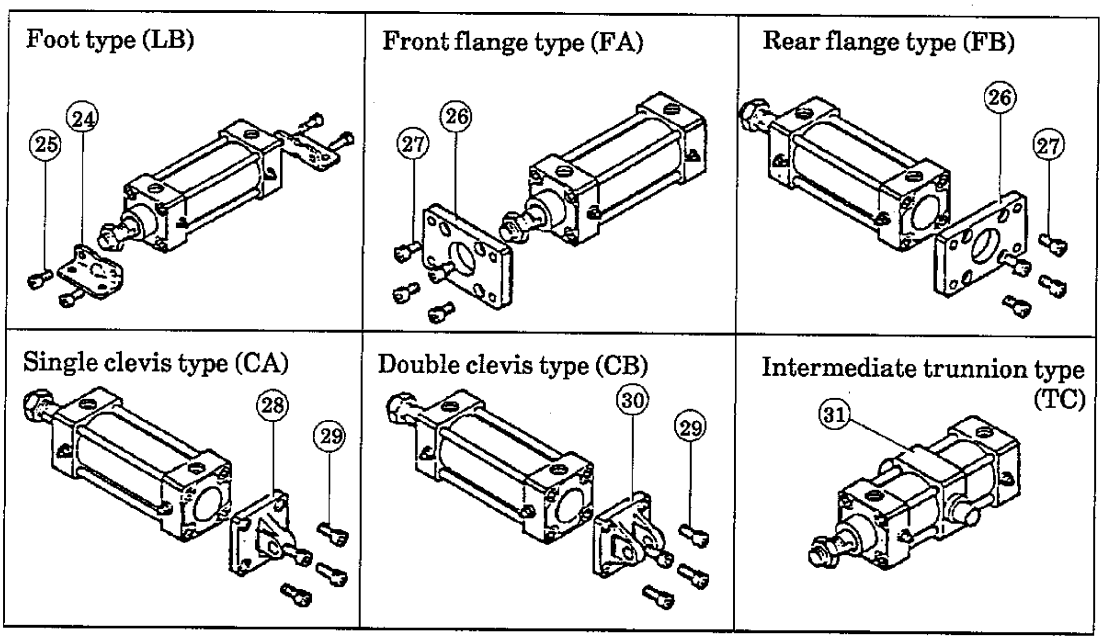
● Sealant (Paste or liquid)


[CD-400-C]
Right False

## 4.2 Installation

1) The ambient temperature range for this cylinder is 5~120°C (Not to be frozen).
2) Use cylinder with bellows over its rod within the area with much dust.
3) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.
4) Assembly of supporting metal fittings:
   The supporting metal fittings are supplied with the cylinder at the time of deliver. Install them as shown in the figures on this page.
   However, the trunnion types (TC, TA and TB) are shipped with the trunnion mounted.

Assembly of supporting metal fitting (same as disassembling)

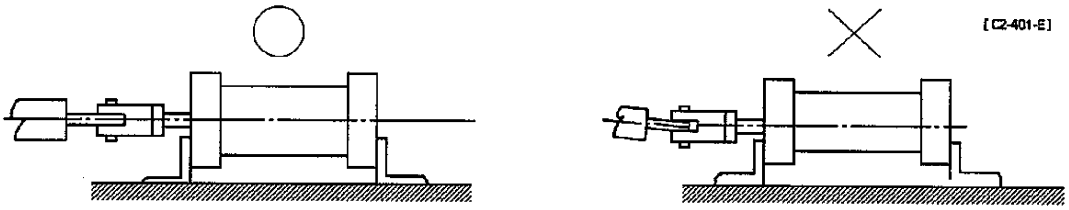



[C2-401-D]

5) 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).

6) When cylinder is fixed and rod end is connected with pin joint:

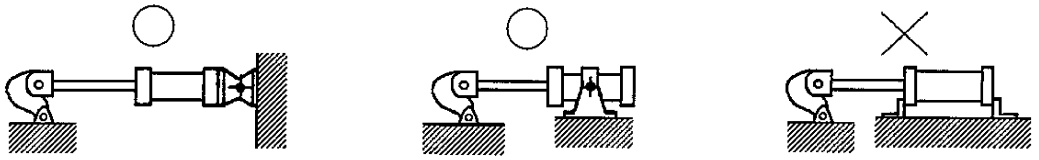
In case the load acting direction is not parallel with the rod axial center, the rod and tube may get entangled causing seizure, etc. Hence, make sure that the rod axial center and the load transfer direction are aligned to each other.



[C2-401-E]

7) 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.



Clevise type　　Trunnion type　　Foot type

[C2-401-F]

## 4.3 Switch installation position

1) When the stroke end is installed

Install in the position indicated in table 4 in order to operate the switch in the position of maximum sensitivity.

Furthermore, please refer to table 5 as well since the circumference direction in which the switch is mounted in the installation position will differ depending on the stroke.

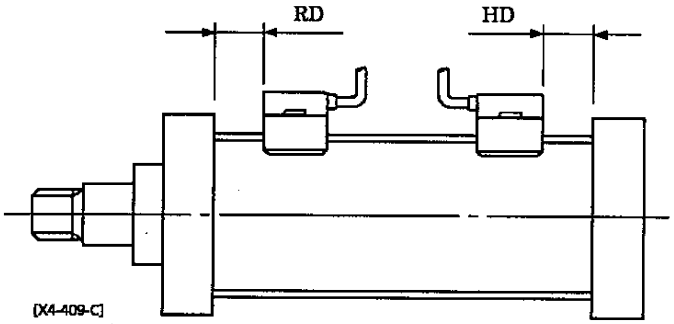
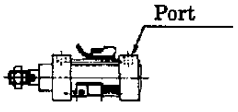
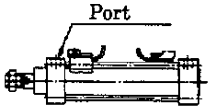
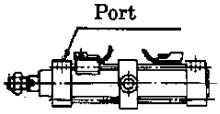
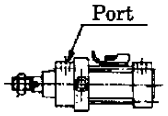
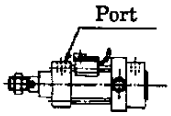



Table 4
Position of maximum sensitivity

| Tube bore (mm) | RD / HD (mm) |
|---|---|
| ϕ40 | 0 |
| ϕ50 | 1.5 |
| ϕ63 | 1.5 |
| ϕ80 | 3 |
| ϕ100 | 7 |

Table 5. Circumference direction switch installation position stroke

| Item | Stroke for irregular surface installation | Stroke for uniform surface installation | Stroke for intermediate trunnion installation |
|---|---|---|---|
| Skeleton diagram / Bore |  Port [C7-501-F] |  Port [C7-501-G] |  Port [C7-501-H] |
| ϕ40 | 150~332 | 333 or more | 333 or more |
| ϕ50 | 145~331 | 332 or more | 332 or more |
| ϕ63 | | | |
| ϕ80 | | | |
| ϕ100 | 140~331 | | |

| Item | Rod side trunnion installation stroke | Head side trunnion installation stroke |
|---|---|---|
| Skeleton diagram / Bore |  Port [C7-501-I] When position detection of the rod side stroke end is not possible |  Port [C7-501-J] When position detection of the head side stroke end is not possible |
| ϕ40 | 150 or more | 150 or more |
| ϕ50 | 145 or more | 145 or more |
| ϕ63 | | |
| ϕ80 | | |
| ϕ100 | 140 or more | 140 or more |

2) When installing in the stroke intermediate position

If the piston is detected in the middle of a stroke, secure the piston at the stop position, move the switch back-and-forth along the piston, and find the positions at which each of the switches come ON. The intermediate position between these two positions is the piston position of maximum sensitivity and this becomes the installation position.

## 4.4 Switch installation procedure

1) Switch installation procedure

① Pass a flat washer and toothed lock washer through the hexagon-socket-head bolt and insert the bolt in the slotted hole on the switch mounting plate.

② Place the mounting bracket on the cylinder tie rod and tighten the hexagon-socket-head bolt in the center hole. The tightening torque is 1N · m {10kgf · cm}.

③ Tighten the mounting bracket in four places with the mounting screws. The tightening torque is 1N · m {10kgf · cm}.

Tighten these mounting screws (figure 5) in the following order; ①→②→③→④→①→②.

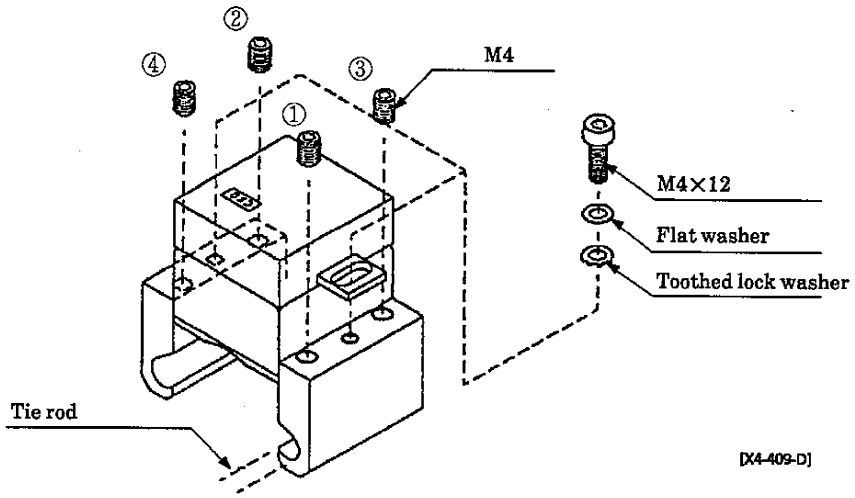



Fig 5. Switch installation procedure

2) Switch movement procedure

Loosen all of the mounting screws and the hexagon-socket-head bolt on the switch mounting bracket and then after moving the switch to the designated mounting bracket position, tighten the center hexagon-socket-head bolt. Once this is done tighten the mounting screws (figure 5) in the following order; ①→②→③→④→①→②. The tightening torque is 1N · m {10kgf · cm}.

# 5. MAINTENANCE

## 5.1 Cylinder

### 5.1.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items
   ⓐ Check the bolts and nuts fitting the piston rod end fittings and supporting fittings for slackening.
   ⓑ Check to see 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.

   See "Trouble shooting", 5.1.2, should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

### 5.1.2 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 cylinder. |
| Does not function smoothly | Speed is below the low speed limit | Limit the load variation. |
| | Improper or misalignment of installation | Correct the installation state and/or change the supporting system. |
| | Exertion of transverse (lateral) load | Install a guide.<br>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.<br>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.<br>Reverse the installation state and/or change the supporting system. |

## 5.1.3 Disassembling

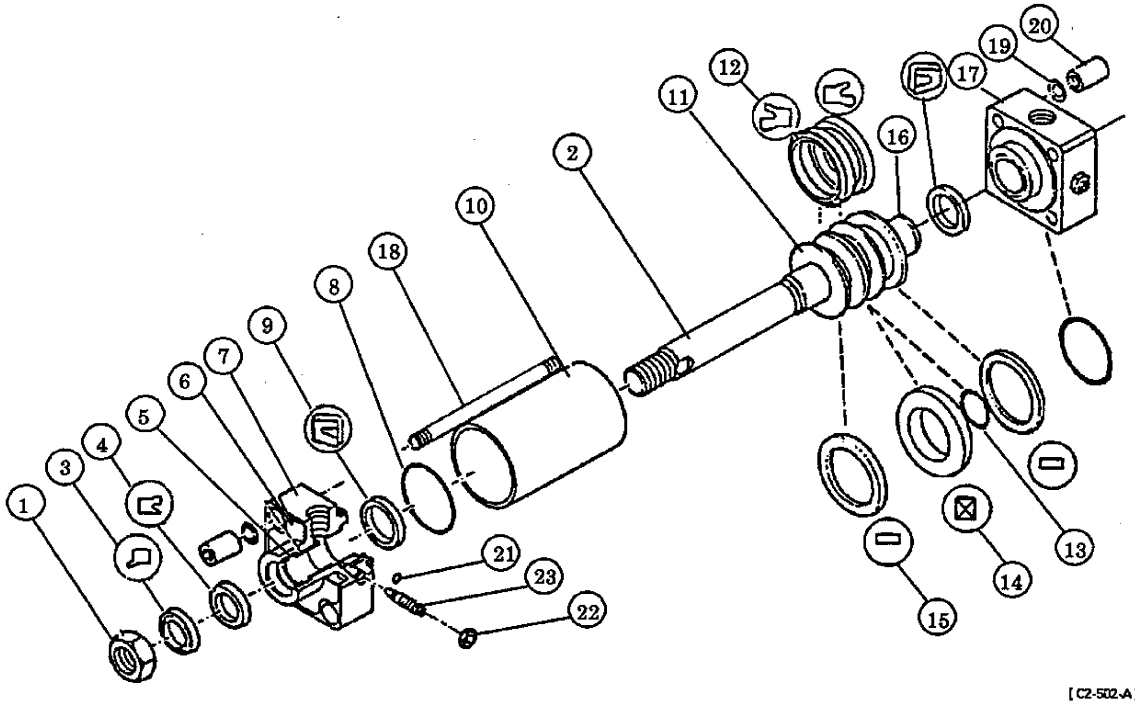
Should any air leakage occur, take the following corrective actions.

1) Prepare the following tools for disassemling.

Disassembling tools

| Name | Qty | Place of use | Applicable tube ID (mm) |
|---|---|---|---|
| Hex. bar spanner (Nominal 8) | 2 | 20 | 40, 50, 63 |
| Hex. bar spanner (Nominal 12) | 2 | 20 | 80, 100 |
| Spanner (Nominal 13) | 1 | 22 | For all tube ID |
| Minus tip screwdriver (Nominal 5.5 × 75) | 1 | 12, 23 | For all tube ID |
| Minus tip screwdriver (Nominal 9 × 200) | 1 | 9 | For all tube ID |
| Marret hammer | 1 | For disassembling 7, 17 and 10 | For all tube ID |
| Ice pick | 1 | 3, 4, 8 and 21 | For all tube ID |

2) Disassemble the cylinder, referring to the following drawing.




[C2-502-A]

| Part No. | Part Name | Qty | Part No. | Part Name | Qty | Part No. | Part Name | Qty |
|---|---|---|---|---|---|---|---|---|
| 1 | Rod nut | 1 | 11 | Piston (R) | 1 | 21 | Needle gasket | 2 |
| 2 | Piston rod | 1 | 12 | Piston packing | 2 | 22 | Needle nut | 2 |
| 3 | Dust wiper | 1 | 13 | Piston gasket | 1 | 23 | Cushion needle | 2 |
| 4 | Rod packing | 1 | 14 | Piston magnet | 1 | | | |
| 5 | Bushing | 1 | 15 | Wear ring | 2 | | | |
| 6 | Masking plate | 2 | 16 | Piston (H) | 1 | | | |
| 7 | Rod cover | 1 | 17 | Head cover | 1 | | | |
| 8 | Cylinder gasket | 2 | 18 | Tie rod | 4 | | | |
| 9 | Cushion packing | 2 | 19 | Conical spring washer | 8 | | | |
| 10 | Cylinder tubu | 1 | 20 | Round nut | 8 | | | |

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 bushing
   (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.
   Specify the kit No. when ordering.

| Part No. | Name \ Tube ID(mm) / Kit No. | ϕ 40 | ϕ 50 | ϕ 63 | ϕ 80 | ϕ 100 |
|---|---|---|---|---|---|---|
| | | SCA2-T-40K | SCA2-T-50K | SCA2-T-63K | SCA2-T-80K | SCA2-T-100K |
| 3 | Dust wiper | SFR-16F | SFR-20F | SFR-20F | SFR-25F | SFR-30F |
| 4 | Rod packing | PNY-16F | PNY-20F | PNY-20F | PNY-25F | PNY-30F |
| 8 | Cylinder gasket | F4-667140 | F4-667141 | F4-667142 | F4-667143 | F4-667144 |
| 9 | Cushion packing | PCS-20F | PCS-24F | PCS-24F | PCS-35F | PCS-45F |
| 12 | Piston packing | PGY-40F | PGY-50F | PGY-63F | PGY-80F | PGY-100F |
| 15 | Wear ring | F4-650583 | F4-650584 | F4-650585 | F4-650586 | F4-650587 |
| 21 | Needle gasket | P-3F | P-3F | P-3F | P-3F | P-3F |

5) When replacing the packing, apply the heat-resistant grease given below.
   Recommended grease :SUMICO LUBRICANT CO., LTD molybdenum type grease MOLYTHERM #0

## 5.2 Switch

### 1) Troubleshooting

| Trouble | Cause | Countermeasures |
|---|---|---|
| Switch does not work | Cut line | Replace the switch |
| | | Recheck the external circuit |
| | Wrong voltage | Use the instructed voltage |
| | Wrong installation position | Set in the correct position |
| | Misaligned installation position | Correct the misalignment, tighten harder |
| | Switch direction is reversed | Set in the correct direction |
| | When detected during the stroke | Slow the speed |
| Switch does not return | Piston has not been moved | Move the piston |
| | Welded contact | Replace the switch |
| | Surrounding temperature is wrong | Set the surrounding temperature to between 5 and 120* C |
| | External signal defect | Recheck the external circuit |

# 6. HOW TO ORDER

## 6.1 Selex cylinder

• Without switch

SCA2 - L2T — LB — 40 — B — 100 ——— Y

• With switch

SCA2 - L2T — LB — 40 — B — 100 — E0 — R — Y

ⓐ ⓑ ⓒ ⓓ ⓔ ⓕ ⓖ

Double action · Heat-resistant Switch-included specifications

The order number example given above indicates a selex cylinder no.2, foot mounting type, tube bore of ϕ40, with cushion at both ends, stroke of 100, E0 switch with 1 switch on each rod end, and with the double knuckle option.

| ⓐ Mounting style | |
|---|---|
| OO | Basic type |
| LB | Foot mounting type |
| FA | Front flange mounting type |
| FB | Rear flange mounting type |
| FC | Special rear flange mounting type |
| CA | Single clevis mounting type |
| CB | Double clevis mounting type |
| TC | Intermediate trunnion type |
| TA | Front trunnion mounting type |
| TB | Rear trunnion mounting type |

| ⓑ Tube bore (mm) | |
|---|---|
| 40 | ϕ40 |
| 50 | ϕ50 |
| 63 | ϕ63 |
| 80 | ϕ80 |
| 100 | ϕ100 |

| ⓒ Cushion | |
|---|---|
| B | With cushion at both ends |
| R | With cushion at rod side |
| H | With cushion at head side |
| N | Without cushion |

Note : Mounting bracket is attached to the product at shipment. (The trunnion mounting types are assembled at shipment.)

| ⓓ Stroke (mm) | | |
|---|---|---|
| Std. stroke | Max. stroke | |
| 150 | ϕ40 | 600 |
| 200 | ϕ50 | 600 |
| 250 | ϕ63 | 600 |
| 300 | ϕ80 | 700 |
| 350 | ϕ100 | 800 |
| 400 | | |
| 450 | | |
| 500 | | |

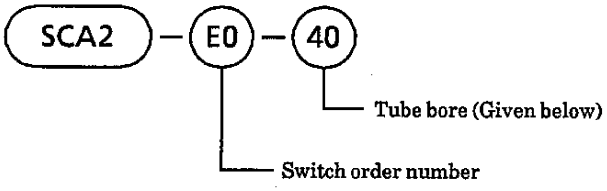
| ⓔ Switch model code |
|---|
| E0 |

| ⓕ Qty of switch | |
|---|---|
| R | Rod end, 1 ea. |
| H | Head end, 1 ea. |
| D | Switches, 2 ea. |
| T | Switches, 3 ea. |

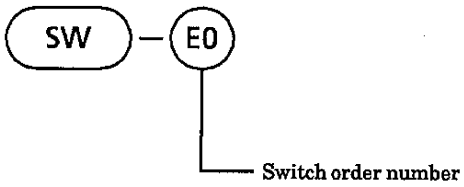
| ⓖ Options & accessories | |
|---|---|
| L | Bellow: Silicone rubber glass cloth |
| M | Alteration in piston rod material |
| No code | Cushion needle position R (Standard) |
| S | Cushion needle position S |
| T | Cushion needle position T |
| I | Single knuckle |
| Y | Double knuckle |
| B1 | Single bracket |
| B2 | Double bracket |
| B4 | Trunnion type No.2 bracket |

## 6.2 Switch unit order number display procedure

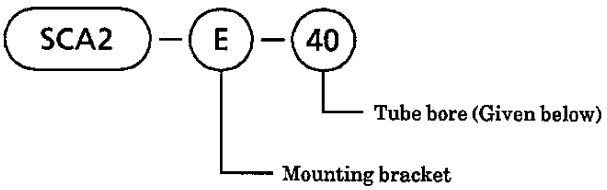
### (A) Switch unit + mounting bracket type




### (B) Switch unit only




### (C) Mounting bracket type




| ④ Tube bore(mm) | |
|---|---|
| 40 | ϕ40 |
| 50 | ϕ50 |
| 63 | ϕ63 |
| 80 | ϕ80 |
| 100 | ϕ100 |