Discontinue

CKD Corporation

SM-
209216-A

INSTRUCTION MANUAL

SUPER RODLESS CYLINDER
High Precision Guide Mounted Type

SRG

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.

Discontinue

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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1. OPENING THE PACKAGE

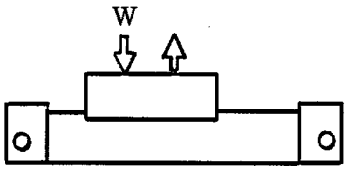
- Confirm that the model No. in the label of the product is same as the order one.
- Inspect the outward damage.
- Keep the seal cap on the ports because alien substances don't come in the ports. (Remove the cap when you install the product.)

2. INSTALLATION

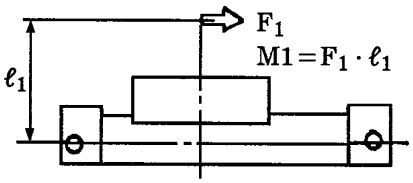
2.1 Condition to install

1) Operate this cylinder at the ambient temp. of 5~60 °C.
2) Be careful not to bump the cylinder tube against an object. The tube, when distorted, causes malfunction.
3) A too long stroke increases the slackness of the cylinder tube, leading to malfunction. Choose the load that falls within the tolerable range indicated by the graph and table on the next page.

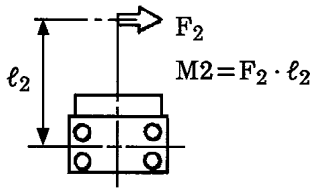
● Vertical load



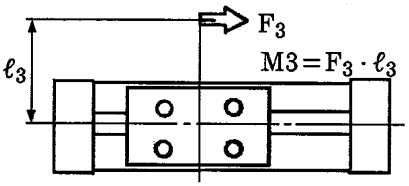
● Bending moment



● Radial moment



● Twisting moment



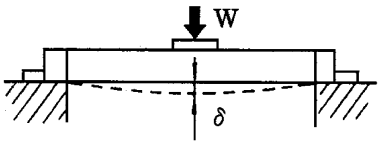
[C3-401-D]

Note 1 : Be sure that the moment including the force of inertia produced when the load is moved or stopped does not exceed the levels indicated above. Excess moment will damage the component.

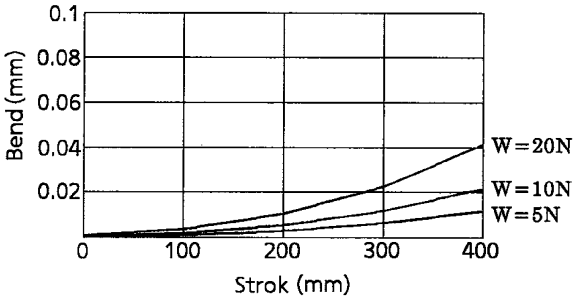
4) Air leaks in a small amount. Because of this, the pressure will not be retained even if the cylinder port is closed with air inside the cylinder.
5) Do not perform electric welding after the rodless cylinder is installed. The current runs through the cylinder to produce sparks between the dustproof belt and the cylinder tube, damaging the belt as a result.

Discontinue

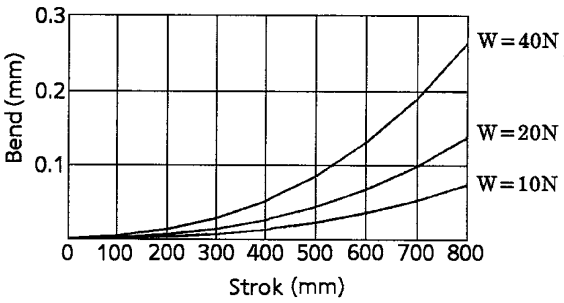
● Bend of Cylinder tube δ



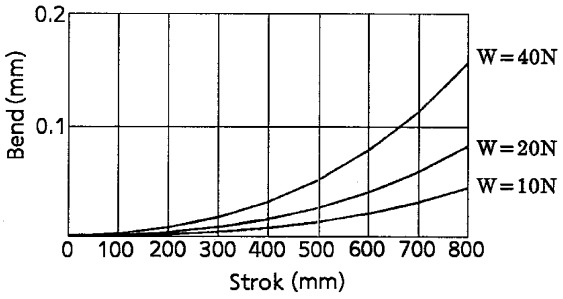
● SRG-12



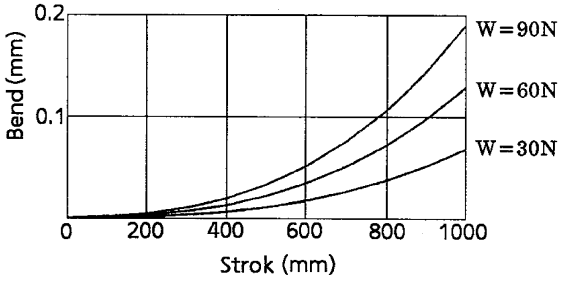
● SRG-16



● SRG-20



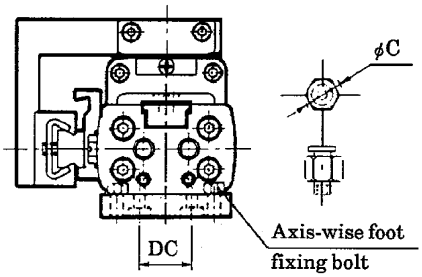
● SRG-25



Load and moment tolerances

Item / Tube bore (mm)	Vertical load W : N {×0.102kgf}	Bending moment M1 : N·m {×0.102kgf·m}	Lateral bending M2 : N·m {×0.102kgf·m}	Twisting moment M3 : N·m {×0.102kgf·m}
ϕ12	20	1	0.5	3
ϕ16	40	2.5	1	5.5
ϕ20	40	2.5	1	5.5
ϕ25	90	6.5	2.5	17

6) The following conditions apply to the pipe joints used for the central port (option marking R/T).



Mounting style / Tube bore (mm)	Outer diameter of usable joint φC		
	OO	LB	LB1
ϕ12	11 or less	Unusable for central port pipe	11 or less
ϕ16	12 or less		12 or less
ϕ20	16 or less		16 or less
ϕ25	26 or less		26 or less

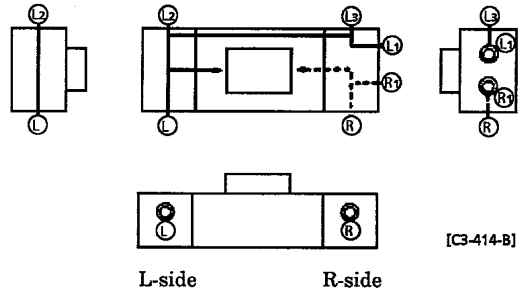
Discontinue

7) Those whose support is of the axis-wise foot type (LB, LB1) and option markings are R and T have the joint and axis-wise foot fixing bolt which interfere with each other. To avoid this, secure the cylinder unit in place (by fastening the axis-wise foot bolt) before the joint is fitted (the joint will get in the way if it is fitted first, making it very difficult to tighten the bolt).

8) Piping port position and operation direction

Tube bores ϕ12~ϕ20

● Option markings (no marking, R, B, T)

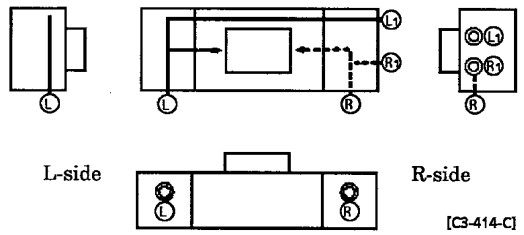


[C3-414-B]

Ⓡ indicates the R-side pressure port, and Ⓛ the L-side pressure port.
At the time of shipment, all the ports except one each at Ⓡ and Ⓛ were sealed by plugs. Remove the plugs for connection to other ports. Those with option code D or S cannot be manufactured.

Tube bores ϕ25

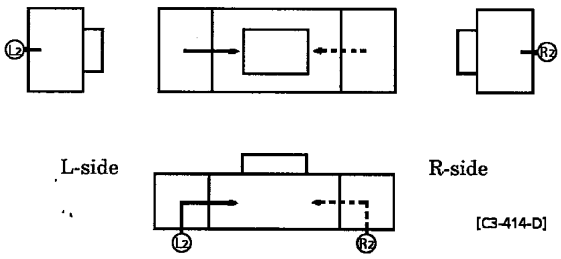
● Option markings (no marking, R, B, T)



[C3-414-C]

Ⓡ indicates the R-side pressure port, and Ⓛ the L-side pressure port.
At the time of shipment, all the ports except one each at Ⓡ and Ⓛ were sealed by plugs. Remove the plugs for connection to other ports, but bottom piping is not possible. Choose options (D, S) for bottom piping if it is necessary.

● Option markings (D, S for bottom piping)

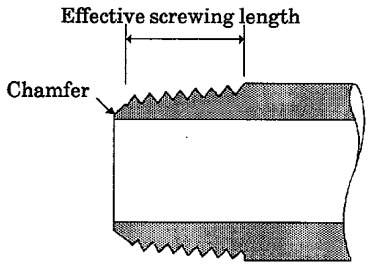


[C3-414-D]

Ⓡ indicates the R-side pressure port, and Ⓛ the L-side pressure port.
No piping available except for (R2) and (L2) as there are no other ports.

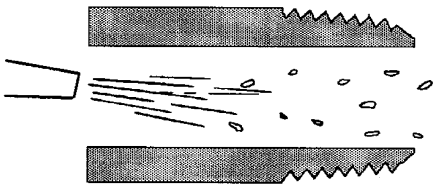
2.2 Piping

1) Be sure that the pipes and tubes in the circuit after the filter are of galvanized metal, nylon, rubber or other corrosion-resistant materials.
2) The pipe connecting the cylinder and the electromagnetic valve should have an effective cross-sectional area that allows the cylinder piston to move with the required speed.
3) Install the filter for removing rust, foreign matters or drain the fluid from inside the pipe as near the electromagnetic valve as possible.
4) Be sure that the gas pipe has the effective screwing length as shown in the drawing. The screw end should also have a 1/2-pitch chamfer.

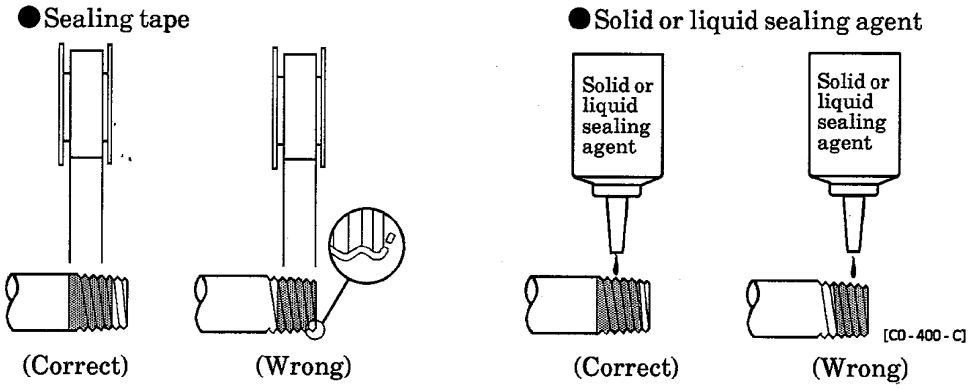


[CO-400-A]

5) Before connecting the pipe, be sure to flash it (air blow) in order to remove chips and other foreign matters from the inside.


[CO-400-B]

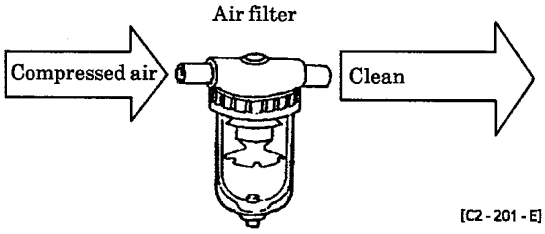
6) Sealing tape or a sealing agent is used for piping. Be sure to leave two threads from the end of the pipe as shown in the drawings so as to prevent fragments of the tape or the agent from entering the pipe or the equipment.



[CO-400-C]

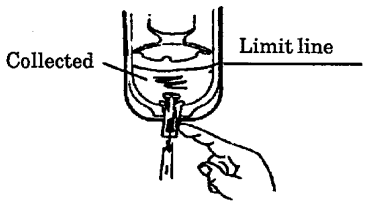
2.3 Operation Fluid

1) To obtain clean and dry air, make the compressed air go through an air filter first. In installing the filter within the circuit, take the following into consideration: filtering ability (5 microns or smaller desirable), fluid volume, and installation position (near the direction-control valve).



[C2 - 201 - E]

2) Drain the fluid regularly that has collected in the filter before the fluid level exceeds the limit line.



[C2 - 201 - F]

3) Make sure that the adequate maintenance and inspection of the compressor are carried out to ensure that the circuit is free from compressor oil carbide (carbon or tar-like material). The presence of carbide causes the solenoid valve and cylinder to malfunction.

4) This cylinder is pre-lubricated and be used without additional lubrication.

If lubrication becomes necessary, use class 1 turbine oil ISO VG32. The use of other lubricating oil may affect the packing, leading to malfunction. After lubrication starts, be careful about oil shortage for it destabilizes the operation.

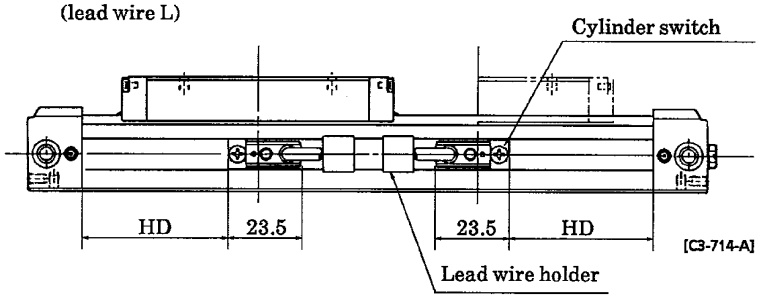
5) As there is slight leak outside, it is not operable under the low oil pressure..

Discontinue

2.4 Cylinder Switches

1) The cylinder switches were set at the position (for max. sensitivity) as indicated in the table below at the time of their shipment. Before operation, however, it is recommended to check the position of each switch. If the switch and the cylinder have been purchased separately, or if another switch has been added, check that the switch is properly positioned.

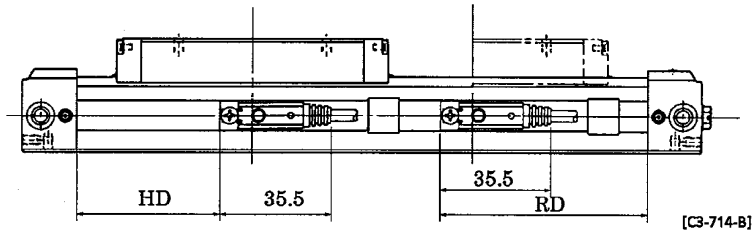
• With cylinder switch,SRG-※※-※※-※※※-M※V※
(lead wire L)



[C3-714-A]

Marking / Model	HD	RD
SRG-※※-12	40.5	60.5
SRG-※※-16	47	67
SRG-※※-20	52.5	72.5
SRG-※※-25	60	82

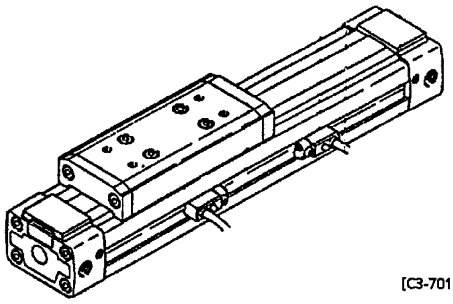
• With cylinder switch,SRG-※※-※※-※※※-M※H※
(lead wire straight)



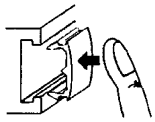
[C3-714-B]

2) To adjust the position of the switch, loosen the screw (round-head screw) and slide the switch and the switch mount and fasten them at the proper position.

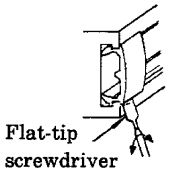
3) To replace the switch, loosen the screw (round-head screw) and take it out from the mount. Leave the mount on the cylinder. Next, set a new switch in the mount, position them and fasten the screw (tightening torque: 50~70 N/cm).


[C3-701-B]

4) Setting the lead wire holder
Use your thumb to push the lead wire holder into the groove until it snaps in.


[C3-714-C]

5) Removing the lead wire holder
Wedge a flat-tip screwdriver into the gap between the cylinder tube and the holder, and turn it for easy detachment.



[C3-714-D]

6) To set the switch at the middle of the stroke, proceed as follows.

① M0※, M2※, M3※, M5※

Fix the piston at the stop position. Move the switch back and forth over the piston and find the position at which the switch first comes on. The midway point between the two positions is where the switch is most sensitive, and therefore the SW set position, given the piston position.

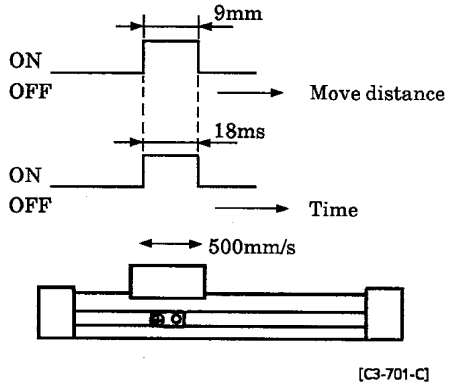
② 2-color display non-contact switch M2WV、M3WV

Move the switch and fasten it where the green light comes on (max. sensitivity point).

- The 2-color display non-contact switch indicates the operation range by turning on a red light and the max. sensitivity range (SW set position for max. sensitivity) by a green light. This makes SW setting very easy. Electricity is on even while the red light is on, posing no problem to the operation of the switch.

7) Mid-stroke detection is required often when the cylinder speed is relatively fast, and problems normally associated with stroke-end detection may occur. The following cautions should be taken.

Exact responses from control circuits (relay circuit, program-mable controller, program)?



[C3-701-C]

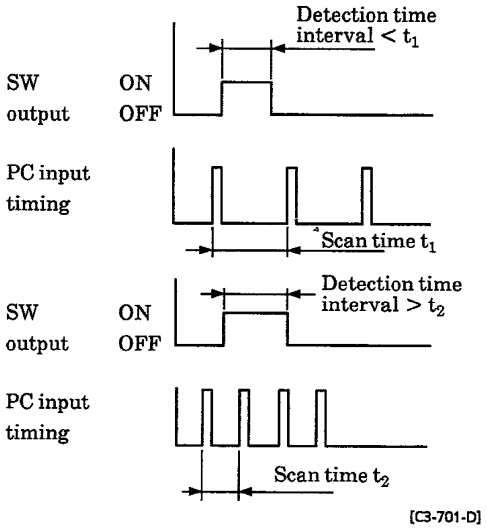
The cylinder switch has the response speed of faster than 1ms, but the detectiont time interval can be made greater than the one obtained by the following formula.

$$\text{Detection time interval (s)} = \frac{\text{operation range (mm)}}{\text{cylinder speed (mm/s)}}$$

Ex. When the operation range is 9 mm and the cylinder speed 500 mm/s, then the detection time interval is only 18 ms (see the drawing above).

It is necessary, therefore, to take in the signal without fail within this short time interval. Use a self-hold circuit or other means suitable to the situation.

With PC inputting, in particular, it is necessary that not only the response time of the input/output circuit, but the program scanning time are shorter than this detection time interval (see the drawing).



[C3-701-D]

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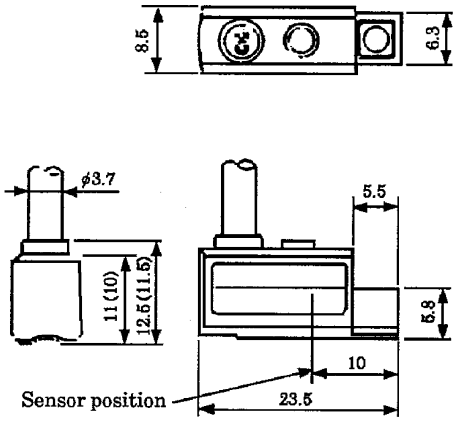
8) The table below shows the operation ranges of the switches.

Item	Operation range		
	Non-contact SW		Contact SW
Tube bore (mm)	M2V, M2H, M3V, M3H	M2WV, M3WV	M0V, M0H, M5V, M5H
ϕ12	4~13	4~12	3~11
ϕ16			
ϕ20			
ϕ25	9.5~15.5	9~14	8.5~13.5

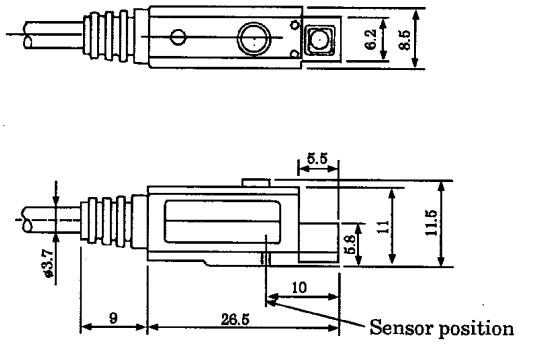
9) Switch dimensions

- Lead wire L (M※V)



[C3-714-G]

- Lead wire straight (M※H)



[C3-714-H]

Figure in ( ) is for 2-color display

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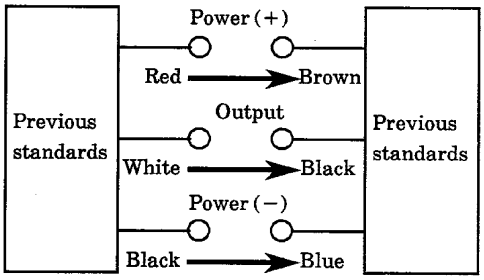
2.5 Caution for Operation (cylinder switch)

For safe and correct use of the cylinder switch, please observe the cautions for use.

This switch, in compliance with the JIS standards revision regarding proximity switches, has wire colors which correspond to signals differently from the previous model, as illustrated. Note, in particular, that the color black is for output, and not for power (−), in the new standards. Be sure to check such changes before wiring.



2.5.1 Caution for Operation (non-contact switches: M2V, M2H M2WV, M3V, M3H, M3WV)

1) Wiring

Wire the switch correctly according to the wire colors. Be sure to turn off the power of the electric circuit before wiring.

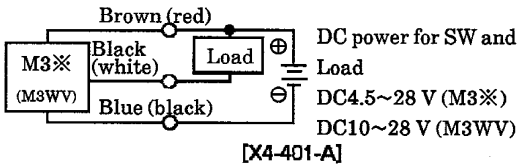


Fig. 1 M3※(M3WV) basic circuit 1 (same power for SW and load)

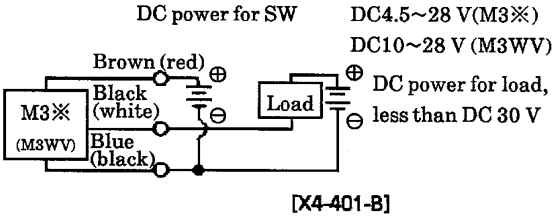


Fig. 2 M3※(M3WV) basic circuit 2 (separate power for SW and load)

2) Output circuit protection

- With an inductive load (relay, electromagnetic valve), surge voltage occurs when the switch is turned off. To protect the circuit, be sure to install a protection circuit shown in Fig. 3.

- With a capacity load (capacitor), rush current occurs when the switch is turned on. Be sure to install a protection circuit shown in Fig. 4.

- If the total length of the lead wires exceeds 10 m, be sure to install a protection circuit as shown in Fig. 5 and 6 (for M2※M2WV) and Fig. 7 (M3※M3WV).

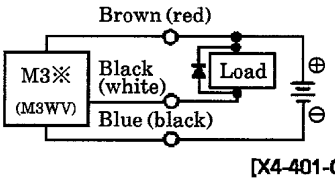


Fig. 3 Absorption device (diode) set in parallel to the inductive load. Use V06C (Hitachi) or its equivalent for the diode.

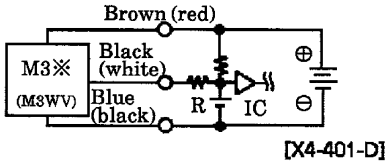


Fig. 4 Current-restricting resistor as capacity load. Be sure to use a resistor with resistance (ohm) greater than the figure obtained by the following calculation.

$$\frac{V}{0.15} = R\ (\text{ohm})$$

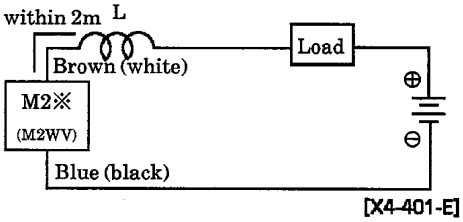


Fig. 5
- Choke coil
  L = several hundred microH ~ several mH
  Good high frequency property
- Wiring near the SW (within 2 m)

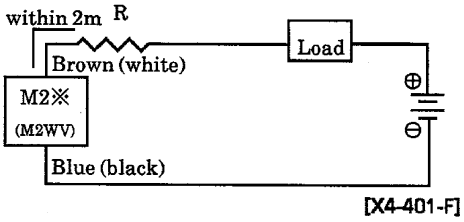


Fig. 6
- Rush-current limit resistor
  As much resistance as tolerated by R loaded circuit
- Wiring near the SW (within 2 m)

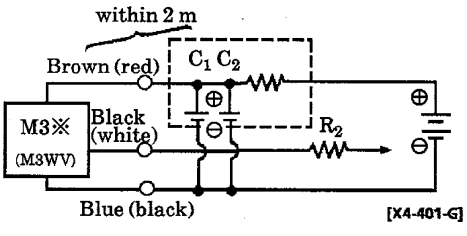


Fig. 7

- Power noise absorption circuit
  C_1 = 20~50 microF electrolytic capacitor (withstand voltage 50 V or more)
  C_2 = 0.01~0.1 microF ceramic capacitor
  R_1 = 20~30 ohms
- Rush-current limit resistor
  As much resistance as tolerated by R_2 loaded circuit
- Wiring near the SW
  (within 2 m)

3) Connection to programmable controller (sequencer)

How connection is made differs depending on PC types. Make connections in the ways indicated in Fig. 8~Fig. 12.

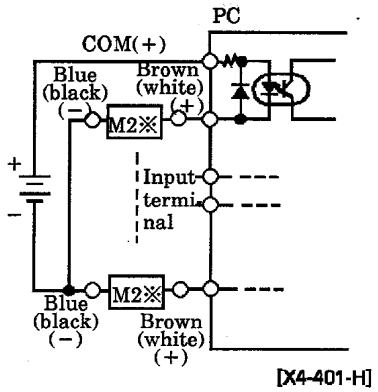


Fig. 8 M2※(M2WV) connection to source input (external power)

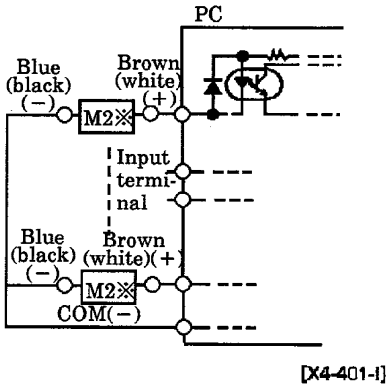


Fig. 9 M2※(M2WV) connection to source input (internal power)

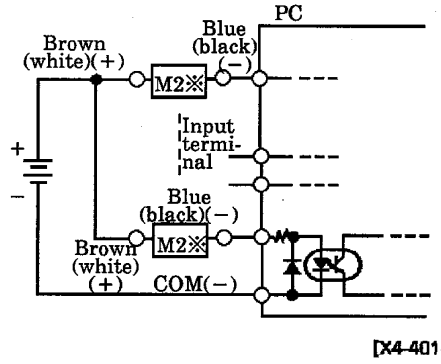


Fig.10 M2※(M2WV) connection to sync. input

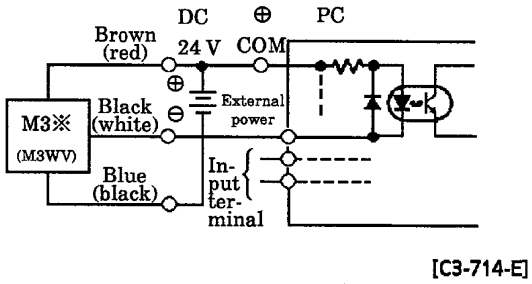


Fig. 11 M3※(M3WV) connection to source input (external power)

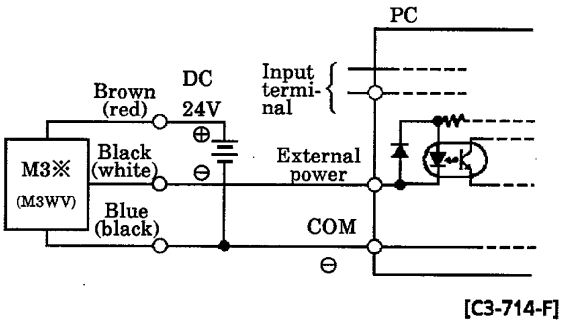


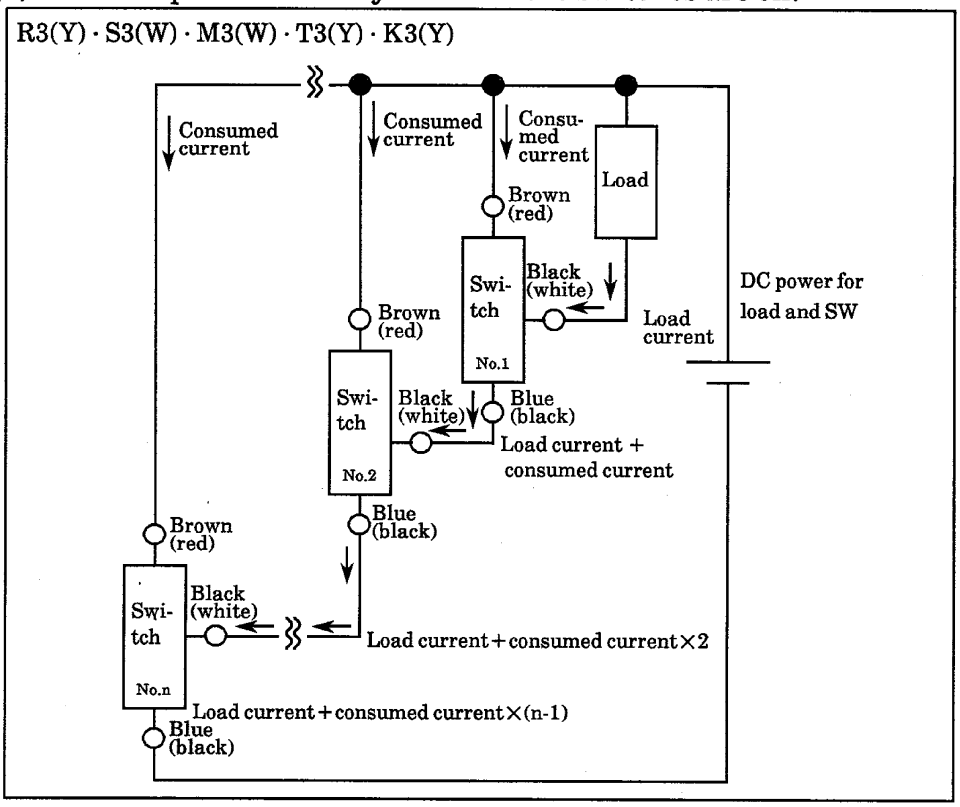
Fig. 12 M3※(M3WV) connection to source input (internal power)
The M3※ switch cannot be connected to the sync. input sequencer.

4) Serial connection

(1) When the M2※ and M2WV are connected serially, the total voltage drop by these switches is the sum of the voltage drop at each of all these switches. The voltage that applies to the load side equals the power voltage minus the total voltage drops by the switches. Check the input specifications of the programmable controller, which is a load, in determining the connection quantity in determing the number or switches.

(2) In serially connecting several 3-wire non-contact switches, the same principle as the 2-wire types above applies regarding the total voltage drops by switches. The amount of the current that runs through the switches is the sum of the current consumed by the switches and that consumed by the load. In determining the connection quantity, check the specifications of the load so that the current will not exceed the max. load current of the switch.

(3) The lamp comes on only when all the switches are on.



Discontinue

5) Parallel connection

With the M2※ and the M2WV, the amount of leak current increases by the number of switches connected. During the on-off interval of one switch, the voltage at both ends of the parallel switch drops to the internal voltage drop level, which is lower than the load voltage range, when the switch is turned on. Because of this, the other switches cannot be turned on. Check the input specifications of the programmable controller to be connected as a load.

This is not the problem with the M3V and M3WV. Their leak current increases by the number of switches connected, as in the case of the M2※ and M2WV, but the amount of the leak current is so small (less than 10 microamperes) that it does not affect the operation in any way. There is no problem of the lamp becoming dim or unable to be turned on.

6) Magnetic environment

Avoid using the system in a place exposed to a strong magnetic field or large current (large magnet, spot welder, etc.). There will be mutual interference if the SW cylinders are set in parallel close to each other, or a magnetic body passes very close to the cylinder, affecting the detection precision.

7) Lead wire protection

Be sure that the minimum bending radius of the lead wire is at least R9 in order to protect the lead wire from repeated bending stress and tensile stress. For the moving sections, use wires for robots or other wires resistant to bending.

2.5.2 Caution for Operation (contact switches: M0V, M0H, M5V, M5H)

1) Lead wire connection

Do not connect the lead wire of the switch directly to the power, but always insert a load serially. With the M0※, pay attention to the following ① and ②.

① With DC power, be sure to connect the brown wire (white) to the plus side of the power and the blue (black) to the minus side.

With reverse connection, the switch functions but the lamp does not come on.

② When connecting to the AC relay or programmable controller input, the switch lamp may not come on if half-wave rectification is taking place in these circuits. In such a case, reverse the polarity of the switch lead wire connection, and the lamp will come on.

2) Contact capacity

Be sure that the use of load will not exceed the max. contact capacity of the switch. If the current level is smaller than the rated current value, the M0※ lamp may not come on.

Discontinue

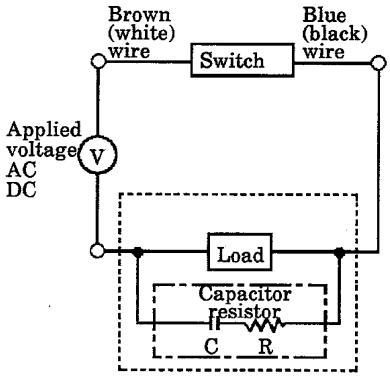
3) Contact protection

In using a relay or other inductive load, be sure to install the contact protection circuit as shown in Fig. 13 and Fig. 14 below.

If the total length of the wires exceed the figures of Table 1, install the contact protection circuit as shown in Fig. 15 and Fig. 16.

Table 1

Voltage	Wire length
DC	50m
AC	10m



User wiring

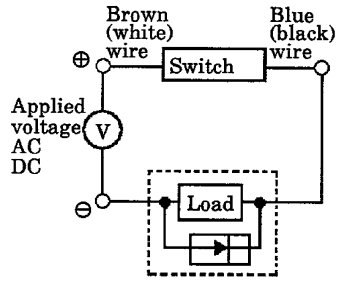
Protection circuit (spark quenching circuit)

[X4-401-M]

Recommended figure: capacitor 0.033-0.1 microFresistance 1-3 kilo-ohm

XEB1K1 (Okaya Electric) or equivalent

Fig. 13 With capacitor resistor

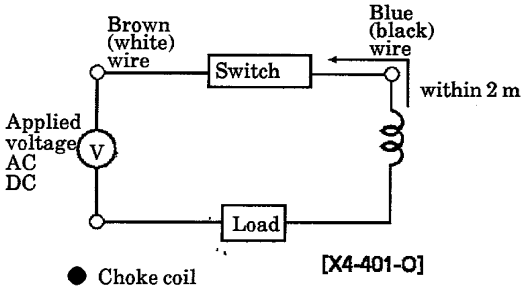


User wiring

Protection circuit [X4-401-N]

Ordinary rectifier diode V06C (Hitachi) or equivalent

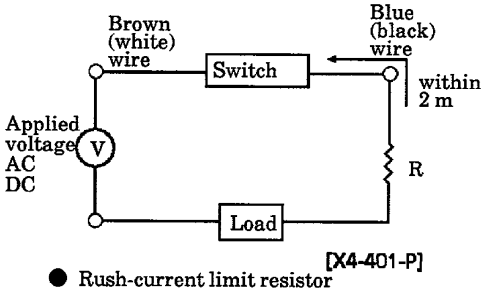
Fig. 14 With diode



[X4-401-O]

- Choke coil
  L = several hundred microH ~ several mH
  Good high frequency property
- Wiring near the SW (within 2 m)

Fig. 15



[X4-401-P]

- Rush-current limit resistor
  As much resistance as tolerated by R loaded circuit
- Wiring near the SW (within 2 m)

Fig. 16

4) Relay

Choose a relay from among the following.

- ○Omron ..... M Y
- ○Fuji Electric HH5
- ○Tokyo Electric ..... MPM
- ○Matsushita Electric Works .... H C

5) Serial connection

When several M0※ switches are connected serially, the total voltage drop by these switches is the sum of the voltage drop at each of all these switches. When a M0※ is used and the others are M5※ to check the function, the voltage drop is approx. 2.4 V, about the voltage drop of one M0※ switch. The lamp comes on only when all the switches are on.

6) Parallel connection

When several switches are connected in parallel, there is no limitation to the number of switches, but, with the M0※, the switch lamp may become dim or not come on.

7) Magnetic environment

Avoid using the system in a place exposed to a strong magnetic field or large current (large magnet, spot welder, etc.). There will be mutual interference if the SW cylinders are set in parallel close to each other, or a magnetic body passes very close to the cylinder, affecting the detection precision.

8) Lead wire protection

Be sure that the minimum bending radius of the lead wire is at least R9 in order to protect the lead wire from repeated bending stress and tensile stress. For the moving sections, use wires for robots or other wires resistant to bending.

3. SUITABLE USAGE

3.1 Working pressure range

Max. operation pressure MPa{kgf/cm²}	0.7 {7.1}	
Min. operation pressure MPa{kgf/cm²}	Equivalent of ϕ12, ϕ16, ϕ20	0.2 {2.04}
	Equivalent of ϕ25	0.1 {1.02}
Proof pressure MPa{kgf/cm²}	1.05 {10.7}	

3.2 Supply grease to "High-Precision guide"

Supply grease to the guide when it ran 100km normaly. But the tact time to grease depends on the usage condision or environment.

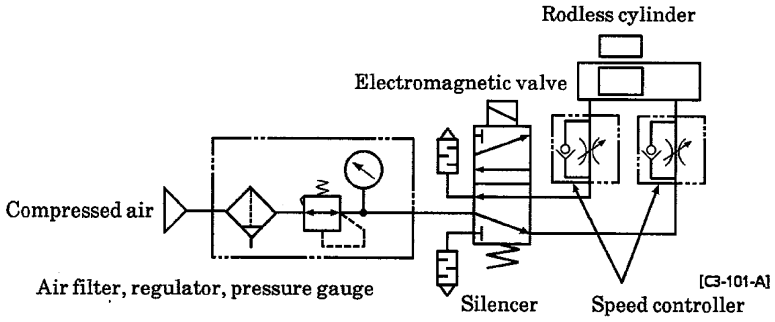
Normaly supply lithium-grease from the supply-port of the grease-nipple on the guide.

Never mix the different grease, because it increases the consistency sometimes, and happens the trouble.

3.3 Basic Circuit Chart

Basic circuit chart (no lubrication)

The illustration shows the basic circuit.



3.4 Operation

1) Be sure that the supply pressure to the cylinder is between the min. operation pressure and the max. operate pressure as described in 3.1 Specifications.

2) At the time of delivery, the tightness of the cushion has been adjusted with no load. Use the cushion needle to adjust its tightness to suit the load. There will be more cushioning by tightening (turning clockwise) the needle.

An impact absorber may be needed if the kinetic energy is greater than that in the table below, such as when the load is heavy and the object moves fast.

Discontinue

$$\text{Kinetic energy J}\{\times 0.102\text{kgf/m}\} = \frac{1}{2} \times \text{mass (kg)} \times \{\text{speed(m/s)}\}^2$$

Note) This is how the kinetic energy is calculated.

The average cylinder speed Va is obtained by dividing L by T ($Va = \frac{L}{T}$).

Va : Average speed (m/s)

L : Cylinder stroke (m)

T : Operating time (s)

On the other hand, the cylinder velocity immediately before rushing into the cushion, Vm, is obtained by the following:

$$Vm = \frac{L}{T} \times \left(1 + 1.5 \times \frac{\omega}{100}\right)$$

Vm : Velocity immediately before rushing into the cushion (m/s)

ω : Cylinder load rate

Use Vm thus obtained as the speed in calculating the kinetic energy.

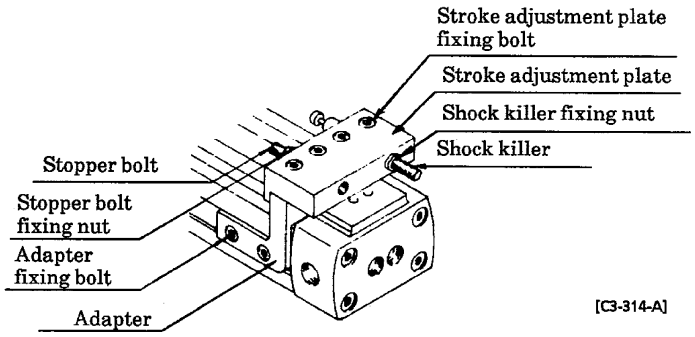
Cushion characteristics

Tube bore (mm)	Effective cushion length (mm)	Tolerable energy absorption J{×0.102kgf·m}	
		With cushion	Without cushion
ϕ12	14.5	0.03	0.003
ϕ16	19.2	0.22	0.007
ϕ20	22.2	0.59	0.010
ϕ25	20.9	1.40	0.015

3) For piston speed adjustment, install a speed controller as illustrated in the basic circuit on page 13.

4) Unit adjustment for all stroke adjustment

(1) The stroke adjustment unit can be relocated by loosening the adapter fixing bolts (and the stroke adjustment plate fixing bolts for the cylinders of ϕ12-ϕ25).



Tightening torques of the adapter fixing bolt and the stroke adjustment plate fixing bolt

Tightening torque / Model	Adapter fixing bolt N·cm{×0.102kgf·cm}	Stroke adjustment plate fixing bolt N·cm{×0.102kgf·cm}
SRG-12·16	100~120	50~70
SRG-20	250~270	
SRG-25	520~560	250~270

(2) Stroke adjustment by stopper bolt

There is a danger of pinching your finger if adjustment is made by $\phi 12 \sim \phi 20$ since there is little room between the table and the stroke adjustment plate. Because of this, stroke should be adjusted by moving the stroke adjustment unit.

Loosen the stopper bolt fixing nut and turn the bolt in order to obtain the proper stroke. After this adjustment, tighten the stopper bolt fixing nut at the torque indicated in Table 2 below.

Table 2 Tightening torque of the stopper bolt fixing nut and the shock killer fixing nut

Fastening torque / Model	Stopper bolt fixing nut N·cm {×0.102kgf·cm}	Shock killer fixing nut N·cm {×0.102kgf·cm}
SRG-12·16	110~120	130~180
SRG-20	250~270	290~390
SRG-25	880~950	450~600

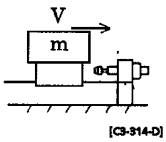
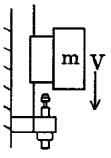
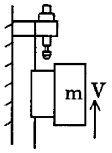
(3) Adjustment of the shock killer

The absorption energy of the shock killer can be adjusted by changing its operation stroke. For this adjustment, loosen the shock killer fixing nut and turn the shock killer. When the adjustment is over, tighten the nut at the torque indicated in Table 2.

(4) Checking of the tolerable collision energy of the shock killer

Use the following equations to calculate the colliding object mass Me and collision energy E and check that Me and E are within the tolerable range indicated by Fig. 1 the next page. Also check, by referring to Table 3 the next page, that repetition frequency, collision speed and other specifications are within the tolerable ranges.

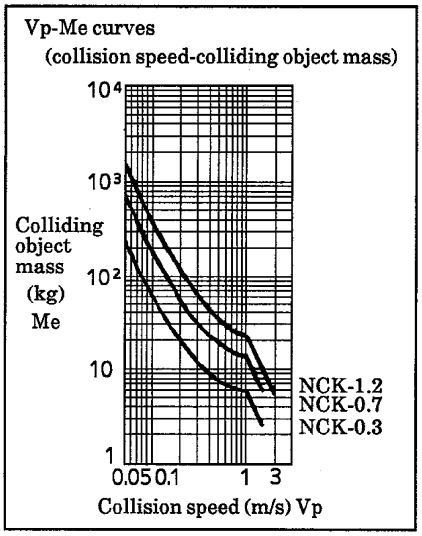
Note that the tolerable ranges of Me and E vary depending on the speed of collision.

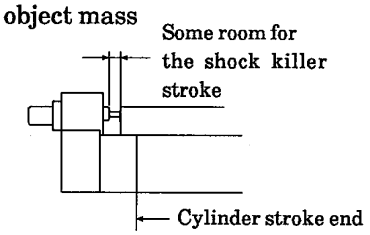
	Horizontal move	Vertical descent	Vertical ascent
Examples	 [C3-S14-D]	 [C3-S14-E]	 [C3-S14-F]
Colliding mass Me (kg)	$Me = m + \frac{2F \cdot St}{V^2}$	$Me = m + \frac{2 \cdot St(F+mg)}{V^2}$	$Me = m + \frac{2 \cdot St(F-mg)}{V^2}$
Collision energy E (J)	$E = \frac{mV^2}{2} + F \cdot St$	$E = \frac{mV^2}{2} + (F+mg) \cdot St$	$E = \frac{mV^2}{2} + (F-mg) \cdot St$

● Signs

E	: Collision energy	J {×0.102kgf·m}
Me	: Colliding mass	kg
m	: Work mass	kg
F	: Cylider thrust	N {×0.102kgf}
V	: Collision speed	(m/s)
St	: Shock killer stroke	(m)
g	: Gravity acceleration	9.8(m/s²)

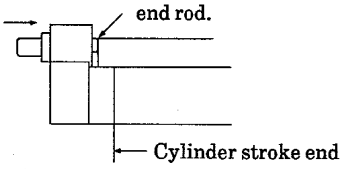
Fig.17 Tolerable range of colliding object mass





Absorption energy at the time of product shipment

SRL2-12	2.4J
SRL2-16	2.4J
SRL2-20	5.7J
SRL2-25	10J



(Note) Explanation of the shock killer that comes with the model with the all-stroke adjustment feature.

5) Caution for use

The shock killer, with the rated stroke, absorbs the rated energy. At the time of shipment, it was positioned in a way as to leave some room for its stroke at the cylinder stroke end. Because of this, actual energy to be absorbed is smaller than the tolerable absorption energy. If the rated energy absorption is required, make adjustment so that all the stroke of the shock killer can be used.

The tolerable absorption energy varies depending on the speed of collision. Be sure that the energy level does not exceed one third of the max. absorption energy indicated in Table 3 when the collision speed is 2000 mm/s, and one half of that when it is 1000 mm/s.

6) Shock killer

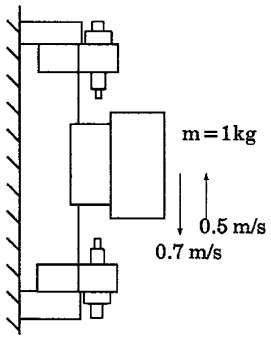
Specifications

Model		SRG-12 · 16	SRG-20	SRG-20
Shock killer model / Item		NCK-00-0.3-C	NCK-00-0.7-C	NCK-00-1.2
Classification		No adjuster, spring return type		
Max. absorption energy J {kgf·m}		3{0.3}	7{0.7}	12{1.2}
Stroke mm		6	8	10
Absorption energy per hour J {kgf·m/hour}		6300 {630}	12,600 {1,260}	21,600 {2,160}
Max. collision speed m/s		1.5		2.0
Max. repetition frequency count/min		35	30	30
Ambient operation temp. °C		5~60		
Return spring force	At released N{kgf}	2.9{0.3}	2{0.2}	2.9{0.3}
	At maximum compression N{kgf}	4.5{0.46}	4.3{0.44}	5.9{0.6}
Return time S		0.3 or less		

Discontinue

7) Example of calculation (SRG-20の場合)

● Example (1) : Ascending and Descending



Operation conditions

- Load weight M : 1kg
- Collision speed
  Ascending : 0.5m/s
  Descending : 0.7m/s
- Operation pressure: 0.5MPa (157N)

①Kinetic energy when ascending (E1)

$$E1 = \frac{1 \times 0.5^2}{2} + (157 - 1 \times 9.8) \times 0.008$$
$$= 1.30J$$

As this is smaller than half the max. absorption energy, the kinetic energy (E1) can be absorbed.

$$Me = 1 + \frac{2 \times 0.008\ (157 - 1 \times 9.8)}{0.5^2}$$
$$= 10.42kg$$

As Me of the shock killer used in the SRG-20 is 18 kg when V=0.5 m/s from Fig. 17, it is absorbable.

②Kinetic energy when descending (E1)

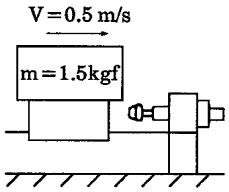
$$E1 = \frac{1 \times 0.7^2}{2} + (157 + 1 \times 9.8) \times 0.008$$
$$= 1.58J$$

As this is smaller than half the max. absorption energy, the kinetic energy (E1) can be absorbed.

$$Me = 1 + \frac{2 \times 0.008\ (157 + 1 \times 9.8)}{0.7^2}$$
$$= 6.45kg$$

As Me of the shock killer used in the SRG-20 is 16 kg when V=0.7 m/s from Fig.17, it is absorbable.

● Example (2): Horizontal move



Operation conditions

- Load weight M : 1.5kg
- Collision speed
  Horizontal : 0.5m/s
- Operation pressure: 0.3MPa (94N)

①Horizontal kinetic energy (E1)

$$E1 = \frac{1.5 \times 0.5^2}{2} + 94 \times 0.08$$
$$= 0.94J$$

As this is smaller than half the max. absorption energy, the kinetic energy (E1) can be absorbed.

$$Me = 1.5 + \frac{2 \times 94 \times 0.008}{0.5^2}$$
$$= 1.53kg$$

As Me of the shock killer used in the SRG2-20 is 18 kg when V=0.5 m/s from Fig.17, 1.53 is smaller than 18 and it is absorbable.

Discontinue

4. MAINTENANCE

4.1 Regular Check

1) To keep the cylinder in top condition, carry out regular checks once or twice a year.

2) Check the following.

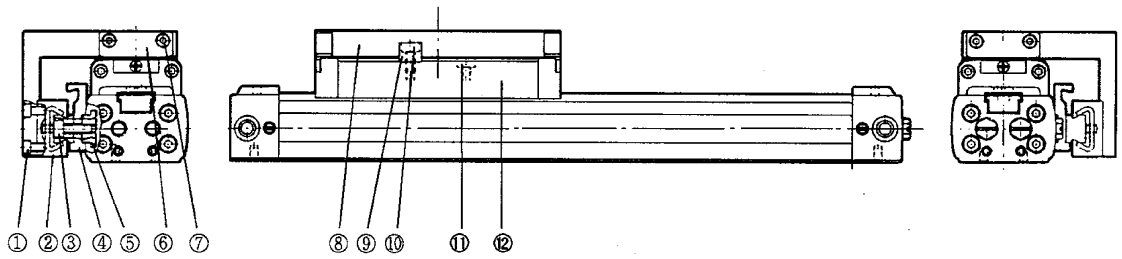
ⓐ Loose load mount screw, loose unit mount screw
ⓑ Smooth movement
ⓒ Change in the piston speed and cycle time
ⓓ Outside leak
ⓔ Change in table play
ⓕ Stroke
ⓖ Loose round head screw for the switch, or its position change
ⓗ Cracks in the connecting part of the switch lead wire and the switch
ⓘ Presence of magnetic material, such as cut chips, sticking to the switch mount position.

If any problems are detected, refer to "5. Troubles and corrective measures" and implement proper measures. Fasten any loose sections if there are any.

4.2 Disassembly / Assembly

In the case of air leak or other troubles, implement proper measures by following the procedures stated below. Refer to the following internal structural drawing and disassembly/assembly drawing.

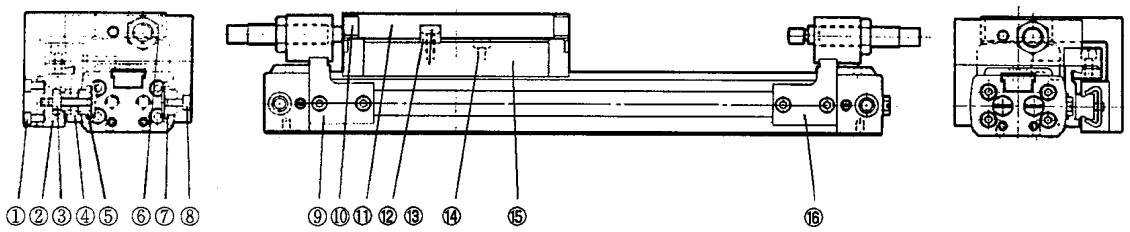
1) Internal structural drawing (SRG)



Parts No.	Name	Material	Parts No.	Name	Material
1	Hex. head bolt	Alloy steel	7	Hex. head bolt	Alloy steel
2	High-precision guide	Stainless steel	8	Connection plate	Aluminum alloy
3	Hex. head bolt	Alloy steel	9	Key	Steel
4	Guide holder	Aluminum alloy	10	Hex. head bolt	Alloy steel
5	Plate nut (B)	Alloy steel	11	Hex. head bolt	Alloy steel
6	Stopper plate	Steel	12	Table	Aluminum alloy

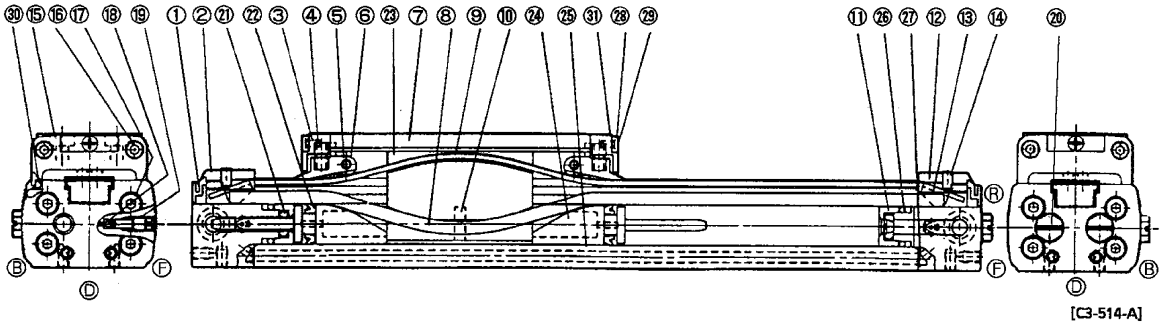
Discontinue

2) Internal structure of SRG with full stroke adjustment.



Parts No.	Name	Material	Parts No.	Name	Material
1	Hex. head bolt	Alloy steel	9	adaptor (R)	Steel
2	LM guide	Stainless steel	10	Stopper plate	Steel
3	Hex. head bolt	Alloy steel	11	接続プレート	Aluminum alloy
4	Guide holder	Aluminum alloy	12	Key	Steel
5	Plate nut (B)	Alloy steel	13	Hex. head bolt	Alloy steel
6	Plate nut	Alloy steel	14	Hex. head bolt	Alloy steel
7	Hex. head bolt	Alloy steel	15	Table	Aluminum alloy
8	Hex. head bolt	Alloy steel	16	adaptor (L)	Steel

3) SRG is the "Super-rodless Cylinder SRL2" with one linear high-precision guide. See the following internal structure of SRL2 for the internal structure of SRG without the previous one of SRG and SRG with full stroke adjustment.

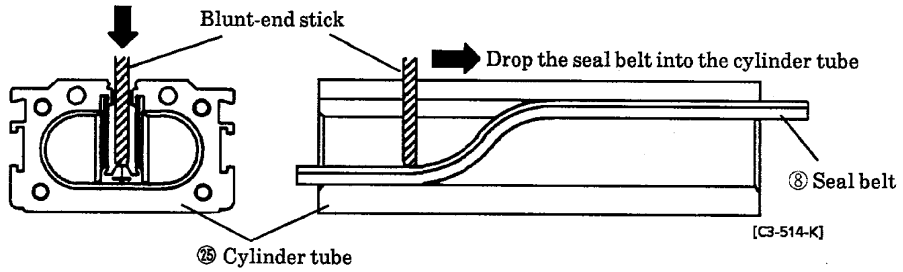


Parts No.	Name	Material	Parts No.	Name	Material
1	Belt cover	Polyamide	18	Needle gasket	Nitrile rubber
2	Cover (L)	Aluminum alloy	19	Cushion needle	Steel
3	Table cover	Acetal resin	20	Plug	Brass or copper
4	Spring	Carbon steel	21	Cushion packing	Urethane rubber
5	Belt tension	Acetal resin	22	Piston packing	Nitrile rubber
6	Parallel pin	Steel	23	Yoke	Aluminum alloy
7	Table	Aluminum alloy	24	Piston	Acetal resin
8	Seal belt	Urethane rubber	25	Cylinder tube	Aluminum alloy
9	Dust-proof belt	Stainless steel + nitrile rubber	26	Cylinder gasket	Nitrile rubber
10	Magnet	Special alloy	27	O-ring	Nitrile rubber
11	Cushion adapter	Acetal resin	28	Plate..	Stainless steel (ϕ12~ϕ20), alloy steel (ϕ25~ϕ40)
12	Cover (R)	Aluminum alloy			
13	Belt spacer	Steel	29	Cross-recessed tapping screw	Stainless steel
14	Hex. cap set screw	Alloy steel			
15	Hex. head bolt	Alloy steel	30	Dust wiper	Acetal resin
16	Hex. head bolt	Alloy steel	31	2-side adhesive tape	
17	Hex. head bolt	Alloy steel			

Discontinue

4) SRL2 Cylinder appears when you losen and disassemble the bolts of ①, ②, ⑧ of 1) internal structure of SRG and 2) internal structure of SRG with full stroke adjustment in 4.2 Disassembly / Assembly.

5) Disassemble SRL2 Cylinder according to the following procedure with reference to the previous internal structure drawing and parts list of SRL2.
   (1) Loosen the hex. cap set screw ⑭ (do not take it out).
   (2) Remove the hex. head bolt ⑮, and take out the table Ass'y ⑥⓪ and the dust wiper ③⓪.
   (3) Remove the belt cover ① and then the belt spacer ⑬ (if the belt cover and the belt spacer are difficult to take out, leave them there as they can be removed later).
   (4) Move the piston yoke Ass'y to the center of the cylinder tube ②⑤. Next remove the hex. head bolt ⑰ and then take out the cover Ass'y ⑤⑦ from the cylinder tube (be careful not to lose the O-ring ②⑦).
   (5) Detach the dust-proof belt ⑨ from the cylinder tube ②⑤.
   (6) Remove the piston yoke Ass'y ⑤⑨ from the cylinder tube ②⑤.
   (7) Detach the seal belt ⑧ from the cylinder tube ②⑤. The seal belt cannot be pulled out while being attached to the slit of the cylinder tube. Use a stick with a blunt end to push the seal belt and drop it inside the cylinder tube.



   (8) Unscrew the cross-recess screw ⑤⑧ and remove the cushion adapter ⑪ and the cushion packing ②①.

6) Check the following.
   (1) Scratch inside the tube.
   (2) Scratch, wear or crack on the piston surface.
   (3) Crack of both end covers.
   (4) Scratch or crack of the cushion adapter.
   (5) Scratch or wear of the packings for the sliding sections (seal belts, dust-proof belt, cushion packing, piston packing, slider).
   If any problems are detected, repair the parts or replace them with repair kits.

7) The repair kits are listed as follows.

Discontinue

Tube bore (mm)	Kit No.	⑧ Seal belt	⑨ Dust-proof belt	㉑ Cushion packing	㉒ Piston packing
ϕ12	SRL2-12K-※	F4-214913-※	F4-214916-※	F4-225145	F4-219017
ϕ16	SRL2-16K-※	F4-214914-※	F4-214917-※	F4-225146	F4-219040
ϕ20	SRL2-20K-※	F4-214915-※	F4-214918-※	F4-225147	F3-219963
ϕ25	SRL2-25K-※	F4-221959-※	F4-221964-※	F4-670392	F3-222049

Tube bore (mm)	Kit No.	㉕ Cylinder gasket	㉚ Dust wiper
ϕ12	SRL2-12K-※	P-11	F4-227466
ϕ16	SRL2-16K-※	P-14	F4-227467
ϕ20	SRL2-20K-※	P-18	F4-227468
ϕ25	SRL2-25K-※	P-22A	F3-222016

8) Procedures for replacement with repair kits

Common procedures

After the consumable parts are removed, wash the repair kits mount section and the sliding section. Next, grease the repair kits, repair kits mount section and the sliding section before setting the repair kits in place. Use the lithium soap base for the grease.

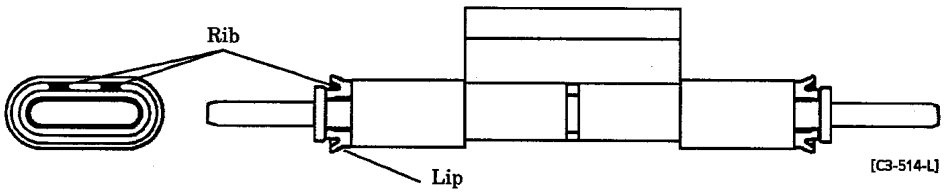
Recommended grease: Daphne Eponex No.1, Idemitsu Kosan Duplex No.1, Kyodo Resin

(1) Piston packing replacement

When detaching the piston packing ㉒, be careful not to scratch the groove for fitting the piston packing (scratched groove will cause air leak).

Be sure to fit the piston packing in the right direction.

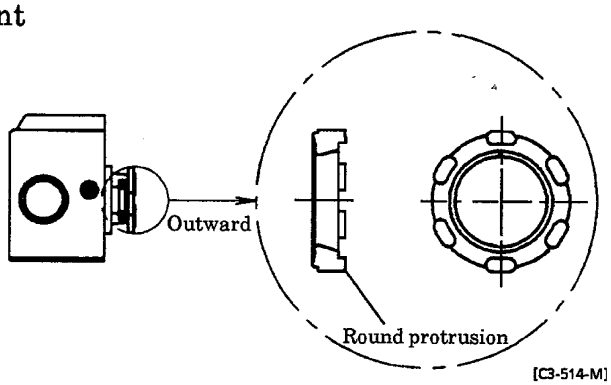
The lip should be facing outward and the rib on the upper face of the piston.



Note : Fitting the piston packing ㉒ to the single piston yoke Ass'y unit ㊾ will make it difficult to mount the piston yoke Ass'y and the seal belt ⑧ on the cylinder tube ㉕. To avoid this inconvenience, follow 9) Assembly procedures of the standard SRL2 described the next page.

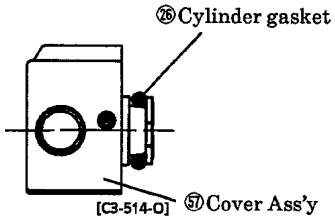
(2) Cushion packing replacement

The cushion packing ㉑ should be set in the proper direction. Be sure that the round protrusion faces outward (the protrusion is visible), and, with the cover ㊼ in place, fit the cushion adapter ⑪ to the cover and fasten the cross-recessed screw ㊽.



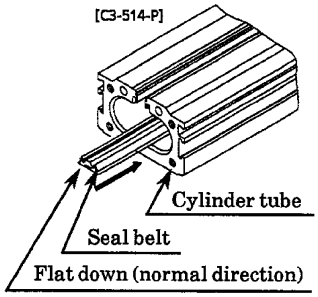
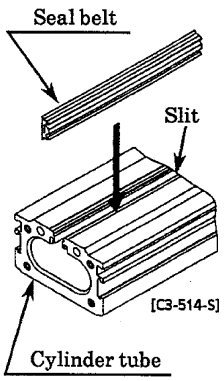
(3) Cylinder gasket replacement

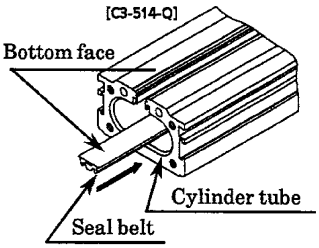
Take out the cylinder gasket ㉖ from the cover Ass'y ㊼ and replace it with a new one. When detaching the cylinder gasket, be careful not to scratch the groove for fitting the gasket (scratched groove will cause air leak).

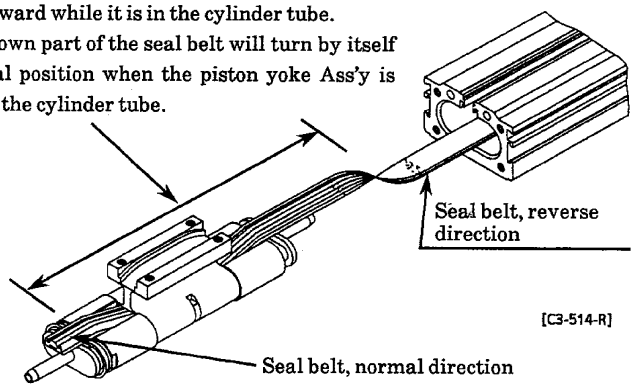


9) Assembly procedures of the standard SRL2

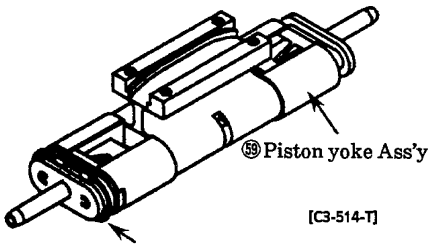
(1) Insert the seal belt into the cylinder tube. Follow the procedures described below.

<table>
<tr><th>Cylinder bore
Cylinder stroke</th><th>φ12, φ16</th><th>φ20, or more</th></tr>
<tr><td>2 m or less</td><td>[C3-514-P]
 
</td><td rowspan="2"> 

Insert the seal belt through the slit of the cylinder tube.</td></tr>
<tr><td>Over 2 m</td><td>[C3-514-Q]
 

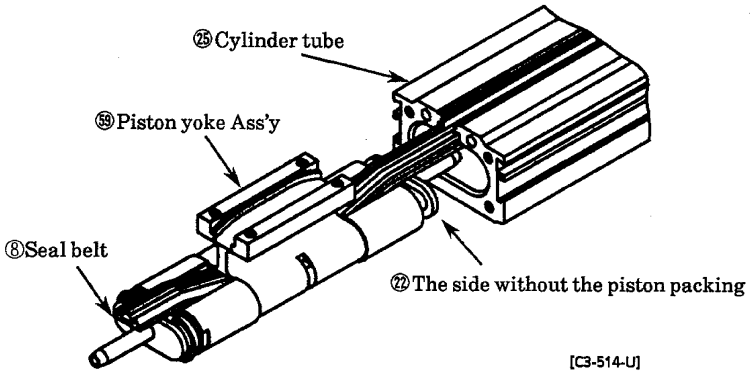
Turn the seal belt upside down and insert it.</td></tr>
<tr><td colspan="3">The flat face of the seal belt should be facing downward (normal direction) while it is inside the piston yoke Ass'y, but upward while it is in the cylinder tube.
The upside down part of the seal belt will turn by itself to the normal position when the piston yoke Ass'y is inserted into the cylinder tube.
 
</td></tr>
</table>

(2) Mount one piston packing ㉒ onto the piston yoke Ass'y ㊾.
(Fit the packing in the proper direction. Refer to 8) Repair kits replacement procedures, (1) Piston packing replacement.)

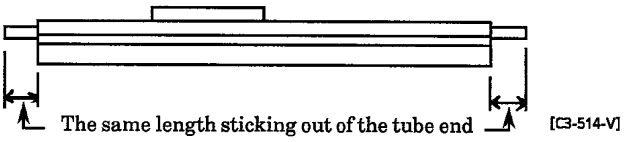


Set the piston packing only on one side

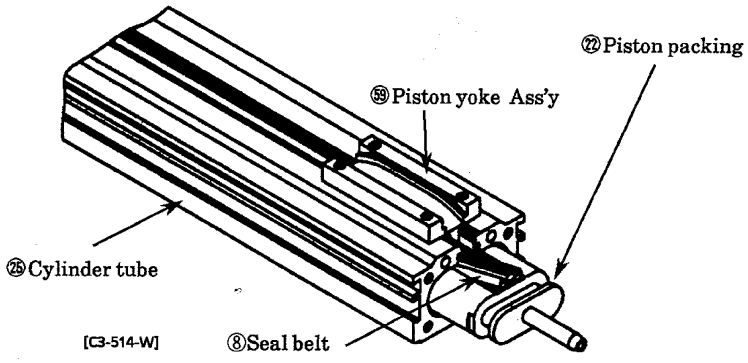
(3) Insert the seal belt ⑧ into the piston yoke Ass'y. Be sure that the side of the piston yoke Ass'y without the piston packing faces the cylinder tube ㉕, and that the flat side of the seal belt faces downward.



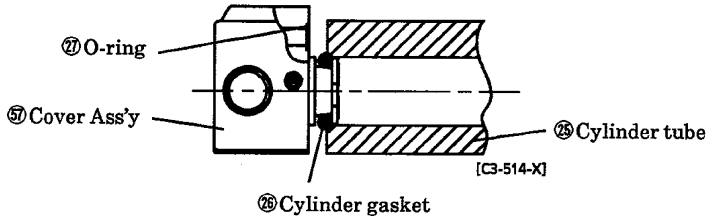
(4) Insert the piston yoke Ass'y together with the seal belt ⑧ into the cylinder tube ㉕. Adjust the seal belt position so that the same length of the belt sticks out of the either end of the cylinder tube.



(5) Push the piston yoke ㊾ in the direction so that the side without the packing comes out of the cylinder tube ㉕, and fit the packing ㉒ into the groove, as illustrated below.

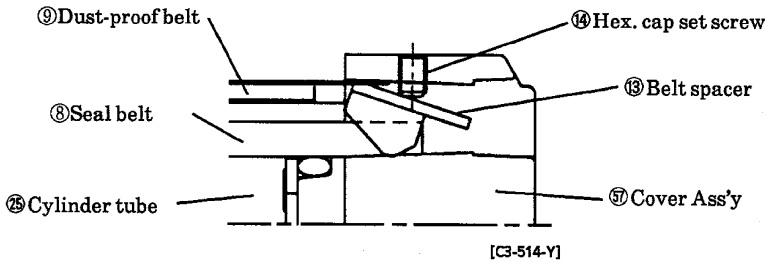


(6) Push the piston yoke Ass'y back into the center of the cylinder tube. Next, attach the cover Ass'y ㊼ to the cylinder tube and secure it by the hex. head bolt ⑰. Be careful not to pinch the cylinder gasket ㉖ between the cover Ass'y and the cylinder tube. Do not lose the O-ring ㉗.



(7) Set the dust-proof belt ⑨ in the cylinder tube slit in a way that the same length of the belt sticks out of either side. Next, insert one end of the dust-proof belt into the gap between the cylinder tube and the cover Ass'y ㊼.

(8) Put the belt spacer ⑬ through the window of the cover Ass'y ㊼ (the side onto which one end of the dust-proof belt has been inserted), push it until its end hits the end face of the cylinder tube ㉕. Fasten it by the hex. cap set screw.



(9) Push the dust-proof belt through the slit of the cylinder tube ㉕ from the side fastened by the belt spacer, and insert the opposite end into the gap between the cylinder tube and the cover Ass'y. Be sure that the dust-proof belt is not slack at the piston yoke Ass'y.

(10) Fit a new dust wiper (㉚, SRL2-12~63) or felt (㉞ ㉟ SRL2- 80, 100) in the groove of the table Ass'y ㊵. Next, place the table Ass'y on the piston yoke Ass'y ㊾ and fasten it there by the hex. head bolt ⑮. Be careful not to drop the dust wiper (or felt).

(11) Insert the belt spacer ⑬ through the cover Ass'y window (the side with the dust-proof belt. See ⑨ above.) and secure the dust-proof belt in the same manner as (8) above.

(12) Fit the belt cover ① into the cover Ass'y ㊼. This completes the assembly of the standard SRL2.

5. TROUBLES AND CORRECTIVE MEASURES

Troubles	Causes	Measures
Does not operate	Absence or lack of pressure	Secure the pressure source
	No signal for the direction control valve	Correct the control circuit
	Incorrect mount centering	Correct the fitting
	Damaged piston packing	Replace the packing
	Damaged seal belt	Replace the belt
Jerky movement	Incorrect mount centering	Correct the fitting
	Excessive moment	Set the guide, correct fitting
	Large load	Increase pressure or tube bore tube bore
	Speed control valve is used for meter-in circuit	Change the position of speed control valve for meter - out circuit.
Damage, distortion	Impact from high-speed operation	Reduce the speed,lighten the load,increase cushion capacity (set external cushion mechanism)
	Excessive moment	Set the guide, correct fitting
SW does not function	Incorrect SW position	Reset SW to HD, RD position. See Chapter 7 "Caution for using SW cylinder"
	SW is electrically damaged.	Check the circuit to prevent excess current and voltage (SW replacement). Check if the lead wire is bent too much, causing a short circuit inside (SW replacement)
	SW is mechanically damaged.	Replace the SW, remove outside obstacles.
	Problem with magnetic flux distribution for SW activation	Remove magnetic materials (iron powder in large amount, etc.) from near the SW

Discontinue

6. HOW TO ORDER

● No switch

SRG – 00 – 12 B – 200 ——— A

● With switch

SRG – 00 – 12 B – 200 – MOH※ – R – A

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ Ⓖ

Super Rodless Cylinder

Ⓐ Support types		Ⓑ Tube bore (mm)		Ⓒ Cushion	
OO	Basic type	12	φ 12	B	Both side cushion
LB	Axis-wise foot type	16	φ 16	R	R side cushion
LB1 (Note2)	Axis-wise foot type, option Ⓖ markings "R" and "T" only	20	φ 20	L	L side cushion
		25	φ 25	N	No cushion

R is to the right, L to the left, facing the port

Ⓓ Stroke (mm)	
Standard stroke	Max. stroke
200	Equivalent φ12 : 450 Equivalent φ16, φ20 : 800 Equivalent φ25 : 1000
300	
400	
500	
600	
700	
800	
900	
1000	

Ⓔ Switch type						Ⓕ No. of switches	
Lead wire straight	Lead wire L	Application			Lamp	R	R side 1 SW
M0H※	M0V※	Replay, PC	Contact	2 wires	1-color display	L	L side 1 SW
M5H※	M5V※	Replay, PC, IC circuit, serial connection			No lamp	D	2 SW
						T	3 SW
M2H※	M2V※	PC	Non-contact		1-color display	4	4 SW
——	M2WV※				2-color display	5	5 SW
M3H※	M3V※	Relay, PC, IC circuit, small electromagnetic valve		3 wires	1-color display	For four or more switches, indicate the number by numeral.	
——	M3WV※				2-color display		

The mark ※ indicates the length of the lead wire.

Ⓖ Option, accessory	
A	Full stroke adjustment both sides, with shock killer
A1	Full stroke adjustment R side only, with shock killer
A2	Full stroke adjustment L side only, with shock killer
A3	Full stroke adjustment to be fitted later note 5
H	Larger size of the bolts for mounting table (φ12~φ20) note 6
No code	Port position F, cushion needle position F (standard)
R	Port position R, cushion needle position F (central port)
B	Port position F, cushion needle position B (φ12~φ20)
T	Port position R, cushion needle position B (central port) (φ12~φ20)
D	Port position D, cushion needle position F (φ25)
S	Port position D, cushion needle position D (φ25)

※Lead wire length	
No code	1m (standard)
3	3m (option)
5	5m (option)

Note 1 : Refer to outline drawing for the indication mark of port and cushion needle position.

Note 2 : Support type is "00" or "LB1" at the case of option mark "R" or "T".
(Don't make support type "LB" with option mark "R" or "T", because it occurs to be unable to connect a pipe.)

Note 3 : Bore size φ12~φ20 can add option mark "B" or "T" and φ25 cannot add them.

Note 4 : Bore size φ25 only can add option mark "D" or "S" and φ12~φ20 cannot add them.

Note 5 : Basic cylinder cannot be fitted sull stroke adjustment parts later.
Option mark "A3" has the special nuts for mountion to be fitted tater.

Note 6 : Bolts size is M4 for bore φ12 or φ16. Bolts size is M5 for bore φ20.

Note 7 : Refer to the catalogue when you need the outline dimensions and other details specifications.

Discontinue

Switch model unit marking (same as SRL2)

● Set of SW + mount part (Note 1)

SRL2 – MOH※ Ⓔ

● SW only

SW – MOH※ Ⓔ

● Set of mount part

SRL2 – M

● Lead wire holder (Note 2)

SRL2 – MH

(Note1) The lead wire holder is not included in the SW/mount part set. Arrange for the lead wire if it is required.
(Note2) Each set contains 10 lead wire holders.

Ⓔ Switch type

Lead wire straight	Lead wire L	Application			Lamp
M0H※	M0V※	Relay, PC	Contact	2 wires	1-color display
M5H※	M5V※	Replay, PC, IC circuit, serial connection	Contact	2 wires	No lamp
M2H※	M2V※	PC	Non contact	2 wires	1-color display
——	M2WV※	PC	Non contact	2 wires	2-color display
M3H※	M3V※	Relay, PC, IC circuit, small electromagnetic valve	Non contact	3 wires	1-color display
——	M3WV※	Relay, PC, IC circuit, small electromagnetic valve	Non contact	3 wires	2-color display

※Lead wire length	
No code	1m (standard)
3	3m (option)
5	5m (option)

The mark ※ indicates the length of the lead wire.

● Shock killer unit marking

Model marking	Applicable model
NCK-00-0.3-C	SRG-12・16
NCK-00-0.7-C	SRG-20
NCK-00-1.2	SRG-25

● Repair kits marking

SRL2 – Tube bore K– stroke

● Support marking

SRL2 – Support type (LB,LB1) – Tube bore

(2 brackets, 4 fixing bolts)

● All-stroke adjustment kit marking (Apply to Option mark "A3")

SRG – Tube bore – ※

(Mark "※" means to put "A", "A1" or "A2")

Discontinue

7. SPECIFICATIONS

Part number / Item	SRG (Standard type · Switch assembled type)	
Media	Compressed air	
Max. operation pressure MPa{kgf/cm²}	0.7 {7.1}	
Min. operation pressure MPa{kgf/cm²}	Equivalent of φ12、φ16、φ20 0.2 {2.04} Equivalent of φ25 0.1 {1.02}	
Guaranteed withstand MPa{kgf/cm²}	1.05 {10.7}	
Bore coil	φ12、φ16	φ20、φ25
Port size	M5	Rc1/8
Ambient tempreature ℃	5~60	
Stroke tolerance (mm)	$^{+2.0}_{0}$ (~1000)、$^{+2.5}_{0}$ (~3000)、$^{+3.0}_{0}$ (~5000)	
Working piston speed mm/s	50~1000	
Hole position accuracy to repeat (mm)	±0.05 (At the case of SRG with shock killer) (Note 2)	
Cushioning	Air cushion	
Lubrication	Not required(Please use turbin oil class1, ISO VG 32, when you supply oil. And supply the oil continuously after you supplied oil once.)	

(Note 1) : Note that the operation piston speed in the central port pipe varies depending on the strokes.
(Note 2) : Keep max 0.1mm gap between the table and the connecting plate when the table stop at the each end without shock killer.