CKD

SM－407233－A

INSTRUCTION MANUAL

SUPER RODLESS CYLINDER

SRL2・SRL2-J
SRL3・SRL3-J

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

CKD Corporation

The 4th edition

For Safety Use

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

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

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

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this 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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SRL2・SRL3
(Super Rodless Cylinder)
Manual No. SM-407233-A

1. PRODUCT

1.1 Specifications

Working fluid		Compressed air				
Max. working pressure MPa		0.7				
Min. working pressure MPa		SRL2 SRL3 basic type	SRL2-G SRL3-G with resin guide	SRL2-Q SRL3-Q with position locking mechanism	SRL2-GQ SRL3-GQ with resin guide and position locking mechanism	SRL2-J SRL3-J with dust cover (full cowling type)
	Equivalent of ϕ12, ϕ16, ϕ20	0.2	0.25	0.2	0.25	—
	Equivalent of ϕ25, ϕ32, ϕ40	0.1	0.15	0.15	0.15	0.1
	Equivalent of ϕ50, ϕ63, ϕ80, ϕ100	0.05	0.1	0.1	0.1	0.05
Proof pressure MPa		1.05				
Ambient temperature ℃		5-60 (no freezing)				
Lubrication		Not required (turbine oil ISO VG32 should be use.)(Note 1)				
Working piston speed mm/s (Note 2,3)		50 to 2000 (standard port piping), Equivalent of ϕ12, ϕ16, ϕ20 50-1000 (central port piping, at 1000 strokes) Equivalent of ϕ25, ϕ32, ϕ40, ϕ50, ϕ63, ϕ80, ϕ100 50-1000 (central port piping ,at 2000 strokes)				
Mountable switch models		M2,M2W,M3,M3W,M0,M5,,T2Y,T3Y,T2YD,T2YL,T3YL,T2W,T3W				
Holding power of the Model with position Locking mechanism N		—		Max. thrust ×0.7		—

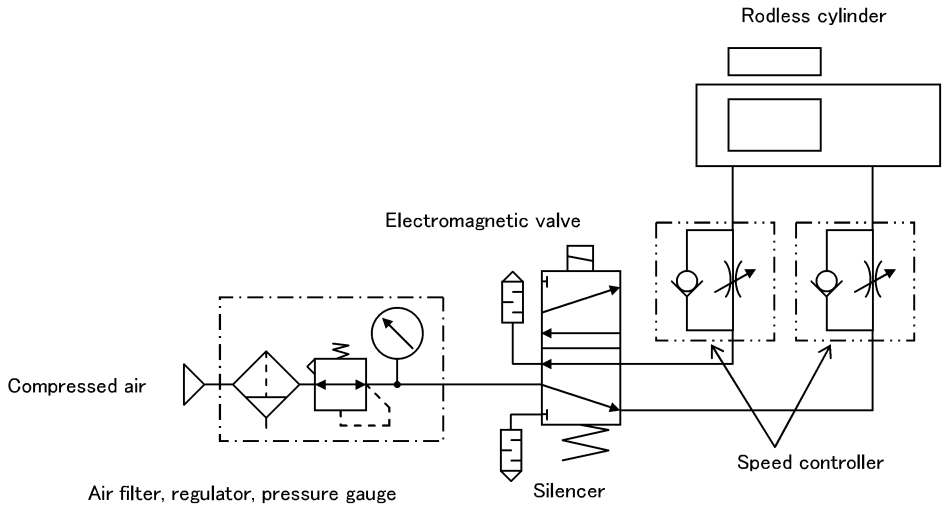
(Note 1) For the model with position locking mechanism, apply grease to the sliding part of the lock lever on a regular basis.

(Note 2) Note that the working piston speed in the central port pipe varies depending on the strokes.

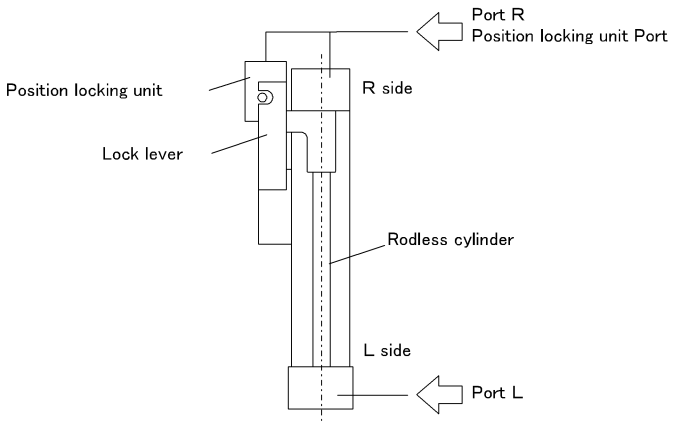
(Note 3) With the model that comes with the position locking feature, reduce the rushing speed to no more than 500 mm/s when the piston is operated at 500-2000 mm/s. The piston speed can be reduced by such means as externally installing a shock absorber or a speed-reduction circuit.

1.2 Basic Circuit Diagram

Basic circuit diagram (no lubrication)
The illustration shows the basic circuit.



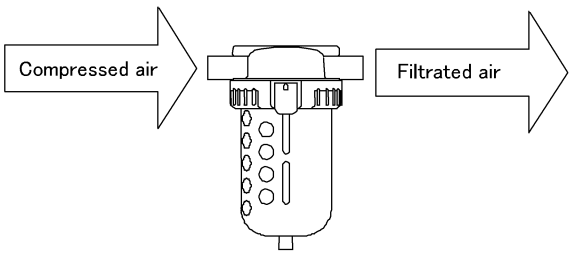
The model with the position locking mechanism requires an air pipe for linking with the position locking unit, Use a tee or other means to make the pipe branch off to the R side of the rodless cylinder and to the position locking unit,
(The circuit before the speed controller is the same as the above circuit.)



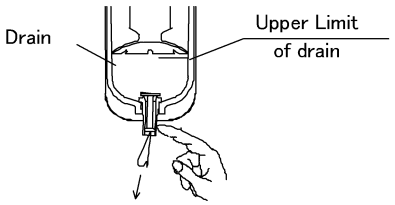
2. CAUTION

2.1 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 mounting orientation (near the direction-control valve).



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



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 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.

3. OPERATION

1) Be sure that the supply pressure to the cylinder is between the min. working pressure and the max. working pressure as described in 1.1 Specificateions.

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 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.

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

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.

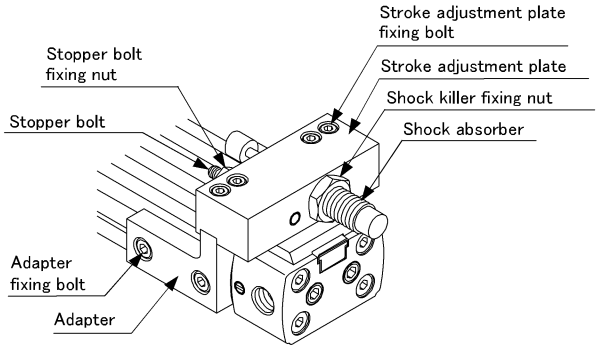
Cushion characteristics

Bore size (mm)	Effective air cushion length (mm)	Allowable energy absorption J	
		Cushioned	No cushion
ϕ 12 or equivalent	14.5	0.03	0.003
ϕ 16 or equivalent	19.2	0.22	0.007
ϕ 20 or equivalent	22.2	0.59	0.010
ϕ 25 or equivalent	20.9	1.40	0.015
ϕ 32 or equivalent	23.5	2.57	0.030
ϕ 40 or equivalent	23.9	4.27	0.050
ϕ 50 or equivalent	24.9	9.13	0.072
ϕ 63 or equivalent	29.6	17.4	0.138
ϕ 80 or equivalent	45.8	33.0	0.393
ϕ 100 or equivalent	45.8	57.0	0.622

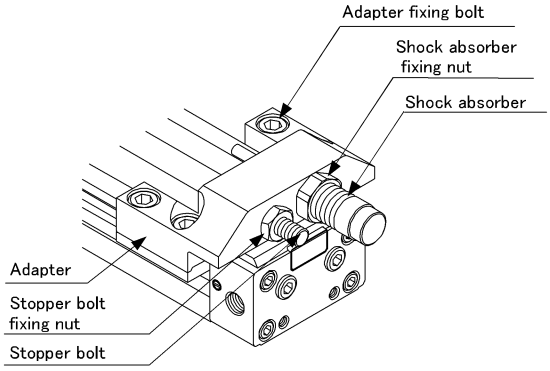
3) For piston speed adjustment, install a speed controller as illustrated in the basic circuit on page 2.

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 12— ϕ 25).



(2) After the stroke adjustment unit has been moved to the desired position, tighten the adapter fixing bolts (and the stroke adjustment plate fixing bolts for the cylinders of ϕ 12— ϕ 25) at the torque indicated in Table 1 below.



CAUTION

If the bolts are tightened at the lower torque than indicated in the table below, it may result in the slippage of the stroke adjustment unit.

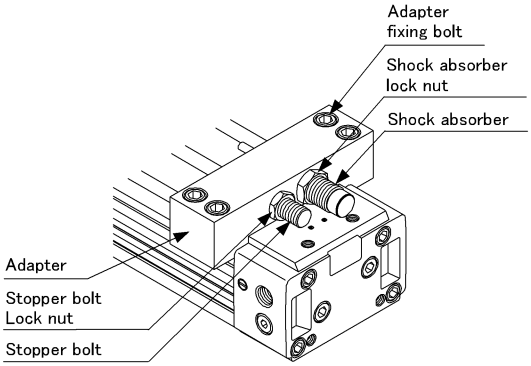


Table 1. Tightening torques of the adapter fixing bolt and the stroke adjustment plate fixing bolt

Tightening torque / Bore size (mm)	Adapter fixing bolt N・m	Stroke adjustment plate fixing bolt N・m
ϕ 12・16 or equivalent	1.0～1.2	0.5～0.7
ϕ 20 or equivalent	2.5～2.7	
ϕ 25 or equivalent	5.2～5.6	2.5～2.7
ϕ 32 or equivalent	22～24	—
ϕ 40 or equivalent	44～48	—
ϕ 50・63 or equivalent	77～83	—
ϕ 80・100 or equivalent	100～110	—

(3) Stroke adjustment by stopper bolt

There is a danger of pinching your finger if adjustment is made by $\phi 12 - \phi 20$ 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 absorber fixing nut

Tightening torque / Bore size (mm)	Adapter fixing bolt N・m	Stroke adjustment plate fixing bolt N・m
ϕ 12・16 or equivalent	1.1～1.2	1.3～1.8
ϕ 20 or equivalent	2.5～2.7	2.9～3.9
ϕ 25 or equivalent	4.5～6.0	4.5～6.0
ϕ 32 or equivalent	9.0～12.0	7.5～10.0
ϕ 40 or equivalent	22～30	22～30
ϕ 50 or equivalent	43～56	55～70
ϕ 63 or equivalent	110～143	55～70
ϕ 80・100 or equivalent	215～280	100～130

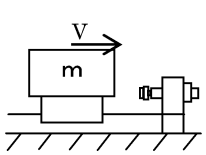
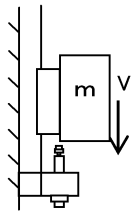
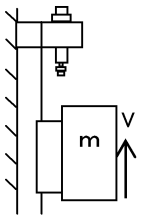
(4) Adjustment of the shock absorber

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

(5) Checking of the tolerable collision energy of the shock absorber.

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.

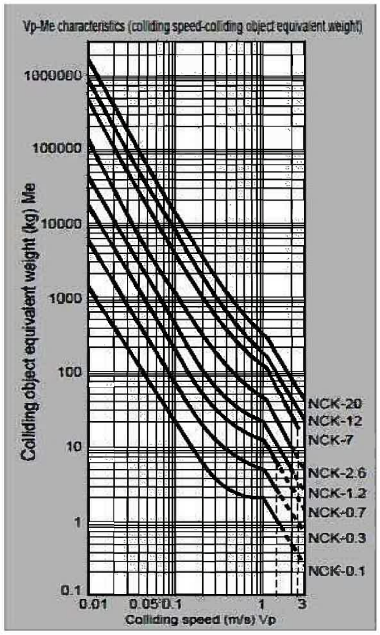
Note that the tolerable ranges of Me and E vary depending on the speed of collision.

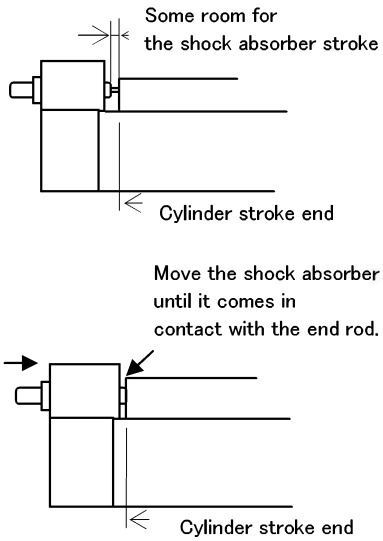
	Horizontal movement	Moving downward	Moving upward
Applications			
Colliding object equivalent weight Me(kg)	$Me=m+\frac{2F \cdot St}{V^2}$	$Me=m+\frac{2 \cdot St\ (F+mg)}{V^2}$	$Me=m+\frac{2 \cdot St\ (F-mg)}{V^2}$
Energy E(J)	$E=\frac{m V^2}{2}+F/St$	$E=\frac{m V^2}{2}+(F+mg)/St$	$E=\frac{m V^2}{2}+(F-mg)/St$

●Signs

E	:	Collision energy	J
Me	:	Colliding object equivalent weight	kg
M	:	Weight of workpiece	kg
F	:	Cylinder thrust	N
V	:	Colliding speed	(m/s)
St	:	Stroke length of shock absorber	(m)
G	:	Gravity Acceleration	9.8(m/s)^2

Fig.1 Tolerable range of colliding object mass





Absorption energy at the time of product shipment

Bore size (mm)

φ 12	2.4J
φ 16	2.4J
φ 20	5.7J
φ 25	10J
φ 32	18J
φ 40	50J
φ 50	86J
φ 63	86J
φ 80	143J
φ 100	143J

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

(6) Caution for use

The shock absorber, with the rated stroke absorbs the rated energy. At the time of shipment, it was positioned in a way as 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 absorber 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.

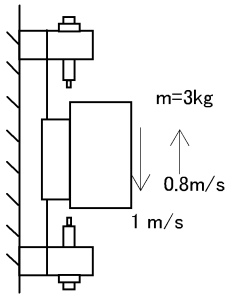
(7) Shock absorber

Table3, Specifications

Bore size(mm)		φ 12・16	φ 20	φ 25	φ 32	φ 40	φ 50・63	φ 80・100
Shock absorber model / Item		NCK-00-0.3-C	NCK-00-0.7-C	NCK-00-1.2	NCK-00-2.6	NCK-00-7	NCK-00-12	NCK-00-20
Classification		No adjuster, spring type						
Allowable energy absorption	J	3	7	12	26	70	120	200
Stroke		6	8	10	15	20	25	30
Absorption energy per hour	J	6,300	12,600	21,600	39,000	84,000	86,400	108,000
Maximum impact velocity	m/s	1.5		2.0		2.5	3.0	
Max. repetition frequency Count / min		35	30	30	25	20	12	9
Ambient temperature.	℃	5～60						
Return spring force N	When extended	2.9	2	2.9	5.9	9.8	16.3	16.3
	When compressed To the limit	4.5	4.3	5.9	11.8	21.6	33.3	33.9
Return time	S	0.3 or less				0.4 or less		0.5 or less

(8) Example of calculation(SRL2-20)

●Example(1) : Ascending and Descending



Operation conditions

- Load weight M : 3kg
- Collision speed
  Ascending : 0.8 m/s
  Descending : 1.0m/s
- Operation pressure : 0.5 Mpa(157N)

① Kinetic energy when ascending (E1)

$$E1 = \frac{3 \times 0.8^2}{2} + (157 - 3 \times 9.8) \times 0.008 = 1.98J$$

As this is smaller than half the max. absorption energy (Table 3), the kinetic energy (E1) can be absorbed.

$$Me = 3 + \frac{2 \times 0.008(157 - 3 \times 9.8)}{0.8^2} = 3.19kg$$

As Me of the shock absorber used in the SRL2-20 is 16 kg when V=0.8 m/s from Fig.1, it is absorbable.

② Kinetic energy when descending (E1)

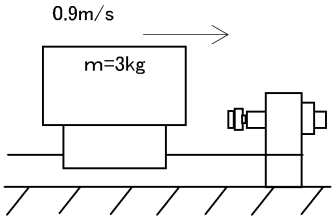
$$E1 = \frac{3 \times 1^2}{2} + (157 + 3 \times 9.8) \times 0.008 = 3J$$

As this is smaller than half the max, absorption energy (Table 3), the kinetic energy (E1) can be absorbed.

$$Me = 3 + \frac{2 \times 0.008(157 + 3 \times 9.8)}{1^2} = 6\ kg$$

As Me of the shock absorber used in the SRL2-20 is 15 kg when V = 1.0 m/s From Fig.1, it is absorbable.

●Example(2) : Horizontal move



Operation conditions

- Load weight M : 3 kg
- Collision speed
  Horizontal : 0.9 m/s
- Operation pressure : 0.3 MPa(94N)

Horizontal kinetic energy (E1)

$$E1 = \frac{3 \times 0.9^2}{2} + 94 \times 0.008 = 2J$$

As this is smaller than half the max. absorption energy (Table 3), the kinetic energy (E1) can be absorbed.

$$Me = 3 + \frac{2 \times 94 \times 0.008}{0.9^2} = 4.86 \text{ kg}$$

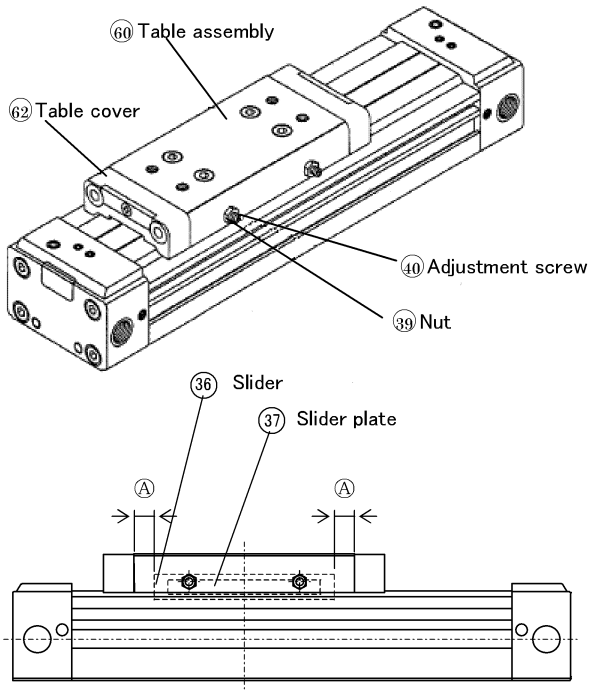
As Me of the shock absorber used in the SRL2-20 is 16 kg when V = 0.9 m/s from Fig.1 4.86 is smaller than 16 and it is absorbable.

5) Adjustment of the product with a resin guid (SRL2-G/GQ,SRL3-G/GQ)
The play of the table with a resin guide can be adjusted using the adjustment screws (40). Follow the procedure below.

(1) Loosen the four nuts (39). (Two each on each side of the table).

(2) After removing the table cover(62), align the adjustment screw (40) hole and an indentation in the slider plate. (Insert the cylinder (36) by the distance A in Table 4, a distance from the table edge surface.)

(3) Temporarily fix the slider (36) using the adjustment screws (40). Then install the table cover (62) to the table assembly(60). (The adjustment screw has a specially-machined end. Always use a CKD-supplied adjustment screw.)



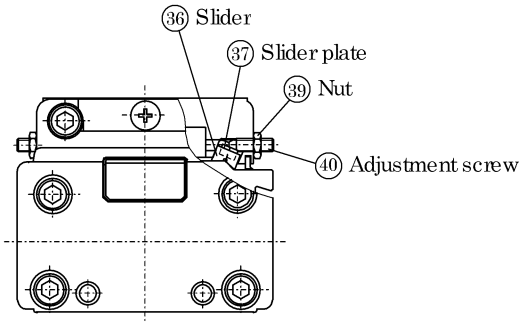
(4) Do the following with each of the four adjustment screw (40)(two on each side of the table) : tighten the adjustment screw to the torque B in Table 4, and then slacken the screw a little by returning it by the angle C.

(5) Do the following with each of the adjustment screws (40); securing the adjustment screw with a hexagonal wrench, tighten the nut (39) to the torque D in Table 4. Then you are finished with the adjustment procedure.

Table4

Bore size mm	(A) Slider to table edge surface distance mm	(B) Adjustment screw tightening torque N・m	(C) Adjustment screw return angle	(D) Nut tightening torque N・m
φ12	7.5	0.03	90°	0.3
φ16	11	0.03	90°	0.3
φ20	7.5	0.03	90°	0.3
φ25	11	0.07	90°	0.7
φ32	1	0.07	90°	0.7
φ40	1	0.07	90°	0.7
φ50	1	0.07	90°	2.5
φ63	1	0.12	—	2.5
φ80, φ100	0	0.5	—	6.1

Note: With a cylinder that has a resin guide, adjustment screws press the slider (resin guide) against the cylinder tube to eliminate the table play. (See the illustration below.) Even after completing the above procedure, the table play may not have been set to the optimum amount.



If you wish to decrease the play, tighten the adjustment screws further.
If you with to increase the play because table movement is prevented or restricted, slacken the adjustment screws.

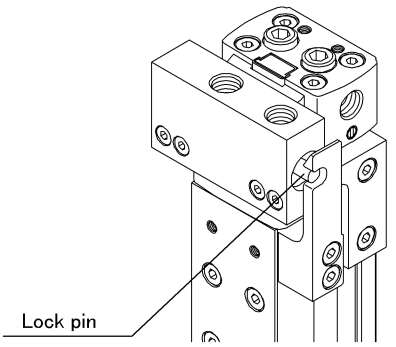
6) Position locking mechanism

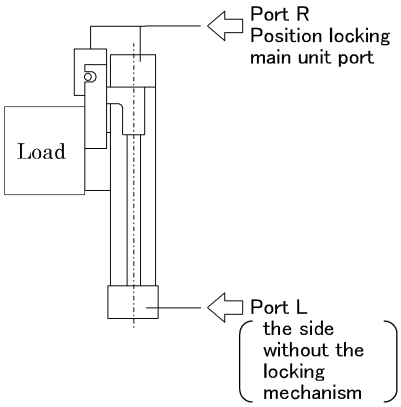
(1) Manual release

- Push down the lock pin with a stick.

(2) Caution

- Release the lock only after supplying pressure to Port L so as to keep the locking mechanism free of load.
  If pressure is supplited to Port R while both Port R and Port L are ventilated and the piston is locked, the lock will be released to eject the table with such a force that it might injure the operator.
- The lock pin may become dislocated when the cylinder is held while the pressure is being applied to the locking mechanism.
  Do not use the solenoid valve of the 3-position all ports blocked nor 3-position P・A・B ports connected.
- The lock may be released when the back pressure is applied during locking. To avoid this, use a single unit electromagnetic valve or an individual manifold exhaust type.





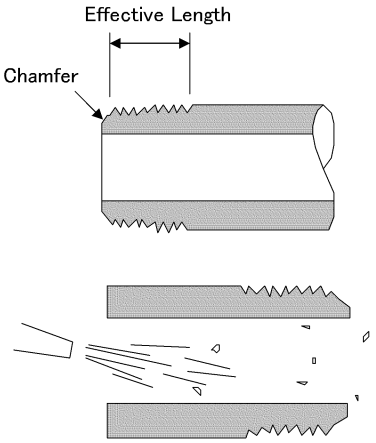
4. INSTALLATION

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.

2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area which is needed for the cylinder to drive at the specified speed.

3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.

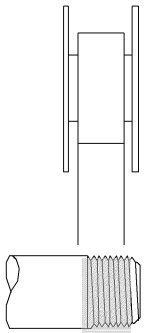


4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

5) Flush air into the pipe to blow out foreign substances and chips before piping.

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

●Seal Tape



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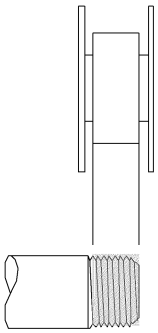
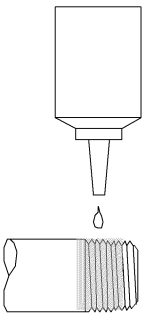
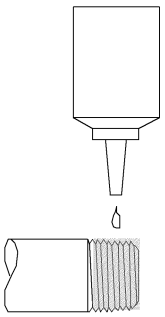


(Incorrect)

●Sealant (liquid)

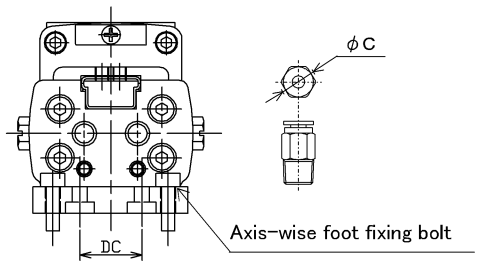


(Correct)



(Incorrect)

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

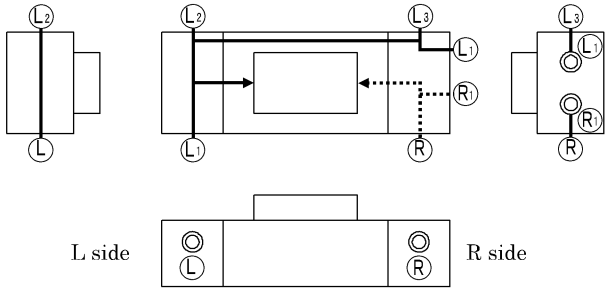


Item / Bore size (mm)	Port position DC	Outer diameter of usable joint ϕC OO	LB	LB1
ϕ12	11	11 or less	Unusable for central Port pipe	11 or less
ϕ16	12	12 or less		12 or less
ϕ20	16	16 or less		16 or less
ϕ25	26	26 or less		26 or less
ϕ32	27	27 or less		27 or less
ϕ40	35	35 or less	26 or less	
ϕ50	35	35 or less	30 or less	
ϕ63	39	39 or less	34 or less	
ϕ80	64	32 or less	26 or less	
ϕ100	73	40 or less	35 or less	

8) Among tubes with bores of ϕ12- ϕ63, 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).

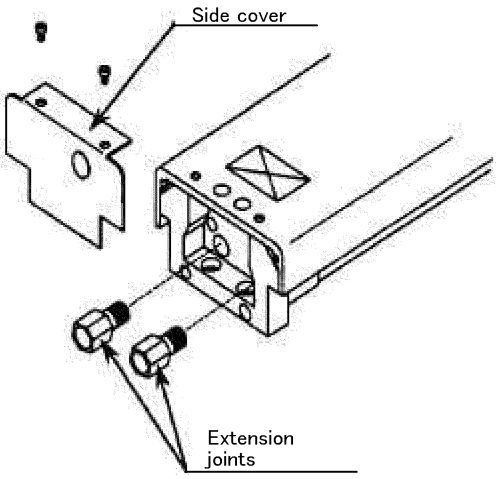
9) Piping port position and operation direction.
Bore size ϕ12- ϕ20

● Option symbol(blank, R, B, T)



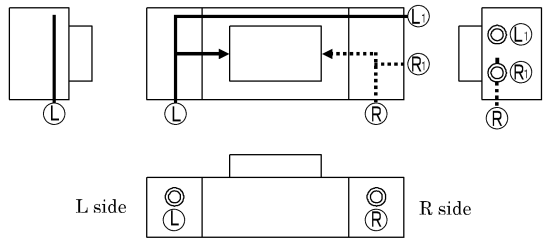
Ⓡ indicates the R side pressure port, and Ⓛ the L-side pressure port.
At the time of shipping, all the ports except one each at Ⓡ and Ⓛ were sealed by plugs. Remove the plugs for connection to other ports. Those with option code D or S cannot be manufactured.

10) Combined piping for SRL2,3-J, if you wish to use the SRL2,3-J (full cowling type cylinder with a dust cover) with a combined piping, remove the side cover from a side of the cylinder to install extension joints shipped with the combined piping port.
Then install the fitting and speed controller.



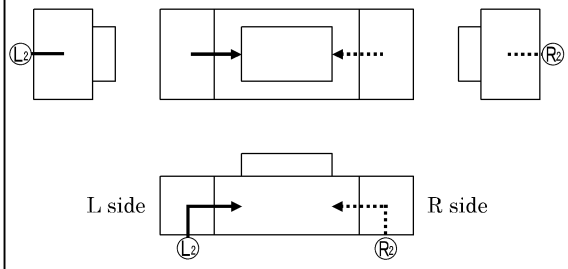
Bore size ϕ 25- ϕ 63

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



Ⓡ 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.

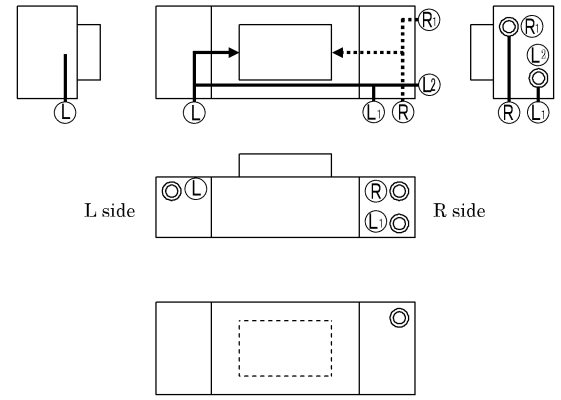
● Option markings (D, S for bottom piping)



Ⓡ indicates the R side pressure port, and Ⓛ the L side pressure port.
No piping available except for $Ⓡ_2$ or $Ⓛ_2$, as there are no other ports.

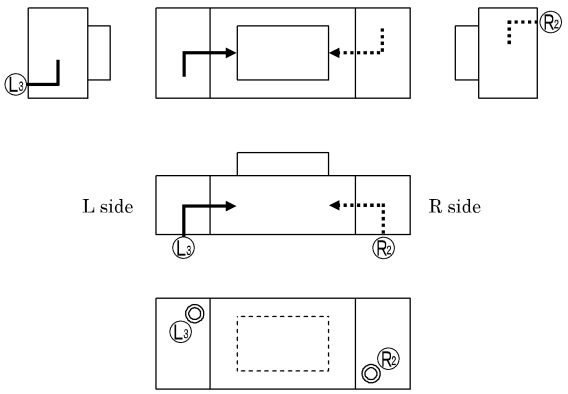
Bore size ϕ 80- ϕ 100

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



Ⓡ indicates the R side pressure port, and Ⓛ indicates the L side pressure port. Before shipping, all plugs other than 1 each at Ⓡ and Ⓛ are sealed with plugs. Pipes are connected to other ports by removing plugs.

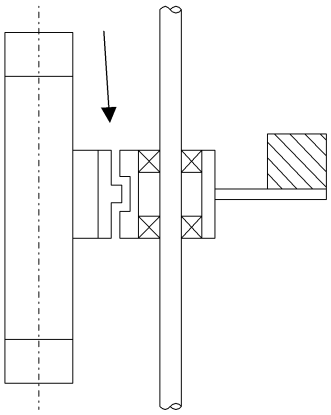
● Option markings (D, S for bottom piping)



There are no ports other than $Ⓡ_2$ or $Ⓛ_2$, so pipes cannot be connected.

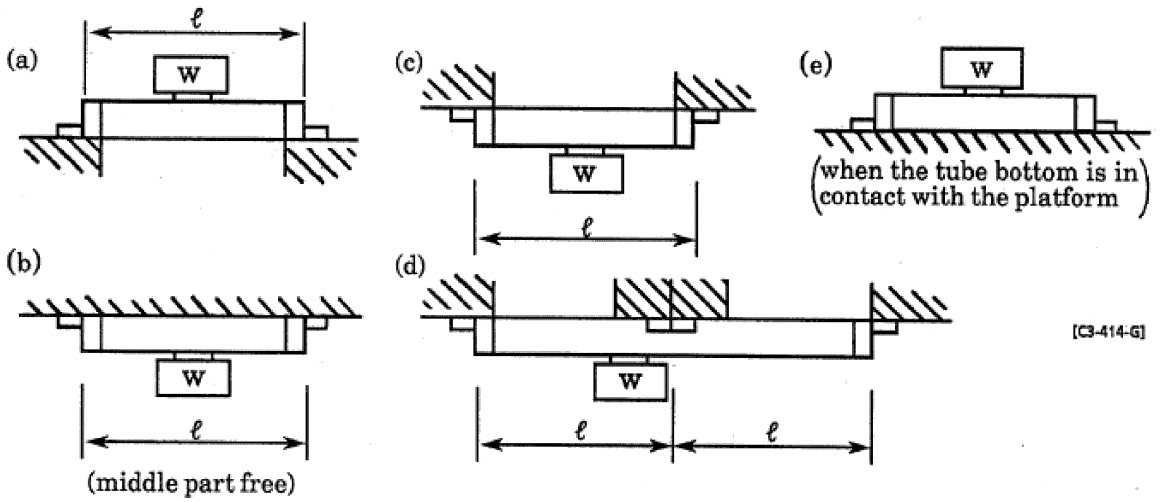
4.2 Installation

1) Operate this cylinder at the ambient temperature, of 5-60℃.
2) Be careful not to bump the cylinder tube against an object. The tube, when distorted, causes malfunction.
3) When using the guide, be sure that the cylinder and the guide are set in such a way that the center shift between them can be absorbed.
   If the guide is directly fixed to the cylinder, the shift of the center will put excessive pressure on the cylinder and causes malfunction.



4) 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 page 17.

   Limitation by support method in the case of vertical load (w).



Note : Do not install the SRL2,3-J upside down ; the operation can be affected by the accumulation of foreign matter and / or cutting fluid.

5) Installation of the SRL2,3-J

(a) Guard the product against "airborne" matter like threads, feathers, powders, and particles because they may pass through the table adapter path way under the cover to adhere to the cylinder, causing a malfunction.

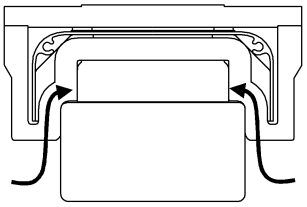
(b) If cutting fluid (oil) or powder gushes out or splashes sideways, provide an additional cover over the cylinder and / or over the sides.

(c) Guard the product against foreign matter that may splash in the space (about 2-3 mm) between the sliding part (table adapter) and cover.

(d) Do not install the STL2-J upside down; the operation can be affected by the accumulation of foreign matter and / or cutting fluid.

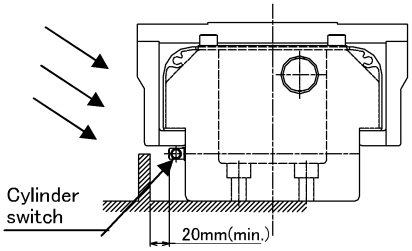
(e) Periodically remove foreign matter on and under the cover. A lack of cleaning may cause a malfunction.

(f) The product has a space under the cover to allow the movement of the table adapter. Guard the product against foreign matter that may enter into this space.



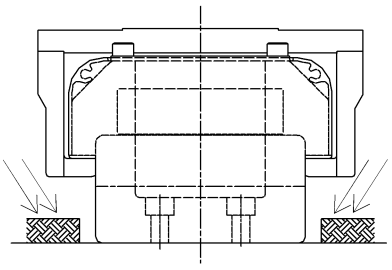
<The arrows show possible routes of penetration of foreign matter.>

(g) We strongly recommend that any wall installed to the product as a protection against foreign matter or cutting fluid be made of a non-magnetic material such as aluminum or brass. If you have to use a wall made of a magnetic material such as steel, provide at least a 20 mm distance to the edge surface of the switch (of any port size).

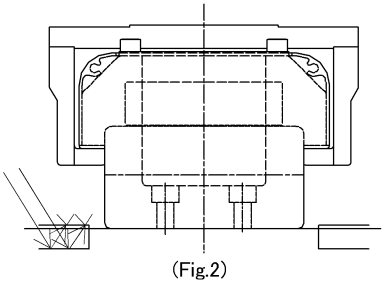


(h) To improve the protection against the penetration and splashes of foreign matters and cutting fluid, we recommend that you combine the side wall (mentioned in (g) above) with a liquid-absorbing sponge-like material laid out on the floor as shown in Figure 1.

Alternatively, as shown in Figure 2, you may produce a gutter-like structure in the floor with a mesh or perforated metal cover. Choose the best method for your site.

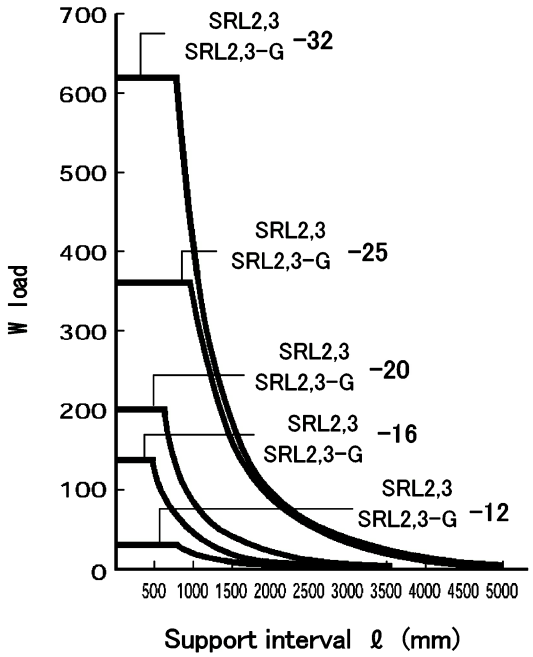


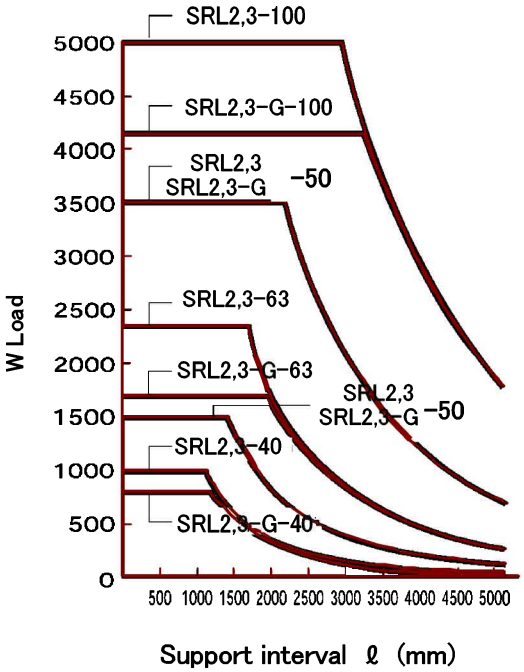
(Fig.1)



(Fig.2)

Correlations between support interval ℓ and the tolerable vertical load W with the support methods(a),(b),(c), and (d).



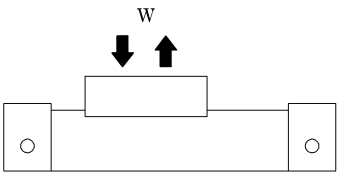


By the support method (e), the range of tolerable vertical load widens to the following.

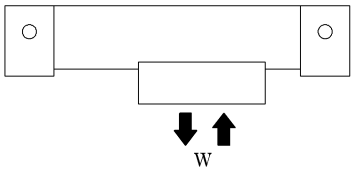
Load and moment tolerances The values shown in ( ) are for the cases with C mount fittings.

Item / Tube bore (mm)		Vertical load W : N	Bending moment M1 : N·m	Radial moment M2 : N·m	Twisting moment M3 : N·m
Standard types	ϕ 12	30(15)	1.5(1)	0.6(0.3)	0.6(0.6)
	ϕ 16	140(70)	5(3.5)	1(0.5)	1(1)
	ϕ 20	200(100)	10(7)	1.5(0.7)	3(3)
	ϕ 25	360(180)	17(12)	5(2.5)	10(10)
	ϕ 32	620(310)	36(25)	10(5)	21(21)
	ϕ 40	970(485)	77(54)	23(11.5)	26(26)
	ϕ 50	1470(735)	154(108)	32(16)	42(42)
	ϕ 63	2320(1160)	275(193)	52(26)	76(76)
	ϕ 80	3500	460	70	100
	ϕ 100	3500	750	95	130
With Resin guide	ϕ 12	30(15)	1.5(1)	0.6(0.3)	0.4(0.4)
	ϕ 16	140(70)	5(3.5)	1(0.5)	0.6(0.6)
	ϕ 20	200(100)	10(7)	1.5(0.7)	1(1)
	ϕ 25	360(180)	17(12)	5(2.5)	2(2)
	ϕ 32	620(310)	36(25)	10(5)	4(4)
	ϕ 40	810(485)	41(41)	18(11.5)	5(5)
	ϕ 50	1440(735)	76(76)	32(16)	9(9)
	ϕ 63	1630(1160)	98(98)	51(26)	12(12)
	ϕ 80	3500	351	70	37
	ϕ 100	4130	386	95	42
With Dust cover	ϕ 25	350	12	3.5	10
	ϕ 32	600	25	7	21
	ϕ 40	950	55	17	26
	ϕ 50	1440	107	23	42
	ϕ 63	2280	200	38	76

●Vertical load(upward)

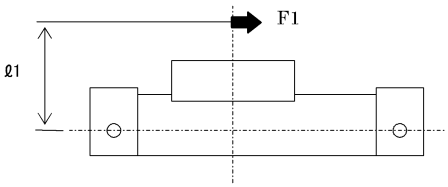


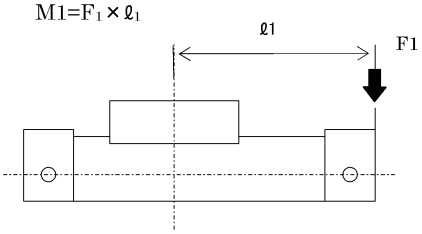
●Vertical load(downward)



●Bending moment M1

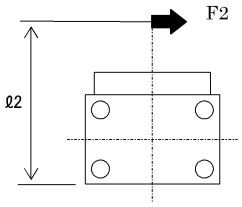
M1=$F_1 \times \ell_1$

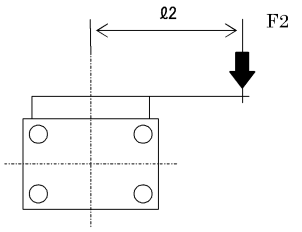




●Radial moment M2

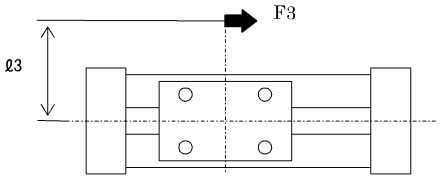
M2=$F_2 \times \ell_2$

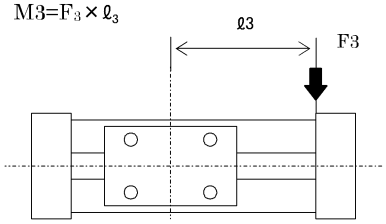




●Twist moment M3

M3=$F_3 \times \ell_3$





Note1 : 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.

Note2 : A long stroke limits the amount of vertical load by support method. Be sure to keep it within the tolerable range indicated in the graph on the previous page.

6) 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.

7) Do not perform electric welding after the rodless cylinder is installed.
The current runs through the cylinder to produce sparks between the dust-proof belt and the cylinder tube, damaging the belt as a result.

5. MAINTENANCE

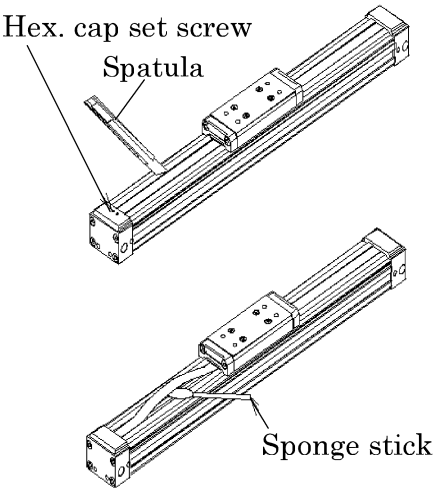
5.1 Regular Check

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
   - ⓔ Chang 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 "5-2. Troubles and corrective measures" and implement proper measures. Fasten any loose sections if there are any.

3) The way to grease to "Seal belt" and "Dust-proof belt"
   Use the lithium soap base for the grease.
   Recommended grease: Daphane Eponex No.1, Idemitsu Kosan
   Duplex SP No.1, Kyodo Yushi

a) The simple way to grease to only "Dust-proof belt"
- ・A thin spatula is put in a little between "Dust-proof belt" and "Cylinder tube".
  "Dust-proof belt" is lifted slowly by a spatula.
  Note: Don't injure "Seal belt" and "Dust-proof belt".
  Heave so that the end of "Dust-proof belt" doesn't come off "Hex. cap set screw".
- ・Grease a rubber part of "Dust-proof belt" and a slit part of "Cylinder tube" using a sponge stick.
- ・"Dust-proof belt" is forced into a slit of "Cylinder tube".



b) The way to grease, a product taken apart.
- ・"Seal belt" and "Dust-proof belt" are taken out by a way of "disassembly procedures" (P28).
  Will confirm that there is no damage in "Seal belt" and "Dust-proof belt".
- ・Dirt on the "Seal belt"," Dust-proof belt" and slit part of "Cylinder tube", is wiped up.
- ・Grease "piston" and "piston packing" , rubber part of "Dust-proof belt", all surface of "Seal belt" and inside part of " Cylinder tube".

"Seal belt" and "Dust-proof belt" are assembled by a way of "assembly procedures" (P36~P38).

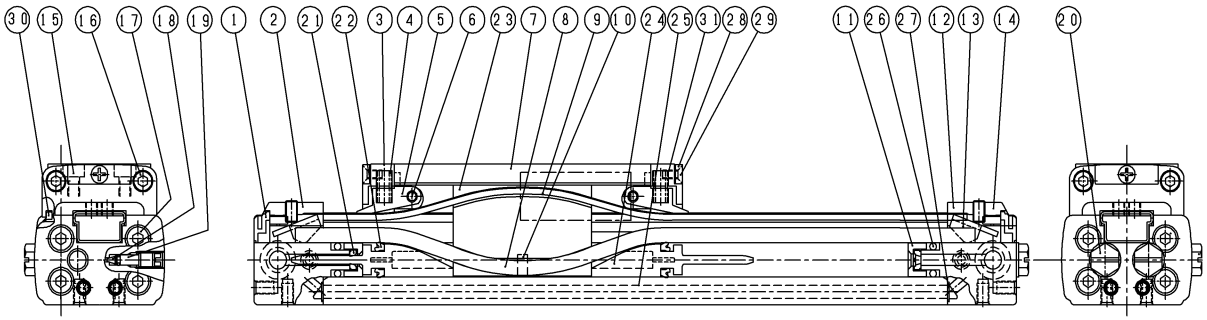
5.2 Troubles and Corrective Measures

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 mounting style
	Damaged piston packing	Replace the packing
	Damaged seal belt	Replace the belt
Jerky movement	Incorrect mount centering	Correct the mounting style
	Excessive moment	Set the guide, correct mounting style
	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 mounting style
SW does not function	Incorrect SW position	Rest 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 power in large amount, etc.) from near the SW

5.3 Disassembly

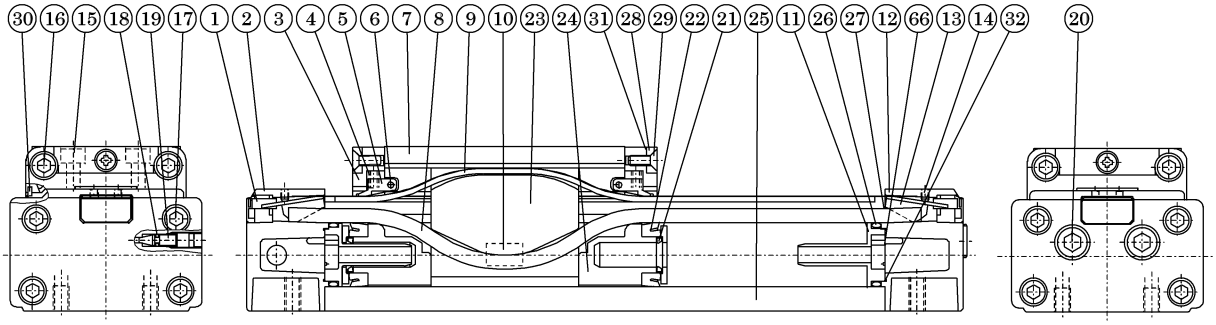
Should any air leakage occur, take the following corrective action.
Refer to the internal structure and the disassembly / assembly drawing.

● Internal structure drawing and parts list of the standard model (SRL2,3)
(φ12 to φ40)



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

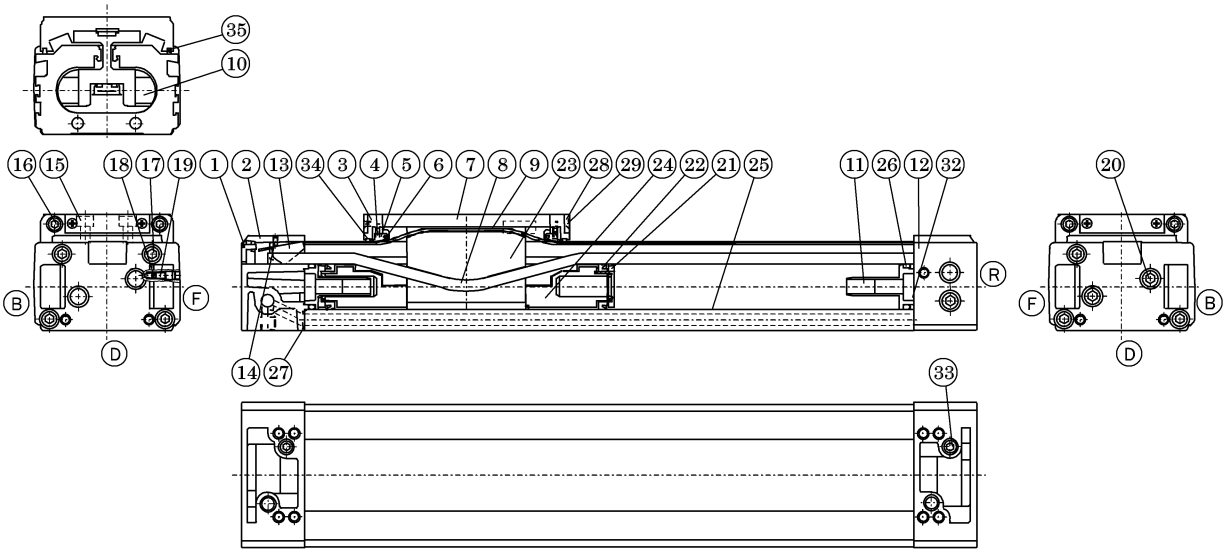
● Internal structure drawing and parts list of the standard model (SRL2,3) (ϕ 50 , ϕ 63)



Parts No.	Name	Material
1	Belt cover	Polyamide
2	Cover (L)	Aluminum alloy
3	Table cover	Acetal resin
4	Spring	Carbon steel
5	Belt tension	Acetal resin
6	Parallel pin	Steel
7	Table	Aluminum alloy
8	Seal belt	Urethane rubber
9	Dust-proof belt	Stainless steel + Nitrile rubber
10	Magnet	Special alloy
11	Cushion ring	Acetal resin
12	Cover (R)	Aluminum alloy
13	Belt spacer	Steel
14	Hex. cap set screw	Alloy steel
15	Hex. head bolt	Alloy steel
16	Hex. head bolt	Alloy steel
17	Hex. head bolt	Alloy steel
18	Needle gasket	Nitrile rubber
19	Cushion needle	Steel
20	Plug	Steel
21	Cushion packing	Urethane rubber
22	Piston packing	Nitrile rubber
23	Yoke	Aluminum alloy
24	Piston	Acetal resin
25	Cylinder tube	Aluminum alloy
26	Cylinder gasket	Nitrile rubber
27	O-ring	Nitrile rubber
28	Plate	Alloy steel
29	Cross-recessed tapping screw	Stainless steel
30	Dust wiper	Acetal resin
31	2-side adhesive tape	−
32	Cushion ring gasket (1)	Nitrile rubber
66	Cushion ring gasket (2)	Nitrile rubber (apply to ϕ 63 only)

● Internal structure drawing and parts list of the standard model (SRL2,3)

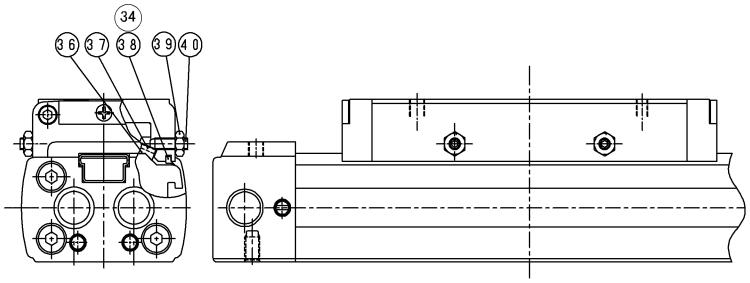
(φ80、φ100)



Parts No.	Name	Material
1	Belt cover	Polyamide
2	Cover (L)	Aluminum alloy
3	Table cover	Acetal resin
4	Spring	Carbon steel
5	Belt tension	Acetal resin
6	Parallel pin	Steel
7	Table	Aluminum alloy
8	Seal belt	Urethane rubber
9	Dust-proof belt	Stainless steel + Nitrile rubber
10	Magnet	Special alloy
11	Cushion ring	Acetal resin
12	Cover (R)	Aluminum alloy
13	Belt spacer	Steel
14	Hex. cap set screw	Alloy steel
15	Hex. head bolt	Alloy steel
16	Hex. head bolt	Alloy steel
17	Hex. head bolt	Alloy steel
18	Needle gasket	Nitrile rubber
19	Cushion needle	Steel
20	Plug	Steel
21	Cushion packing	Urethane rubber
22	Piston packing	Nitrile rubber
23	Yoke	Aluminum alloy
24	Piston	Acetal resin
25	Cylinder tube	Aluminum alloy
26	Cylinder gasket	Nitrile rubber
27	O-ring	Nitrile rubber
28	Plate	Alloy steel
29	Cross-recessed tapping screw	Stainless steel
32	Cushion ring gasket	Nitrile rubber
33	Plug	Steel
34	Felt	Wool
35	Felt	Wool

● Internal structure drawing and parts list of the model with the resin guide (SRL2,3-G)

(Refer to Page 21-23 for the internal structure and parts lists of the cylinder unit)

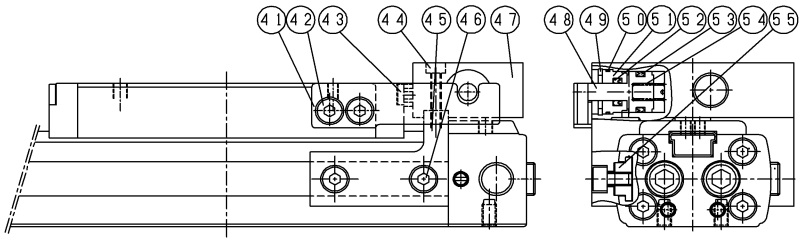


Part No.	Name	Material
36	Slider	Acetal resin
37	Slider plate	Steel
38	Dust wiper φ12-φ63：	Acetal resin
34	φ80, φ100：felt	Wool
39	Hex.nut	Steel
40	Adjustment screw	Alloy steel

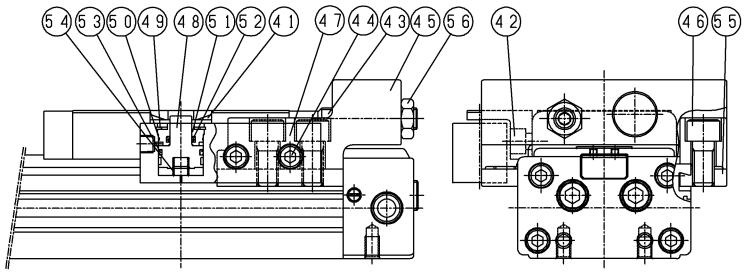
● Internal structure drawing and parts list of the model with the position locking mechanism (SRL2,3-Q, SRL2,3-GQ)

(Refer to Page 21-23 for the internal structure and parts lists of the cylinder unit)

(φ12-φ25)



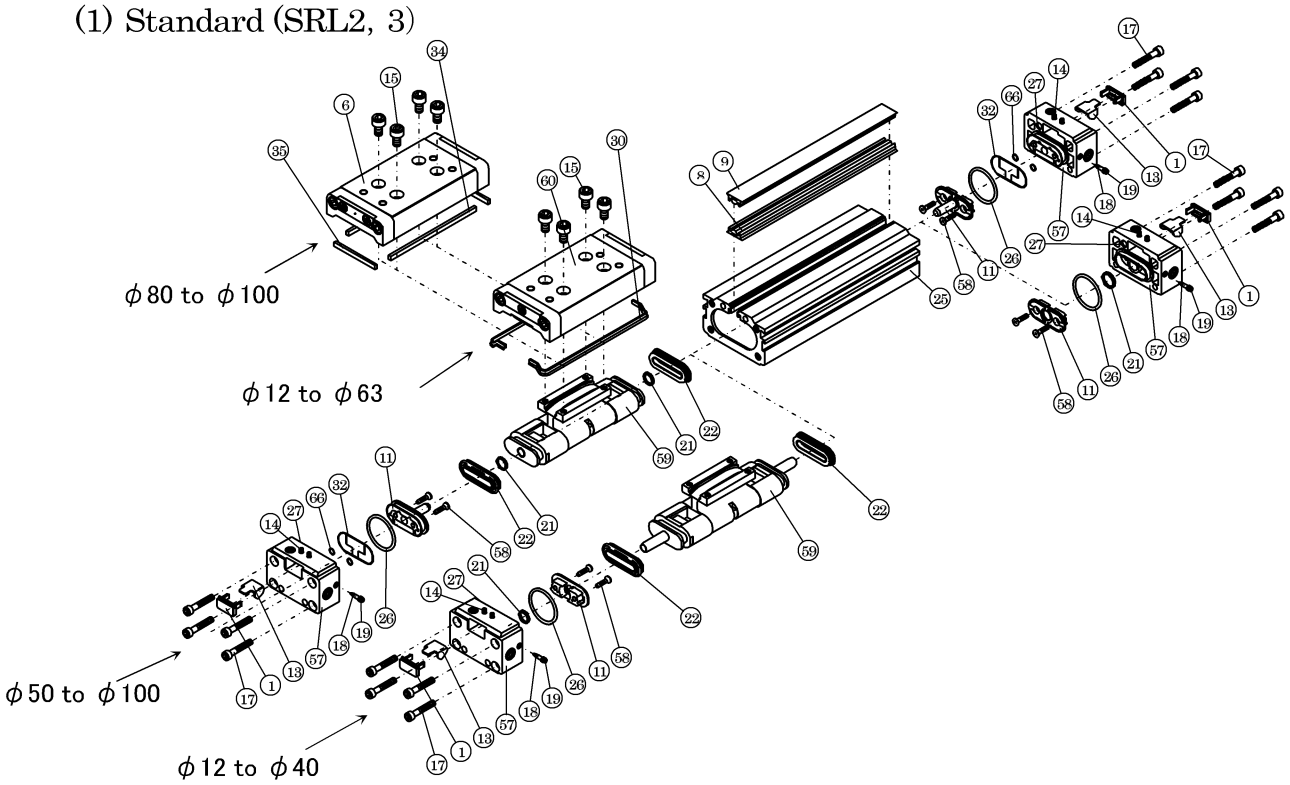
(φ32-φ100)



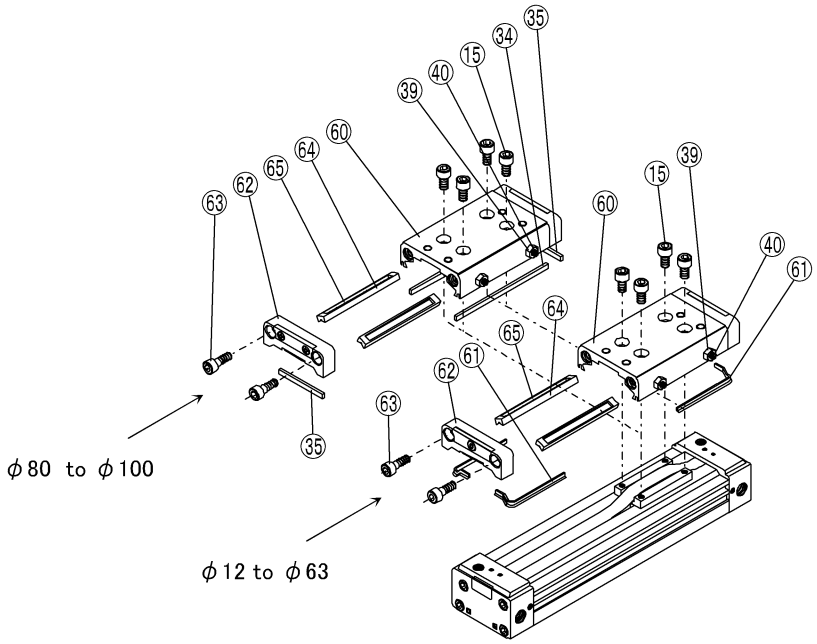
Part No.	Name	Material	Part No.	Name	Material
41	Lock lever	Alloy steel	49	C-type set pin	Alloy steel
42	Hex. head bolt	Alloy steel	50	Gasket	NBR
43	Stopper	Steel	51	Rod cover	Aluminum alloy
44	Hex. head bolt	Alloy steel	52	Rod packing	NBR
45	Adapter	Steel	53	Piston packing	NBR
46	Hex. head bolt	Alloy steel	54	Spring	Carbon steel
47	Position locking unit	Aluminum alloy	55	Plate nut	Alloy steel
48	Locking pin	Alloy steel	56	Hex, nut	Steel

Disassembly / assembly drawing

(1) Standard (SRL2, 3)

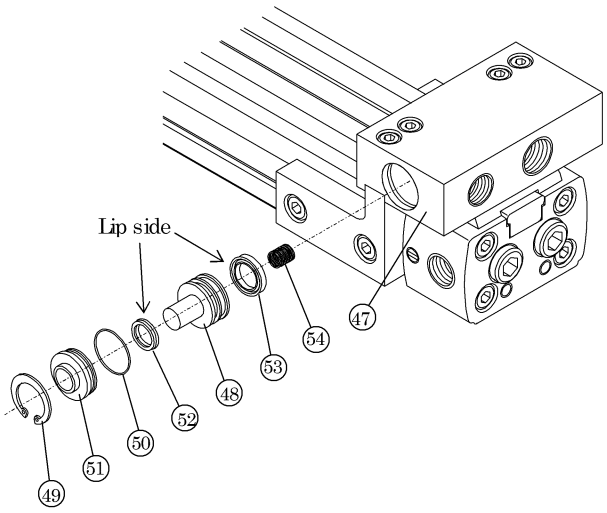


(2) With resin guide (SRL2, 3-G)

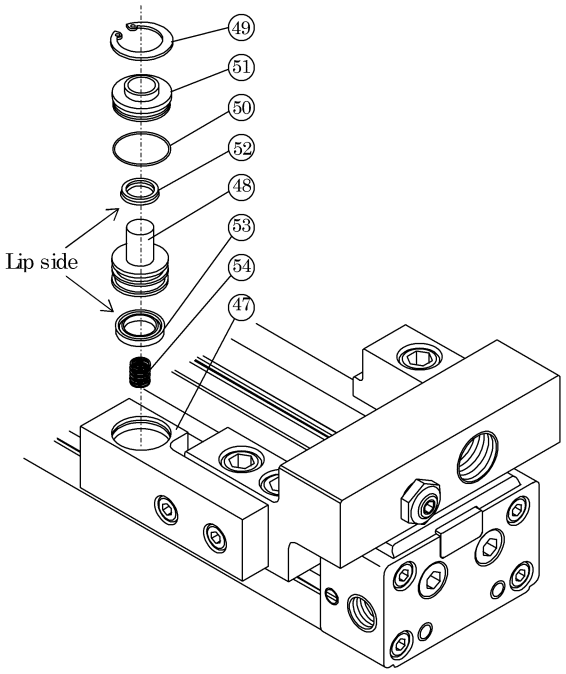


(3) With position locking (SRL2,3-Q SRL2,3-GQ)

(φ12 to φ25)



(φ32 to φ100)



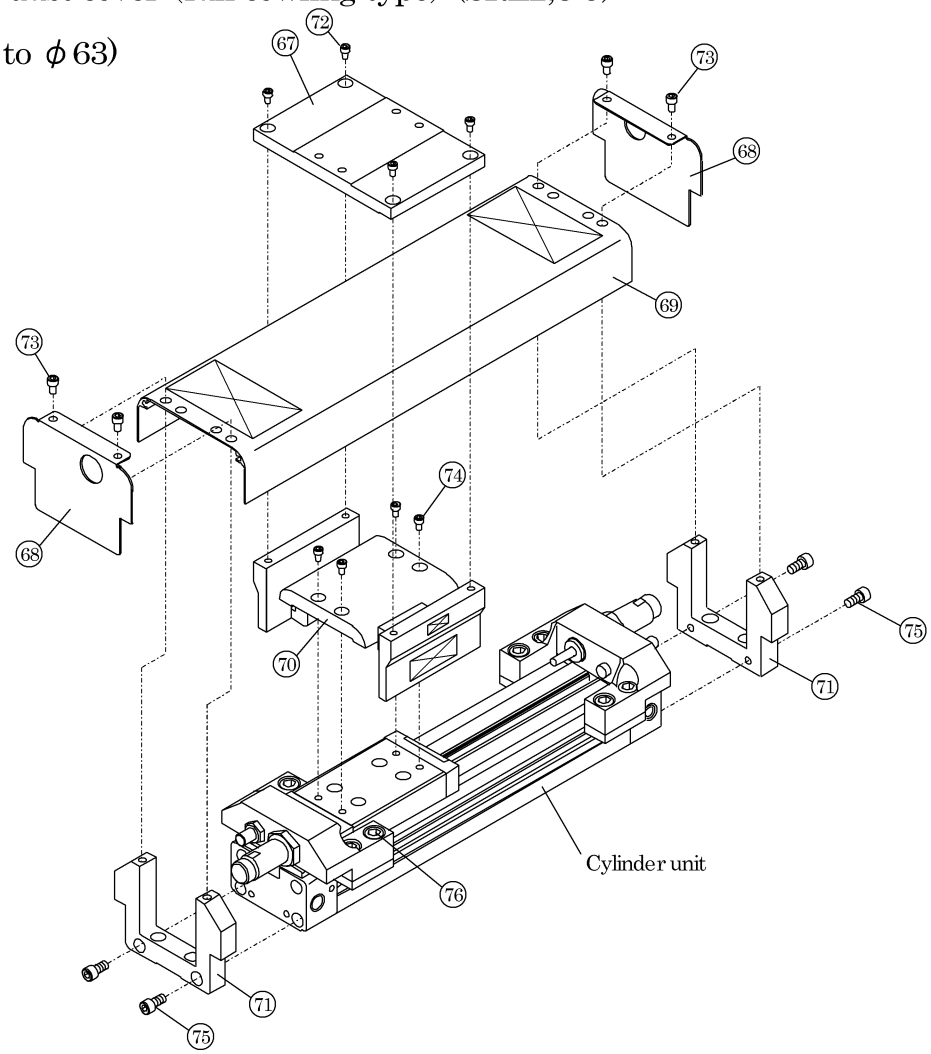
Tightening torques of the screws and bolts

N·m

Parts No.	Name \ Bore size (mm)	φ12	φ16	φ20	φ25	φ32	φ40	φ50	φ63	φ83	φ100
14	Hex. cap set screw	0.6	0.6	0.6	1.0	1.0	1.0	1.0	1.0	2.9	2.9
15	Hex. head bolt	1.1	1.1	3.3	3.3	6.9	11.6	22	22	44	44
17	Hex. head bolt	0.6	0.6	1.4	2.9	2.9	4.9	12.2	12.2	43	43
39	Hex. nut	0.3	0.3	0.3	0.7	0.7	0.7	2.5	2.5	6.1	6.1
40	Adjustment screw	0.03	0.03	0.03	0.05	0.05	0.05	0.2	0.2	0.4	0.4
	Return angle	90°	90°	90°	90°	90°	90°	90°	90°	—	—
58	Cross-recessed screw	0.2	0.2	0.2	0.4	0.7	0.7	—	—	—	—
16	Hex. head bolt	0.2	0.2	0.2	1.5	2.5	2.5	6.1	6.1	12.2	12.2

(4) With a dust cover (full cowling type) (SRL2,3-J)

(ϕ25 to ϕ63)

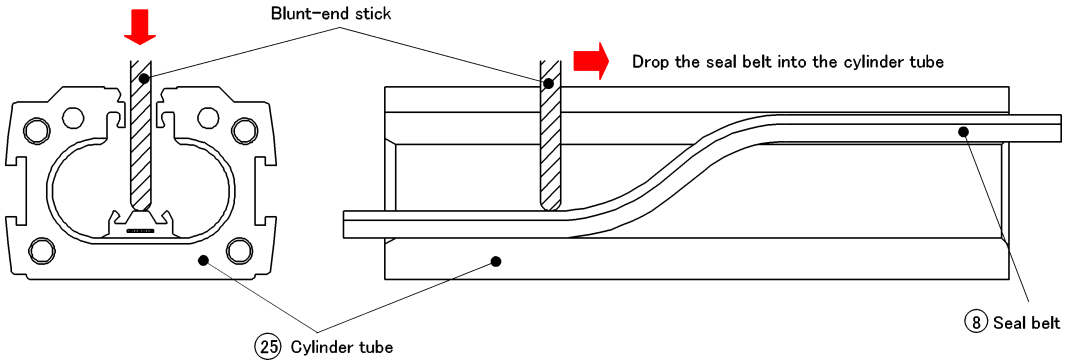


Bolt tightening torque for SRL2,3-J

Port size	⑫		⑬		⑭		⑮		⑯	
	Screw size	Tightening Torque (N·m)	Screw size	Tightening Torque (N·m)	Screw size	Tightening Torque (N·m)	Screw size	Tightening Torque (N·m)	Screw size	Tightening Torque (N·m)
ϕ25	M5×8	6.9	M5×8	2.9	M5×8	6.9	M5×50	2.9	M5×10	5.2～5.6
ϕ32	M6×10	11.6	M6×10	4.9	M6×10	11.6	M6×50	4.9	M8×16	22～24
ϕ40	M6×10	11.6	M6×10	4.9	M6×10	11.6	M6×55	4.9	M10×16	44～48
ϕ50	M8×16	21.6	M8×16	12.2	M8×16	21.6	M8×55	12.2	M12×25	77～83
ϕ63	M8×16	21.6	M8×16	12.2	M8×16	21.6	M8×70	12.2	M12×25	77～83

1) Standard model (SRL2,3) disassembly procedures
Disassemble the standard model SRL2,3 by the following procedures.
See the Disassembly / assembly drawing on page 25.
(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) ((34) (35) felt).
(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 (59) 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-recessed screw (58) and remove the cushion adapter (11) and the cushion packing (21) (this applies only to the SRL2,3-ϕ12 to ϕ40).
(9) Remove the cushion needle (19) .

2) Disassembly procedures for SRL2,3-G with the resin guide
Disassemble the SRL2,3-G with the resin guide by the following procedures.
See the Disassembly / assembly drawing on page 25 (refer to the disassembly procedures for the SRL2,3 as the SRL2,3-G has the same structure as the standard model except the table Ass'y (60)).

(1) Loosen the hex. cap nut (39) and the adjustment screw (40).

(2) Remove the hex. socket bolt (16) , and take out the table cover Ass'y (62) and the dust wiper (36) (felt (35)) (the table covers are at both sides of the table Ass'y (60) . Detach only one them).

(3) Press the table Ass'y (60) in the direction opposite the side of the table cover Ass'y (62) . The slider (36) and the slider plate (37) come out.
Take them out. The slider does not come out when it gets stuck with the adjustment screw (40) . Loosen the screw further to take out the slider.

(4) Remove the hex. socket bolt (15) , and take out the table Ass'y (60).

3) Disassembly procedures for SRL2,3-Q and SRL2,3-GQ with position locking
Disassemble the SRL2,3-Q and SRL2,3-GQ with the position locking mechanism by the following procedures. See the Disassembly / assembly drawing on page 26 (refer to the disassembly procedures for the standard SRL2,3 and the SRL2,3-G with the resin guide as they have the same structure as the SRL2,3-Q and SRL2,3-GQ except the position locking mechanism).

(1) Remove the retaining ring C type (49).

(2) Pull the protruded part of the lock pin (48) for disassembly.

4) Disassembly of the full cowling type cylinder with a dust cover (SRL2,3-J)
Follow the procedure below while referring to the assembly / disassembly drawing for the dust cover equipped model (SRL2,3-J) in page 27. (SRL2,3-J is similar to the standard SRL2,3 model except at the dust cover portion.)

(1) Remove the hex. sockt bolt (72) and the table plate (67).

(2) Remove the hex. sockt bolt (73) and the side cover (68).

(3) Remove the cover (69).

(4) Remove the hex. sockt bolt (74) and the table adapter (70).

(5) Remove the hex. sockt bolt (75) and LB-J bracket (71).

(6) The shock absorber adapter used in the SRL2,3-J is similar to the one used in the standard SRL2,3 model. Remove it as required.

5) Check the following.

(1) Scratch inside the tube.

(2) Scratch, wear on 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 packing for the sliding sections (seal belts, dustproof belt, cushion packing, piston packing, slinder).
If any problems are detected, repair the parts or replace them with repair kits.

6) The repair kits are listed as follws.

SRL2 Standard type repair kits list

(Q'ty)

Bore size (mm)	Kit №	8	9	18	21	22	26	30
		Seal belt	Dust-proof belt	Needle gasket	Cushion packing	Piston packing	Cylinder gasket	Dust wiper
φ12	SRL2-12K-※	1	1	2	2	2	2	2
φ16	SRL2-16K-※	1	1	2	2	2	2	2
φ20	SRL2-20K-※	1	1	2	2	2	2	2
φ25	SRL2-25K-※	1	1	2	2	2	2	2
φ32	SRL2-32K-※	1	1	2	2	2	2	2
φ40	SRL2-40K-※	1	1	2	2	2	2	2
φ50	SRL2-50K-※	1	1	2	2	2	2	2
φ63	SRL2-63K-※	1	1	2	2	2	2	2
φ80	SRL2-80K-※	1	1	2	2	2	2	-
φ100	SRL2-100K-※	1	1	2	2	2	2	-

27	32	66	35	34
O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	2	-	-	-
2	2	4	-	-
2	2	4	2	2
2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL2-G with the resin guide repair kits list

(Q'ty)

Bore size (mm)	Kit №	38	36	Basic repair kits for the SRL2				
		Dust wiper	Slider	Seal belt	Dust-proof belt	Needle gasket	Cushion packing	Piston packing
φ12	SRL2-G-12K-※	4	2	1	1	2	2	2
φ16	SRL2-G-16K-※	4	2	1	1	2	2	2
φ20	SRL2-G-20K-※	4	2	1	1	2	2	2
φ25	SRL2-G-25K-※	4	2	1	1	2	2	2
φ32	SRL2-G-32K-※	4	2	1	1	2	2	2
φ40	SRL2-G-40K-※	4	2	1	1	2	2	2
φ50	SRL2-G-50K-※	4	2	1	1	2	2	2
φ63	SRL2-G-63K-※	4	2	1	1	2	2	2
φ80	SRL2-G-80K-※	-	2	1	1	2	2	2
φ100	SRL2-G-100K-※	-	2	1	1	2	2	2

Basic repair kits for the SRL2					
Cylinder gasket	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	2	-	-	-
2	2	2	4	-	-
2	2	2	4	2	2
2	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with .※

SRL2-Q with position locking repair kits list

(Q'ty)

Bore size (mm)	Kit №	53	52	50	Basic repair kits for the SRL2			
		Piston packing	Rod packing	Gasket	Seal belt	Dust-proof belt	Needle gasket	Cushion packing
φ12	SRL2-Q-12K-※	1	1	1	1	1	2	2
φ16	SRL2-Q-16K-※	1	1	1	1	1	2	2
φ20	SRL2-Q-20K-※	1	1	1	1	1	2	2
φ25	SRL2-Q-25K-※	1	1	1	1	1	2	2
φ32	SRL2-Q-32K-※	1	1	1	1	1	2	2
φ40	SRL2-Q-40K-※	1	1	1	1	1	2	2
φ50	SRL2-Q-50K-※	1	1	1	1	1	2	2
φ63	SRL2-Q-63K-※	1	1	1	1	1	2	2
φ80	SRL2-Q-80K-※	1	1	1	1	1	2	2
φ100	SRL2-Q-100K-※	1	1	1	1	1	2	2

Basic repair kits for the SRL2							
Piston packing	Cylinder gasket	Dust wiper	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2		-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-
2	2	2	2	2	4	-	-
2	2	-	2	2	4	2	2
2	2	-	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL2-GQ with the resin guide and with position locking repair kits list

(Q'ty)

Bore size (mm)	Kit №	38	36	53	52	50	Basic repair kits for the SRL2		
		Dust wiper	Slider	Piston packing	Rod packing	Gasket	Seal belt	Dust-proof belt	Needle gasket
φ12	SRL2-GQ-12K-※	4	2	1	1	1	1	1	2
φ16	SRL2-GQ-16K-※	4	2	1	1	1	1	1	2
φ20	SRL2-GQ-20K-※	4	2	1	1	1	1	1	2
φ25	SRL2-GQ-25K-※	4	2	1	1	1	1	1	2
φ32	SRL2-GQ-32K-※	4	2	1	1	1	1	1	2
φ40	SRL2-GQ-40K-※	4	2	1	1	1	1	1	2
φ50	SRL2-GQ-50K-※	4	2	1	1	1	1	1	2
φ63	SRL2-GQ-63K-※	4	2	1	1	1	1	1	2
φ80	SRL2-GQ-80K-※	-	2	1	1	1	1	1	2
φ100	SRL2-GQ-100K-※	-	2	1	1	1	1	1	2

Basic repair kits for the SRL2							
Cushion packing	Piston packing	Cylinder gasket	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2		-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-
2	2	2	2	2	4	-	-
2	2	2	2	2	4	2	2
2	2	2	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL3 Standard type repair kits list

(Q'ty)

Bore size (mm)	Kit №	8	9	18	21	22	26	30
		Seal belt	Dust-proof belt	Needle gasket	Cushion packing	Piston packing	Cylinder gasket	Dust wiper
φ12	SRL3-12K-※	1	1	2	2	2	2	2
φ16	SRL3-16K-※	1	1	2	2	2	2	2
φ20	SRL3-20K-※	1	1	2	2	2	2	2
φ25	SRL3-25K-※	1	1	2	2	2	2	2
φ32	SRL3-32K-※	1	1	2	2	2	2	2
φ40	SRL3-40K-※	1	1	2	2	2	2	2
φ50	SRL3-50K-※	1	1	2	2	2	2	2
φ63	SRL3-63K-※	1	1	2	2	2	2	2
φ80	SRL3-80K-※	1	1	2	2	2	2	-
φ100	SRL3-100K-※	1	1	2	2	2	2	-

27	32	66	35	34
O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	-	-	-	-
2	2	-	-	-
2	2	4	-	-
2	2	4	2	2
2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL3-G with the resin guide repair kits list

(Q'ty))

Bore size (mm)	Kit №	38	36	Basic repair kits for the SRL3				
		Dust wiper	Slider	Seal belt	Dust-proof belt	Needle gasket	Cushion packing	Piston packing
φ12	SRL3-G-12K-※	4	2	1	1	2	2	2
φ16	SRL3-G-16K-※	4	2	1	1	2	2	2
φ20	SRL3-G-20K-※	4	2	1	1	2	2	2
φ25	SRL3-G-25K-※	4	2	1	1	2	2	2
φ32	SRL3-G-32K-※	4	2	1	1	2	2	2
φ40	SRL3-G-40K-※	4	2	1	1	2	2	2
φ50	SRL3-G-50K-※	4	2	1	1	2	2	2
φ63	SRL3-G-63K-※	4	2	1	1	2	2	2
φ80	SRL3-G-80K-※	-	2	1	1	2	2	2
φ100	SRL3-G-100K-※	-	2	1	1	2	2	2

Basic repair kits for the SRL3					
Cylinder gasket	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	-	-	-	-
2	2	2	-	-	-
2	2	2	4	-	-
2	2	2	4	2	2
2	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL3-Q with position locking repair kits list

(Q'ty)

Bore size (mm)	Kit №	53	52	50	Basic repair kits for the SRL3			
		Piston packing	Rod packing	Gasket	Seal belt	Dust-proof belt	Needle gasket	Cushion packing
φ12	SRL3-Q-12K-※	1	1	1	1	1	2	2
φ16	SRL3-Q-16K-※	1	1	1	1	1	2	2
φ20	SRL3-Q-20K-※	1	1	1	1	1	2	2
φ25	SRL3-Q-25K-※	1	1	1	1	1	2	2
φ32	SRL3-Q-32K-※	1	1	1	1	1	2	2
φ40	SRL3-Q-40K-※	1	1	1	1	1	2	2
φ50	SRL3-Q-50K-※	1	1	1	1	1	2	2
φ63	SRL3-Q-63K-※	1	1	1	1	1	2	2
φ80	SRL3-Q-80K-※	1	1	1	1	1	2	2
φ100	SRL3-Q-100K-※	1	1	1	1	1	2	2

Basic repair kits for the SRL3							
Piston packing	Cylinder gasket	Dust wiper	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-
2	2	2	2	2	4	-	-
2	2	-	2	2	4	2	2
2	2	-	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

SRL3-GQ with the resin guide and with position locking repair kits list

(Q'ty))

Bore size (mm)	Kit №	38	36	53	52	50	Basic repair kits for the SRL3	
		Dust wiper	Slider	Piston packing	Rod packing	Gasket	Seal belt	Dust-proof belt
φ12	SRL3-GQ-12K-※	4	2	1	1	1	1	1
φ16	SRL3-GQ-16K-※	4	2	1	1	1	1	1
φ20	SRL3-GQ-20K-※	4	2	1	1	1	1	1
φ25	SRL3-GQ-25K-※	4	2	1	1	1	1	1
φ32	SRL3-GQ-32K-※	4	2	1	1	1	1	1
φ40	SRL3-GQ-40K-※	4	2	1	1	1	1	1
φ50	SRL3-GQ-50K-※	4	2	1	1	1	1	1
φ63	SRL3-GQ-63K-※	4	2	1	1	1	1	1
φ80	SRL3-GQ-80K-※	-	2	1	1	1	1	1
φ100	SRL3-GQ-100K-※	-	2	1	1	1	1	1

Basic repair kits for the SRL3								
Needle gasket	Cushion packing	Piston packing	Cylinder gasket	O-ring	Cushion ring gasket (1)	Cushion ring gasket (2)	Felt (1)	Felt (2)
2	2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-	-
2	2	2	2	2		-	-	-
2	2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-	-
2	2	2	2	2	-	-	-	-
2	2	2	2	2	2	-	-	-
2	2	2	2	2	2	4	-	-
2	2	2	2	2	2	4	2	2
2	2	2	2	2	2	4	2	2

Note: Specify the kit number when placing an order. Specify the stroke for the kits with ※.

7) Procedures for replacement with repair kits

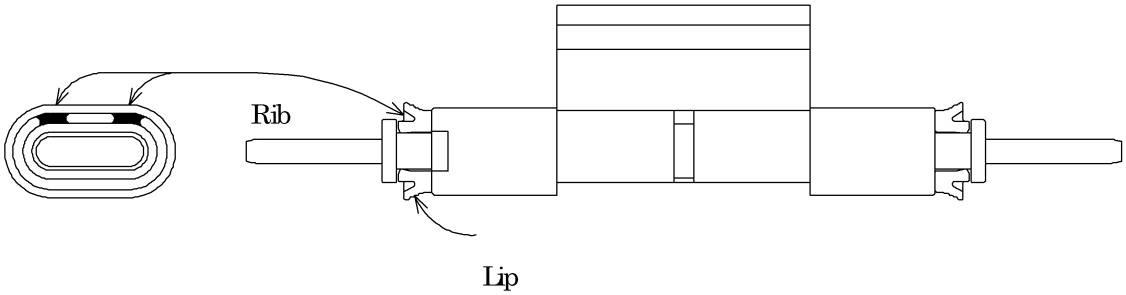
- Common procedures

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 : Daphane Eponex No.1, Idemitsu Kosan
Duplex SP No.1, Kyodo Yushi

(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.

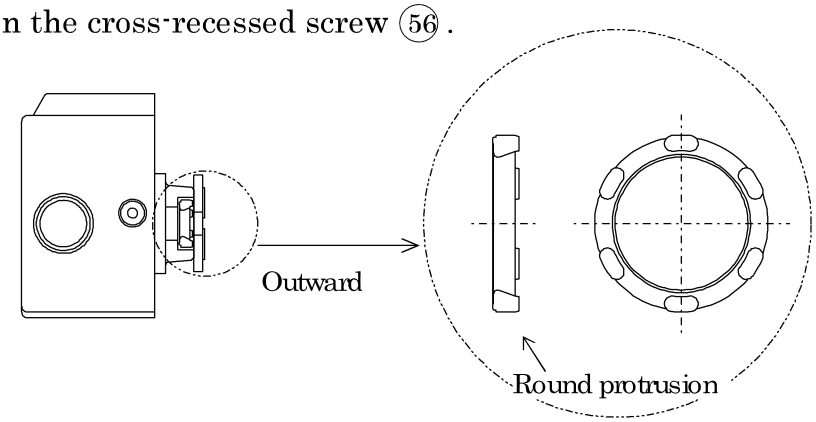


Note:Fitting the piston packing (22) to the single piston yoke Ass'y unit (59) will make it difficult to mount the piston yoke Ass'y and the seal belt (8) on the cylinder tube (25). To avoid this inconvenience, follow 7) Assembly procedures SRL2,3 described the page 39.

(2) Cushion packing replacement

- Cylinder bore ϕ12 to ϕ40

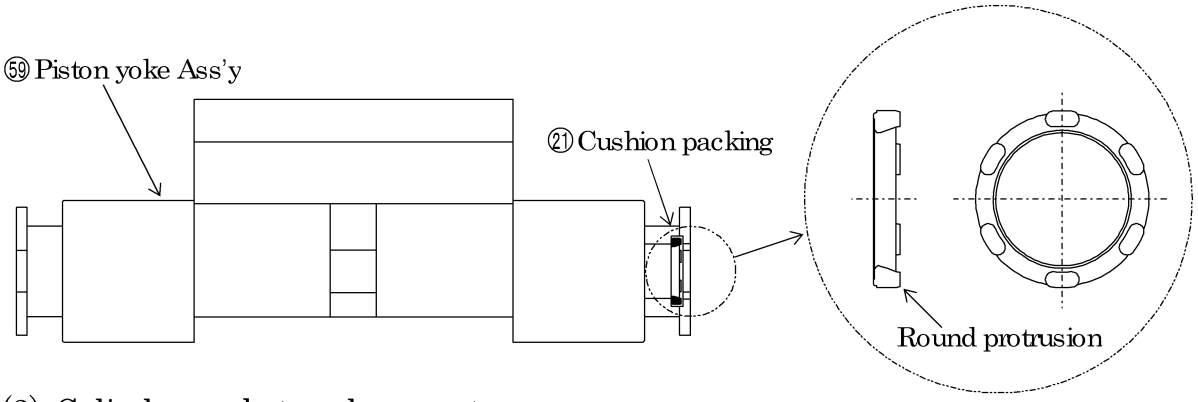
The cushion packing (21) should be set in the proper direction. Be sure that the round protrusion faces outward (the protrusion is visible), and, with the cover Ass'y (57) in place, fit the cushion adaptor (11) to the cover Ass'y and fasten the cross-recessed screw (56).



[SM-407233-A]

- Cylinder bore ϕ50 to ϕ100

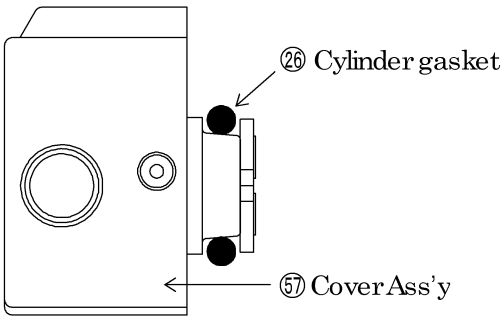
  Use a stick with a pointed end to remove the cushion packing ㉑ from the holes of the piston yoke Ass'y ㊾ . Be careful not to scratch the groove into which the cushion packing has been set (any scratch will negatively affect the function of the cushion).
  Next, fit a new cushion packing into the groove.
  The round protrusion should be on the outside.



(3) Cylinder gasket replacement

- Cylinder bore ϕ12 to ϕ40

  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).



- Cylinder bore ϕ50 to ϕ100

  Loosen the cross-recessed screw ㊽ and remove the cushion ring 11 from the cover Ass'y ㊼ Take out the cushion ring gasket 1,2 ㉜㊻ and the cylinder gasket ㉖ between the cover Ass'y ㊼ and the cushion ring ⑪ and replace it with a new one. (There is no cushion ring gasket 2 ㊻ (O-ring) of ϕ50.)
  Fit the cushion ring ⑪ and fasten the cross-recessed screw ㊽ .

(4) Needle gasket replacement

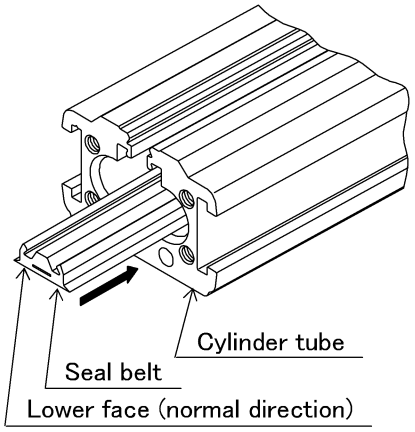
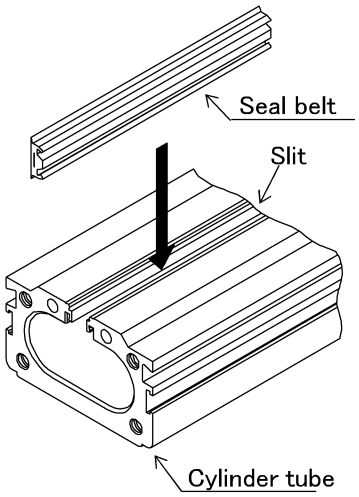
Remove the needle gasket ⑱ from cushion needle ⑲ and replace it with a new one. When detaching the needle gasket, be careful not to scratch the groove for fitting the gasket. (scratched groove will cause air leak.)

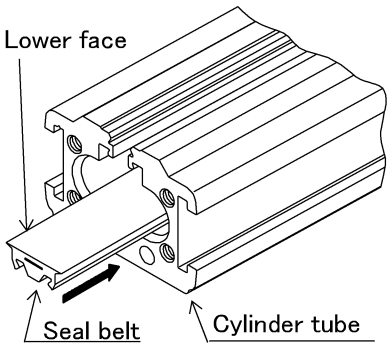
(5) Position locking mechanism replacement

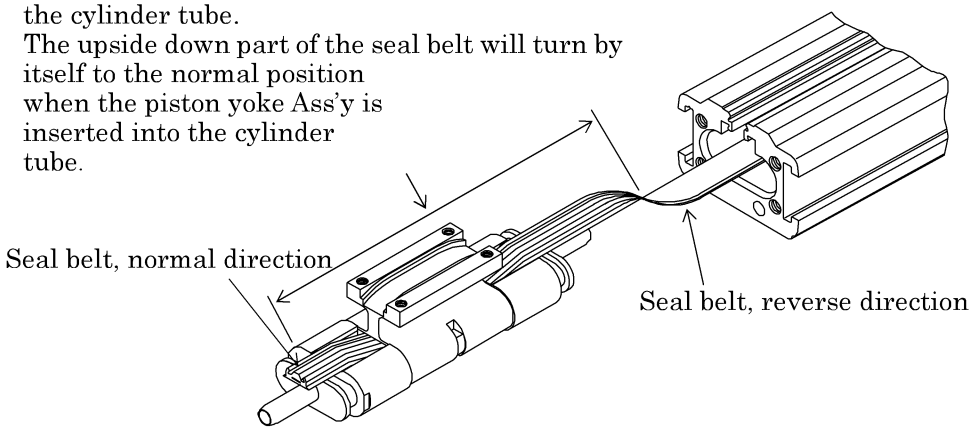
The rod packing ㊷ and the piston packing ㊸ use Y packings and, they therefore should be set in the right direction. Set them in the proper direction indicated in the Disassembly / assembly drawing.

8) The standard model (SRL2,3) assembly procedures

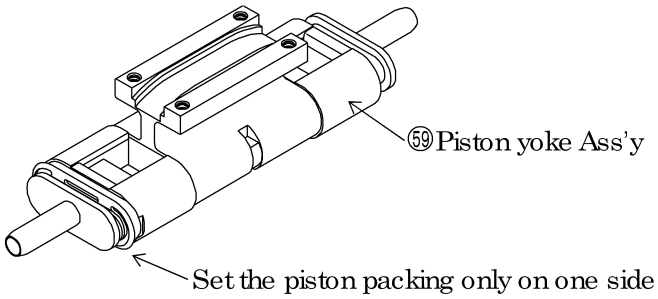
(1) Insert the seal belt into the cylinder tube. Follow the procedures described below.

<table>
<tr><th>Cylinder bore / Cylinder stroke</th><th>ϕ12, ϕ16</th><th>ϕ20 or more</th></tr>
<tr><td>2m or less</td><td> 
</td><td rowspan="2"> 

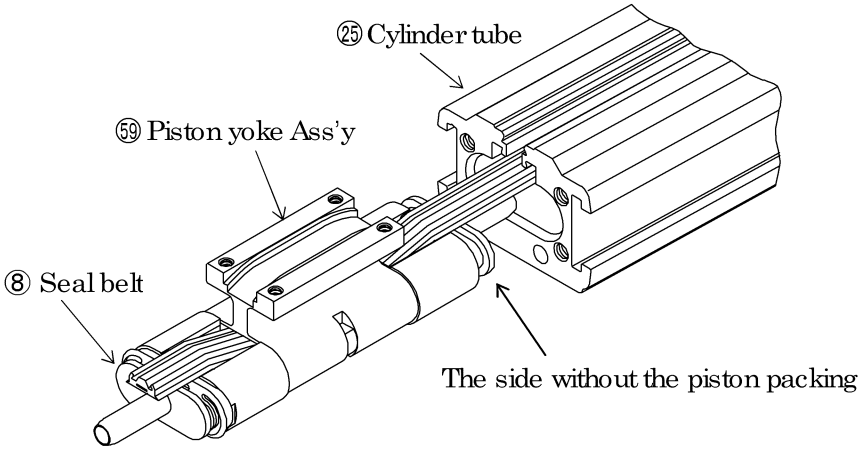
Insert the seal belt through the slit of the cylinder tube.</td></tr>
<tr><td>Over 2m</td><td> 
</td></tr>
<tr><td></td><td colspan="2">Turn the seal belt upside down and insert it.

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>

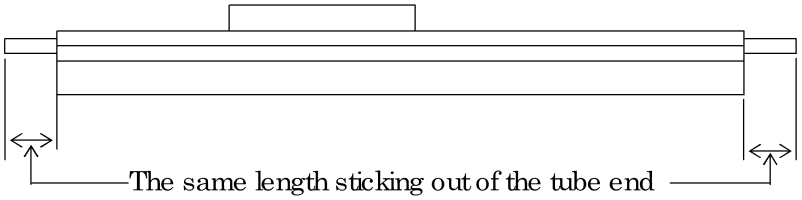
(2) Mount one piston packing ㉒ onto the piston yoke Ass'y ㊾.
(Fit the packing in the proper direction. Refer to 7) Repair kits replacement procedures, (1). Piston packing replacement.)



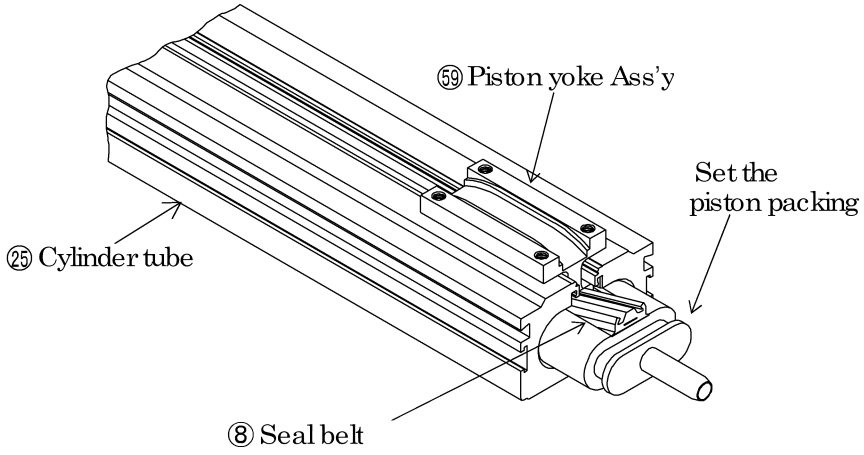
(3) Insert the seal belt ⑧ into the piston yoke Ass'y. Be sure that the side of the piston yoke Ass'y without the piston packing faces the cylinder tube ㉕, and that the flat side of the seal belt faces downward.



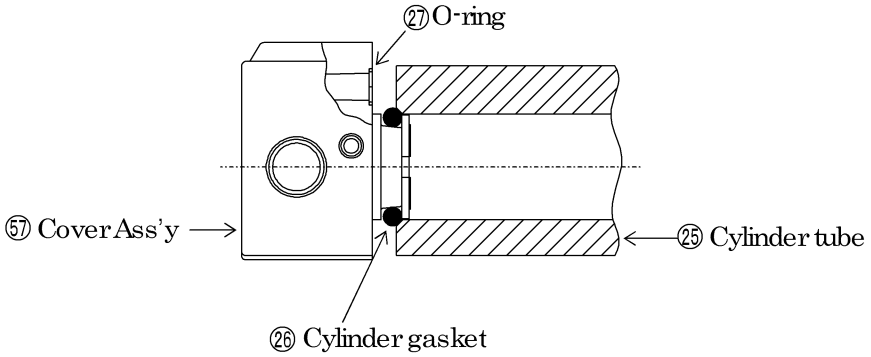
(4) Insert the piston yoke Ass'y together with the seal belt ⑧ into the cylinder tube ㉕. Adjust the seal belt position so that the same length of the belt sticks out of the either end of the cylinder tube.



(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.



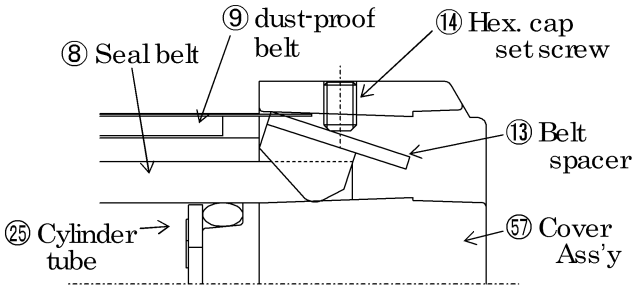
(6) Push the piston yoke Ass'y ⑲ back into the center of the cylinder tube. Next, attach the cover Ass'y ⑰ to the cylinder tube ㉕ and secure it by the hex. socket bolt ⑰. Be careful not to pinch the cylinder gasket ㉖ between the cover Ass'y and the cylinder tube. Do not lose the O-ring ㉗.



(7) Attach the cushion needle ⑲ to the cover Ass'y ⑰.

(8) Set the dust-proof belt ⑨ in the cylinder tube ㉕ 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 ⑰.

(9) Put the belt spacer ⑬ through the window of the cover Ass'y ⑰ (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 screw ⑭.



(10) Push the dust-proof belt ⑨ through the slit of the cylinder tube ㉕ from the side fastened by the belt spacer ⑬ and insert the opposite end into the gap between the cylinder tube and the cover Ass'y ⑰ Be sure that the dust-proof belt is not slack at the piston yoke Ass'y ⑲.

(11) Fit a new dust wiper (㉚ , cylinder bore ϕ12 to ϕ63) or felt (㉞ ㉟ cylinder bore ϕ80, ϕ100) in the groove of the table Ass'y ⑳. Next, place the table Ass'y on the piston yoke Ass'y ⑲ and fasten it there by the hex. socket bolt ⑮ . Be careful not to drop the dust wiper (or felt).

(12) Insert the belt spacer ⑬ through the cover Ass'y ⑰ window (the side with the dust-proof belt ⑨. See 10. Above.) and secure the dust-proof belt in the same manner as 9. avove.

(13) Fit the belt cover ① into the cover Ass'y ⑰. This completes the assembly of the standard model (SRL2,3).

9) Assembly procedures of the SRL2,3-G with resin guide

(1) Proceed with the assembly procedures 1～10 of the standard model SRL2,3.

(2) Of the four new dust wipers ㊳, fit two (φ12-φ63, the ones on the table cover Ass'y ㊷ side) or one felt ㉟ and two felts ㉞ (φ80, φ100, also on the table cover Ass'y side) into the groove on the back of the table Ass'y ㊵.
Next, place the table Ass'y on the piston yoke Ass'y ㊾ and fasten it by the hex. socket bolt ⑮.
Hold the dust wiper with your fingers so as not to drop it.

(3) Place the slider plate ㊲ on the concave of the new slider ㊱.

(4) Insert the slider ㊱ along the cylinder tube ㉕ into the groove of the table Ass'y ㊵

(5) Adjust the position of the slider ㊱ so that the concave on the upper face of the slider plate ㊲ and the adjustment screw ㊵ are aligned. (Insert the slider ㊱ by the distance A in Table1, a distance from the table edge surface.) Turn the screw with your fingers to temporarily fasten the slider.

(6) Fit into the groove of the detached table cover Ass'y ㊷ the remaining two dust wipers ㊳ (φ12-φ63) or one felt ㉟ (φ80, φ100). Next, press the table cover Ass'y against the cylinder tube ㉕ , fit it into the table Ass'y ㊵, and fasten it by the hex. socket bolt ⑯. Hold the dust wiper with your fingers so as not to drop it.

(7) Follow the assembly procedures (12 and 13) on page 9.

(8) Adjust the resin guide. See 5) Adjustment of SRL2,3-G and SRL2,3-GQ with resin guide on page 9, for adjustment.

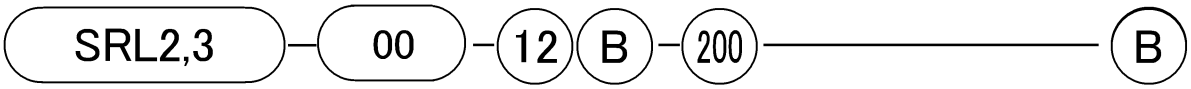
10) Assembly procedures of the SRL2,3-Q and SRL2,3-GQ with position locking.

Fit the parts into the position locking unit as they are shown in the Disassembly / assembly drawing, and fasten them with the C-type set ring ㊾.
Be sure that the C-type set ring is firmly fitted into the groove of the position locking unit.

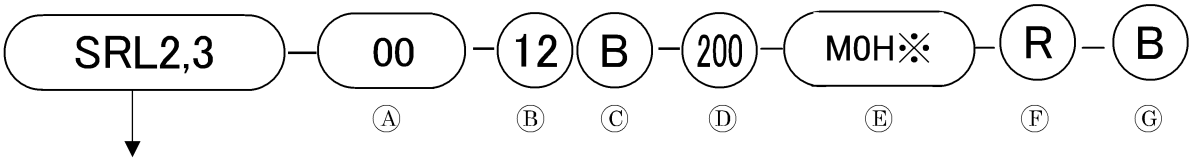
11) Assembly of the full cowling type cylinder with a dust cover (SRL2,3-J)
Reverse the disassembly procedure on page 29.
(For the bolt tightening torque, refer to the table of the "Bolt tightening torque for SRL2,3-J " on page 27.)

6. HOW TO ORDER

- No switch



- With switch



Basic model		Ⓐ Mounting style		Ⓑ Bore size (mm)		Ⓒ Cushion		Ⓓ Stroke(mm)	
SRL2,3	Standard	00	Basic type	12	φ12	B	Both side cushion	Standard stroke	Max. stroke
SRL2,3-G	With resin guide	LB	Axial foot type	16	φ16	R	R side cushion		
SRL2,3-Q	With position locking	LB1	Axial foot type	20	φ20	L	L side cushion	200	
SRL-2,3-GQ	With resin guide and position locking	(Note2)	Bore size 12,16,20,	25	φ25	N	No cushion	300	Max. stroke can be extended to 5000mm (Only for SRL2, 3-J 3000mm max.)
			25,32mm and	32	φ32	R is to the right,		400	
SRL2,3-J (φ23,32,40, 50,63)	With dust cover (full cowling type)		option G markings	40	φ40	L is to the left, facing		500	
			"R" and "T" only	50	φ50	the port.		600	
		LJ	Axial foot type	63	φ63			700	
			Bore size 25,32 and	80	φ80			800	
			common porting	100	φ100			900	
			(full cowling type)					1000	

Ⓔ Switch model no.(Note 3)

Lead wire		contact	Indicator light	Lead wire	Lead wire		contact	Indicator light	Lead wire
Axial lead wire	Radial lead wire				Axial lead wire	Radial lead wire			
M0H※	M0V※	Reed	1 color indicator	2-wire	T2WH※	T2WV※	Solid state	2 color indicator	2-wire
M5H※	M5V※		Without indicator light		T2YH※	T2YV※			
M2H※	M2V※	Solid state	1 color indicator		T3WH※	T3WV※			3-wire
—	M2WV※		2 color indicator		T3YH※	T3YV※			
M3H※	M3V※		1 color indicator		T2YD※	—		Strong magnetic field proof switch	2-wire
—	M3WV※		2 color indicator	3-wire	T2YDT※	—			
M3PH※	M3PV※		1 color indicator		T2YLH※ SRL2,3-J alone	T2YLV※ SRL2,3-J alone		Cutting oil switch	2-wire
					T3YLH※ SRL2,3-J alone	T3YLV※ SRL2,3-J alone			

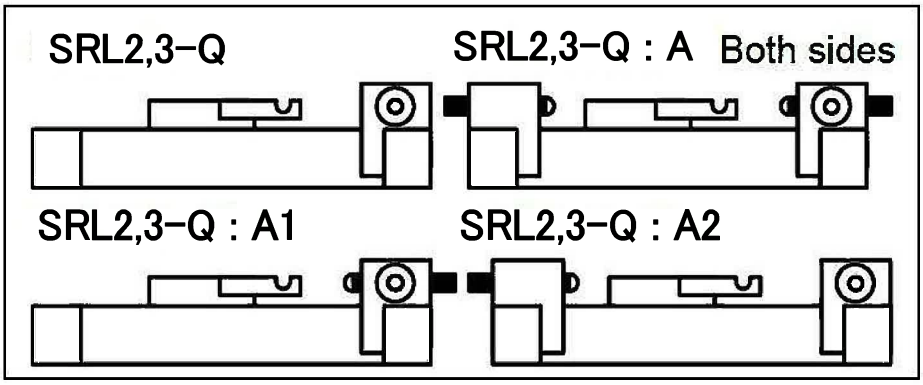
※Lead wire length	
Blank	1m (Standard)
3	3m (Optional)
5	5m (Optional)

Ⓕ Switch quantity		Ⓖ Option and accessory	
R	One on R side	A	Adjustable full-stroke both ends, with shock absorber
H	One on H side	A1	Adjustable full-stroke R end only, with shock absorber
D	Two	A2	Adjustable full-stroke L end only, with shock absorber
T	Three	A3	Adjustable full-stroke bracket retrofitting
		Y	Floating joint
		Y1	Thin floating joint
		L※	Intermediate support bracket (for 00 , LB)
		N※	Intermediate support bracket (for LB1)
		C	C mount bracket (ϕ 12 – ϕ 63)
		H	Table mounting thread size up
		U	Height adjustment plate
		Blank	Port position F, cushion needle position F (standard)
		R	Port position R, cushion needle position F (common port)
		B	Port position F, cushion needle position B
		T	Port position R, cushion needle position B (common port)
		D	Port position D, cushion needle position F (ϕ 25 – ϕ 100)
		S	Port position D, cushion needle position D (ϕ 32 – ϕ 100)
		X	Port position F, cushion needle position F (common port ϕ 80 – ϕ 100)

If more than 4 switches, indicate switch quantity.

The ※ mark indicates the number of sets.
When 2 sets are required, Wire L2 (for LB) or N2 (for LB1).
2 pieces / set

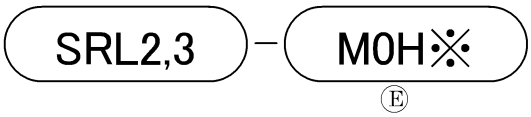
Note1 : Refer to the internal structural drawings, P.21-23, for the markings to indicate the port and cushion needle positions.
Note2 : When the tube bores are 12, 16, 20, 25, 32 mm, and the option markings are "R" and "T", the mounting style are "00" or "LB1" (Piping is not possible, and hence no manufacturing, when the option markings are "R" and "T" and the mounting style is "LB").
Note3 : The C-mount bracket option is available for ϕ 12- ϕ 63 only, and not available for ϕ 80 – ϕ 100.
Also, combination of the C-mount bracket and the full stroke adjustment shock killer (A, A1, A2), or the floating joint (Y), or the middle support (L※, N※) are not available.
Note4 : The all-stroke adjustment part on the R side is a standard component, With A1 required, only the shock killer is added to the R side. With the A display, the R side comes with the position locking, all-stroke adjustment, and the shock killer



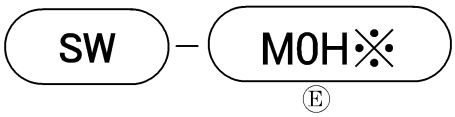
Note5 : If the tube's bore is ϕ 12 ~ ϕ 25, the all-stroke adjustment component cannot be mounted later. The mount plate nut (option) is needed for fitting it later.

- Switch model unit marking

(A) Switch body + Mounting bracket (Note 1)

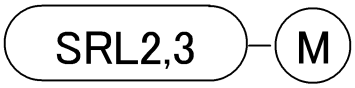


(B) Only switch body

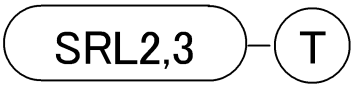


(C) Mounting bracket (Note 2)

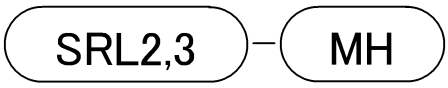
M type switch



T type switch



(D) Lead wire holder (Note 3)



(Note 1) Switch main body + mounting bracket set does not include any lead wire holder. When a lead wire holder is necessary, place an order separately.
(Note 2) M type switch bracket different from T type switch.
(Note 3) Lead wire holder is 10 pieces / 1 set.

Ⓔ Switch model no.

Lead wire		contact	Indicator light	Lead wire
Axial lead wire	Radial lead wire			
M0H※	M0V※	Reed	1 color indicator	2-wire
M5H※	M5V※	Reed	Without indicator light	2-wire
M2H※	M2V※	Solid state	1 color indicator	2-wire
—	M2WV※	Solid state	2 color indicator	2-wire
M3H※	M3V※	Solid state	1 color indicator	2-wire
—	M3WV※	Solid state	2 color indicator	3-wire
M3PH※	M3PV※	Solid state	1 color indicator	3-wire

Lead wire		contact	Indicator light	Lead wire
Axial lead wire	Radial lead wire			
T2WH※	T2WV※	Solid state	2 color indicator	2-wire
T2YH※	T2YV※	Solid state	2 color indicator	2-wire
T3WH※	T3WV※	Solid state	2 color indicator	3-wire
T3YH※	T3YV※	Solid state	2 color indicator	3-wire
T2YD※	—	Solid state	Strong magnetic field proof switch	2-wire
T2YDT※	—	Solid state	Strong magnetic field proof switch	2-wire
T2YLH※ SRL2,3-J alone	T2YLV※ SRL2,3-J alone	Solid state	Cutting oil switch	2-wire
T3YLH※ SRL2,3-J alone	T3YLV※ SRL2,3-J alone	Solid state	Cutting oil switch	2-wire

The mark ※ indicates the length of the lead wire.

※ Read wire length	
1	1m(Standard)
3	3m(option)
5	3m(option)

- Applicable shock absorber model no.

Model	Bore size	Shock absorber model No.
SRL2-12	φ12	NCK-00-0.3-C
SRL2-16	φ16	NCK-00-0.3-C
SRL2-20	φ20	NCK-00-0.7-C
SRL2-25	φ25	NCK-00-1.2
SRL2-32	φ32	NCK-00-2.6
SRL2-40	φ40	NCK-00-7
SRL2-50	φ50	NCK-00-12
SRL2-63	φ63	NCK-00-0.12
SRL2-80	φ80	NCK-00-20
SRL2-100	φ100	NCK-00-20

- C-mount unit marking (φ12 – φ63 only)

SRL2,3 – Bore size – C

(C-mount, 4 mounting bolt 4 pcs.)

- Floating joint set marking

SRL2,3 – Bore size – Y

(Mount, mount base, pin, pain washer, pan head machine screw 4 mounting bolts with spring washer)

- Middle support unit marking

LB

SRL2,3 – Bore size – L (2 pieces / 1 set)

LB1

SRL2,3 – Bore size – N (2 pieces / 1 set)

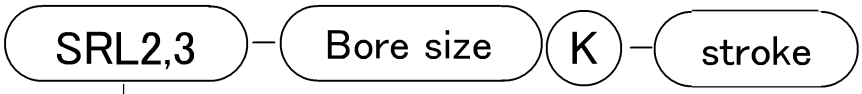
- All-stroke adjustment kit marking

SRL2,3 – Bore size – A1 (1 set)

(In the case of φ12 to φ25, the all-stroke adjustment component cannot be fitted unless the cylinder's option mark is A3)

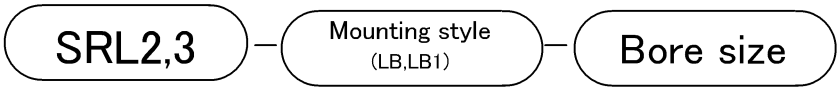
- Dust cover kits marking

- Repair kits marking



Basic type	
SRL2 / SRL3	Standard
SRL2-G / SRL3-G	With resin guide
SRL2-Q / SRL3-Q	With position locking
SRL2-GQ / SRL3-GQ	With resin guide / position locking
SRL2-J / SRL3-J	With dust cover (full cowling type)

- Support marking



(Brackets 2 pcs, mounting bolt 4 pcs.)

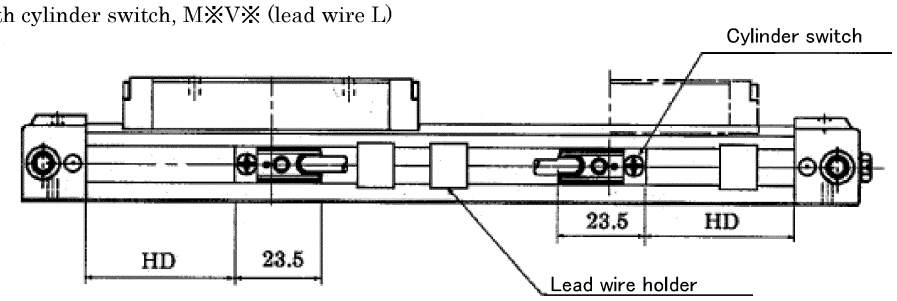
- High adjustment plate set marking

7. CAUTION FOR OPERATING CYLINDER SW

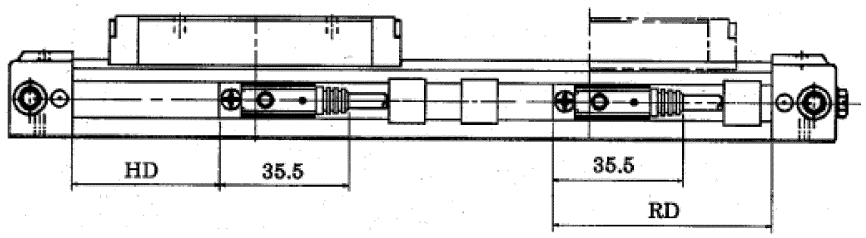
7.1 Common characteristics of Read and Solid state Cylinder Switches

1) The cylinder switches were set at the position (for maximum sensitive position) as indicated in the table below at the time of their shipment. Before operation, however, it s 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.

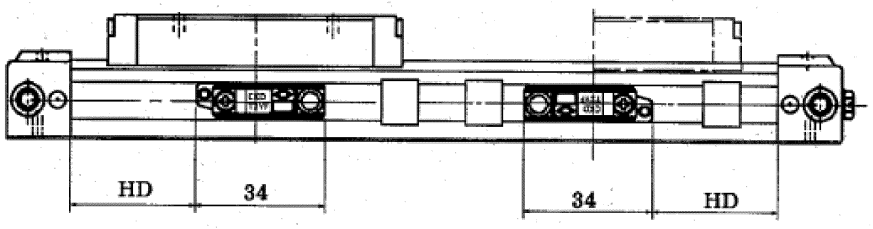
●With cylinder switch, M※V※ (lead wire L)



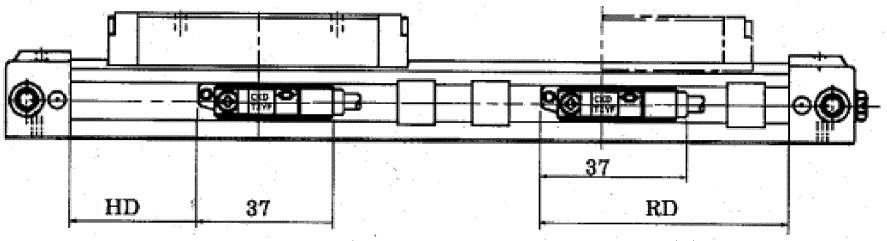
● With cylinder switch, M※H※ (lead wire straight)



●With cylinder switch, T※Y※V※ (lead wire L)



●With cylinder switch, T※Y※H※ (lead wire straight)



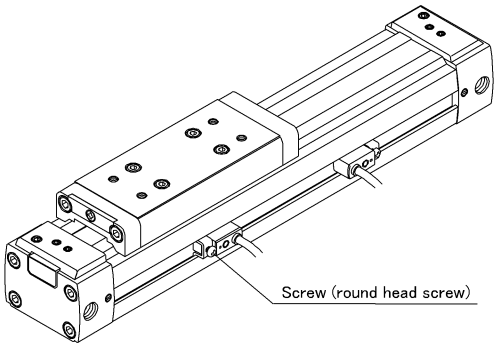
Code	HD			RD		
Bore size	M※	T※Y※	T※W※	M※	T※Y※	T※W※
φ12	40.5	36	32	60.5	65	69
φ16	47	42	38	67	72	76
φ20	52.5	48	44	72.5	77	81
φ25	60	56	52	82	86	90
φ32	74	70	66	96	100	104
φ40	80	76	72	102	106	110
φ50	79	75	71	101	105	109
φ63	98	94	90	120	124	128
φ80	170	165	161	190	195	199
φ100	175	170	166	195	200	204

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 to 70 N/cm).

4) Setting the lead wire holder
Use your thumb to push the lead wire holder into the groove until it snaps in. (Refer to fig.5)

5) Removing the lead wire holder
Wedge a flat-tip screwdriver in to the gap between the cylinder tube and the holder, and turn in for easy detachment. (Refer to fig.6)



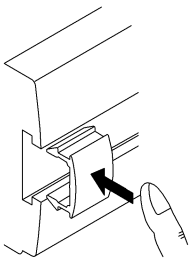


Fig.5

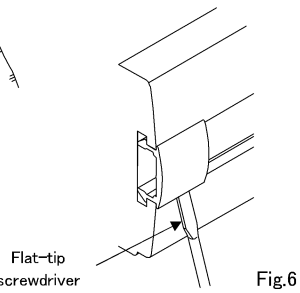


Fig.6

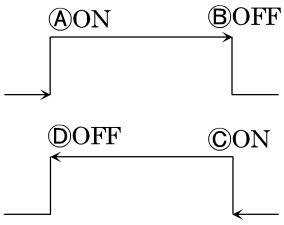
6) Middle-stroke detection

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

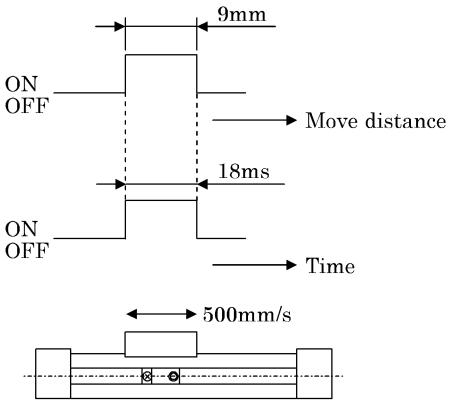
① M0※, M2※, M3※, M5※
The piston is fixed to the stopping position, the switch is moved back and forth at the position of the piston, and position Ⓐ in which the switch is turned on first is discovered. Move the switch further, find the position Ⓑ where it is turned off, return it back from that position, and find the position Ⓒ where it is turned on again. The middle of two positions of Ⓐ and Ⓒ is the maximum sensitive position at the piston position, and it becomes the best mounting orientation.

② 2-color indicator solid state switch M2WV, M3WV, T2Y※, T3Y※, T2W※, T3W※.
Move the switch and fasten it where the green indicator light comes on (Maximum sensitive position).

- The 2-color indicator solid state switch indicates the operation range by turning on a red indicator light and the Maximum sensitive range (best mounting orientation) by a green indicator light. This makes SW setting very easy.
  Electricity is on even while the red indicator light in on, posing no problem to the operation of the switch.



(2) 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, programmable controller, program)?

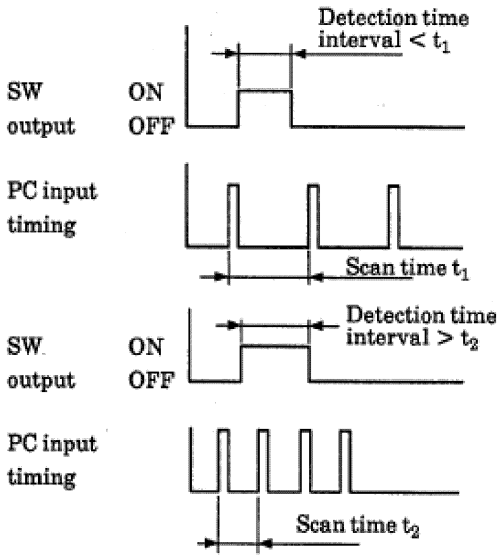


The cylinder switch has the response speed of faster than 1 ms, but the detection time interval can be made greater than one obtained by the following formula.

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

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)



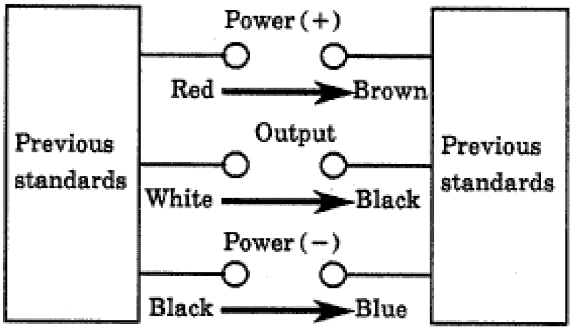
The table below shows the operation range of the switches.

Item / Bore size (mm)	Operation range			
	Solid state switch			Read switch
	M2V,M2H M3V,M3H	M2WV M3WV	T2YV,T2YH T3YV,T3YH	M0V,M0H M5V,M5H
φ12	4 ~ 13	4 ~ 12	2 ~ 7	3 ~ 11
φ16				
φ20			3 ~ 8	
φ25	9.5 ~ 15.5	9 ~ 14	3 ~ 10	8.5 ~ 13.5
φ32	7.5 ~ 15	8~14		7 ~ 13.5
φ40	11.5 ~ 17.5	10 ~ 16.5	4 ~11	10~ 16
φ50	16.5~ 24	14 ~ 21	7 ~ 14	14.5 ~ 21.5
φ63	16 ~ 24	14 ~ 21		14 ~ 21.5
φ80	26.5 ~ 45.5	16.5 ~ 40	10 ~ 24	20.5~ 41
φ100	25 ~ 40.5	21.5 ~ 36		24 ~37

7.2 Switches Specifications

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 solid state switches, has wire colors which correspond to signals differently from the previous model, as illustrated.
Note, in particular, that the color black is for out put, and not for power (—), in the new standards. Be sure to check such changes before wiring.



The previous colors are indicated in the parentheses next to the new colors.

7.3 Caution for Operation

(Solid state switch M2※・M2WV・M3※・M3WV・T2Y※・T3Y※・T2W・T3W)

1) Connection of lead cord

Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.

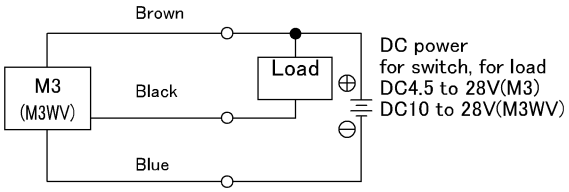


Fig.1 M3※,M3WV,T3Y※,T3W basic circuit(1)
(same power for switch and load)

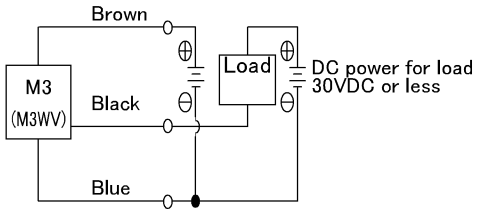


Fig.2 M3※M3WV,T3Y※T3W basic circuit (2)
(separate power for switch and load)

2) Output circuit protection

- When an inductive load (relay, solenoid valve) is connected, a surge voltage is generated when the switch is turned OFF. Provide the following protective circuit. (Fig.3)
- When a capacious load (capacitor) is connected, rush current is generated when the switch is turned ON. Provide the following protective circuit. (Fig.4)
- Provide the following protective circuit if the lead wire length exceeds 10 m. (Fig.5), (Fig.6), (Fig.7)

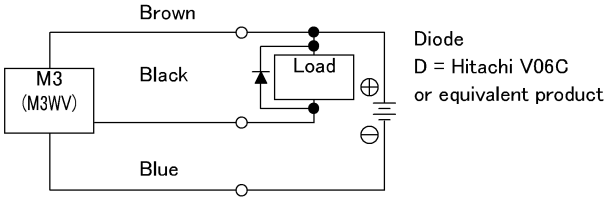


Fig.3 Example showing use of surge absorbing element for inductive load.

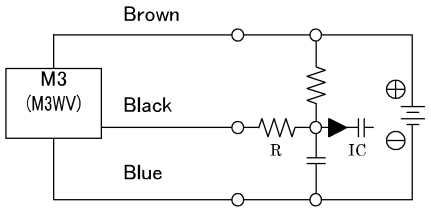


Fig.4 Example showing capacious load (capacitor) is connected. Resistance R (Ω) must be larger than the following equation in this case.

$$\frac{V}{0.15}=R(\Omega)$$

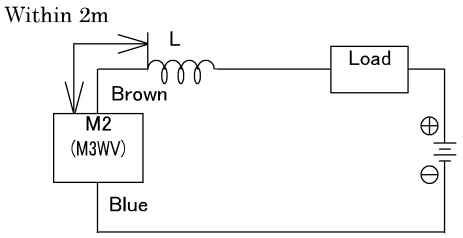


Fig.5 • Chock coil
L= several hundred H to several mH
Chock coil with surpassing high-frequency characteristic
• Install it near by a switch.(Within 2m)

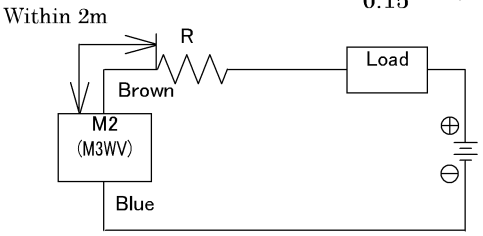


Fig.6 • Rush current limiting resistance
R = Largest resistance that load circuit can tolerate
• Install it near by a switch.(Within 2m)

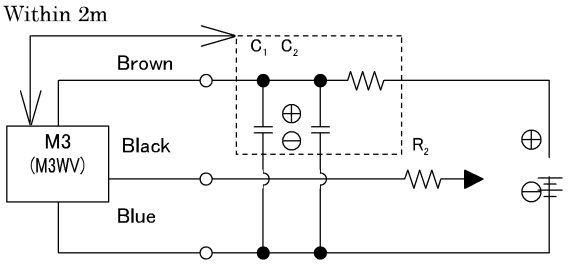


Fig.7 • Electric power noise absorptive circuit C_1=20 to 50μF
Electrolytic capacitor (Withstand voltage 50V or more)
C_2=0.01 to 0.1μF
• Ceramic capacitor
Rush current limiting resistance
R_1=20 to 30Ω
R_2=R2=Use the largest resistance that the load circuit can tolerate.
• Install it near by a switch.(Within 2m)

3) Connection differs with the type of programmable controller used. Connect based on input specifications.

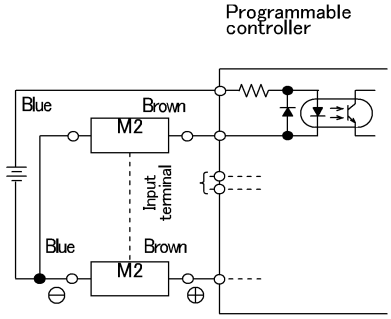


Fig.8 M2※,M2WV,T2Y※,T2W connection to source load input (external electric power) type

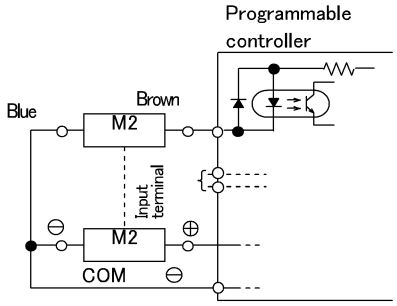


Fig.9 M2※,M2WV,T2Y※,T2W connection to source load input (internal electric power) type

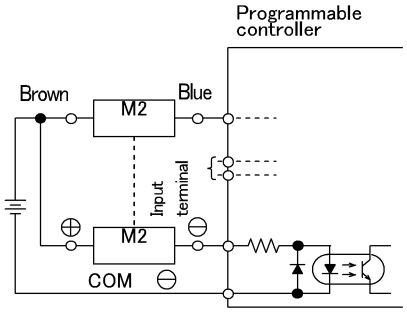


Fig.10 M2※,M2WV,T2Y※,T2W connection to sink input type

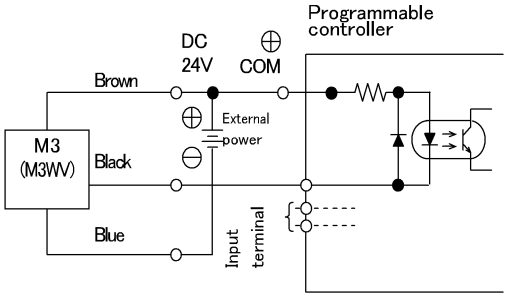


Fig.11 M3※,M3WV,T3Y※,T3W connection to source load input (external electric power) type

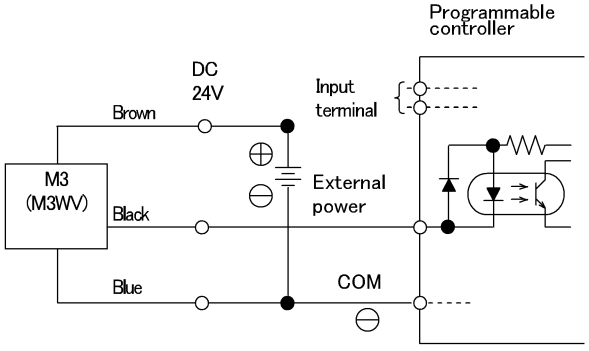


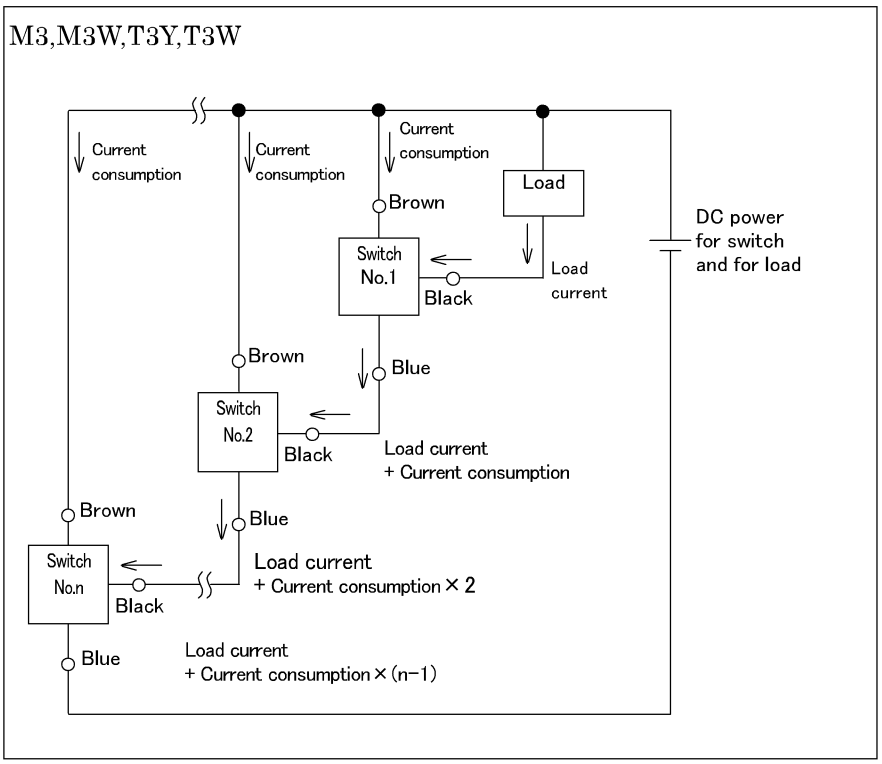
Fig.12 M3※,M3WV,T3Y※,T3W connection to source load input (internal electric power) type
The M3※,M3WV,T3Y※,T3W switch cannot be connected to the sync. Input.

4) Serial connections

(1) When connecting several M2※, M2WV, T2Y※, T2W switches in serial, the switch voltage drop is the total voltage drop of all connected switches. The voltage applied to the load is the voltage obtained by subtracting the voltage drop at switches from the power voltage. Check input specifications of the programmable controller and determine the number of switches to be connected.

(2) When connecting several 3-wire serial solid state switches, the switch's voltage drop is the total voltage drop of all connected switches, as with the 2-wire switch. The current that flows to the switch is the total of the connected switch's current consumption and load current, as shown at upper right. Check load specifications and determine the number of switches to be connected so that the maximum switch load current is not exceeded.

(3) The indicator light turns ON only when all switches are ON.



5) Parallel connections

When connecting M2※, M2WV, T2Y※, T2W switches in parallel, note that leakage current increases in proportion to the number of connected units. When 1 switch is changing from ON to OFF status, voltage at both ends of the switch connected in parallel drops to the internal voltage drop value at switch ON and is less than the load voltage range and other switches will not turn ON. Check input specifications of the programmable controller, which is the connection load, before starting use.

This is not a problem with the M3※, M3WV, T3Y※, T3W Their leak current increases by the number of switches connected, as in the case of the A and B, but the amount of the leak current is so small (less than 10 micro amperes) that is does not affect the operation in any way. There is no problem of the indicator light becoming dim or unable to be turned on.

6) Magnetic environment

Do not operate this product in a place where a strong magnetic field or large current (large magnet or spot welder, etc.) exists. If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

7) Protecting the lead wire

The lead wire's minimum bending radius is 9 mm or more. Pay attention to wiring so repeated bending and tensile strain are not applied to the lead wire. To the moving portion, use such cord of flexibility as for building a robot.

7.4 Caution for Operation (Lead switch M0V・M0H・M5V・M5H)

1) Lead wire connections

Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series. For M0 switch, carefully check following items ①,②.

① When using the switch for DC power supply, connect the brown (white) and blue (black) lines to the positive and negative sides, respectively. If these lines are connected reversibly, the switch is activated, but the indicator light is not lit.

② When the switch is connected to an AC relay or a programmable controller input, the indicator light on the switch is not lit if the half-wave rectification is performed in the connected circuit. If this occurs, reverse the polarities of the switch lead wire connection. The indicator light may then be it.

2) Contact capacity

Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the indicator light may not be lit.

3) Contact protective

In using a relay o other inductive load, be sure to install the contact protection circuit as shown in fig. 1 and fig. 2 below.
If the total lengths of the wires exceed the figures of Table 1, install the contact protection circuit as shown in Fig.3 and Fig.4.

Table 1

Electric power	Length of wire
DC	50m
AC	10m

●When capacitor resister is used.

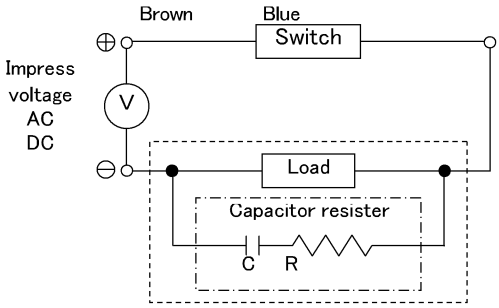


Fig.1

User circuit
Protect circuit
(Spark absorbing circuit)
Recommended value
C(Capacitor) 0.033 to 0.1μF
R (Resister) 1 to 3kΩ
XEB1K1 Okaya Denki Mfg
or equivalent

●When diode is used.

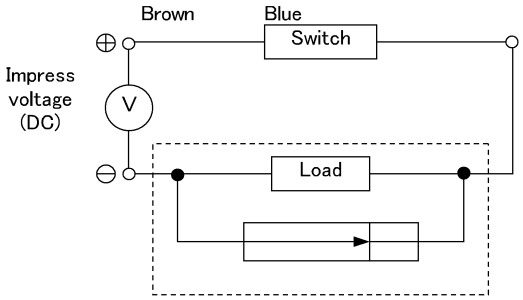


Fig.2

User circuit
Protect circuit
(Spark absorbing circuit)
Rectifying diode, general use
Hitachi Mfg. product V06C
or equivalent

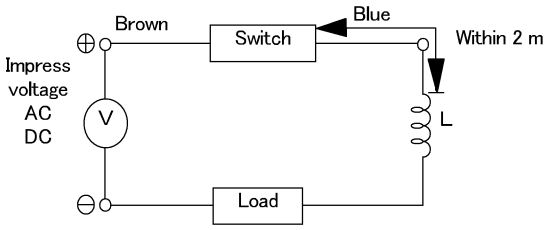


Fig.3

- Choke coil
  L= a couple hundred μ H
  to a couple mH
  surpassing high frequency
  characteristic
- Install it near by a switch.
  (within 2m)

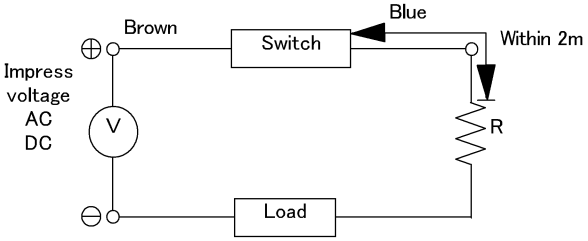


Fig.4

- Dash current restriction resister
  R=As much large resister
  as the load circuit can afford.
- Install it near by a switch.
  (within 2m)

4) Relays

Use the following or equivalent relays.

○OMRON ·····MY type
○Fuji Electric Corporation ·····HH5type
○Tokyo Electrical Engineering Company ·····MP type
○Panasonic, Ltd. ·····HC type

5) Serial connections

When multiple M0 switches are used with they connected in series, the voltage drop at the switch becomes the sum of voltage drop values of all switches. When one M0 switch is used for checking of operation and M5 switch is used for other switches, they can be used with the voltage drop equivalent to one M0 switch (2.4V). In this case, the indicator light is lit only when all switches are turned ON.

6) Parallel connections

When multiple switches are connected in parallel, there are no limitations on the number of switches. However, if multiple M0 switch is turned ON at the same time, the indicator light becomes dark or is not lit.

7) Magnetic environment

Please avoid use in the place where strong magnetic field or large current (large magnet, spot welding machine, etc.) exists in surroundings. When installing the cylinder with switch nearby in parallel, or if a magnetic object is very close to the cylinder, mutual interference may occur and adversely affect detection accuracy.

8) Protecting the lead wire

The lead wire's minimum bending radius is 9 mm or more. Pay attention to wiring so repeated bending and tensile strain are not applied to the lead wire. To the moving portion, use such cord of flexibility as for building a robot.