

INSTRUCTION MANUAL

SUPER RODLESS CYLINDER

SRM3

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

For Safety Use

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

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

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

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

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

CAUTION :

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

INDEX

SRM3

Super Rodless Cylinder

Manual No. SM-429517-A

1. PRODUCT	
1.1 Specifications	1
1.2 Basic Circuit Chart	2
2. CAUTION	
2.1 Operation Fluid	3
3. OPERATION	4
4. INSTALLATION	
4.1 Piping	14
4.2 Installation	15
4.3 Piping Ports	16
4.4 Expression for Calculating Each Moment	17
4.5 Maximum Allowable Loads and Moments	18
4.6 Others	20
5. MAINTENANCE	
5.1 Regular Check	21
5.2 Troubles and Corrective Measures	22
5.3 Disassembly	23
6. HOW TO ORDER	31
7. CAUTION FOR OPERATING CYLINDER SW	
7.1 Common Characteristics of Contact and Non-contact Cylinder Switches	33
7.2 Caution for Operation (cylinder switch)	37
7.3 Caution for Operation (non-contact switches: T2YH, T2YV, T3YH, T3YV, T2YD)	37
7.4 Caution for Operation (contact switches: T0V, T0H, T5V, T5H)	42



1. PRODUCT

1.1 Specifications

Model code		SRM3			SRM3-Q		
Item		Standard · with switch			With position locking · with switch		
Media		Compressed air					
Action		Double acting type			Double acting and with position locking		
Max. Working Pressure MPa		0.7					
Min. Working Pressure MPa		Equivalent of $\phi 25, 32, 40$			0.15		
		Equivalent of $\phi 63$			0.1		
Proof pressure MPa		1.05					
Ambient temperature ℃		5 to 60					
Port size	Tube Bore	Equivalent of $\phi 25$	Equivalent of $\phi 32, 40$	Equivalent of $\phi 63$	Equivalent of $\phi 25$	Equivalent of $\phi 32, 40$	Equivalent of $\phi 63$
	Cylinder port	Rc1/8	Rc1/4	Rc3/8	Rc1/8	Rc1/4	Rc3/8
	Position locking port	—			Rc1/8		
Stroke tolerance mm		+ 2.0 0 (to 1000)、+ 2.5 0 (to 2000)					
Working piston speed mm/s		50 to 1500 (Note 1、Note 2)					
Cushioning		Air cushion					
Lubrication		Not required					
Hold position accuracy to repeat mm		± 0.03					
Position locking unit		—			Equipped with the right cover.		
Holding force N		—			Maximum thrust×0.7		

Note 1: Note that the operation piston speed in the central port pipe varies depending on the strokes.

Note 2: ① Reduce the speed of entering into the position locking unit to 500mm/s or less when operating the cylinder at a speed between 500mm/s and 1500mm/s.

② For speed reduction, install an external shock absorber or speed reduction circuit.

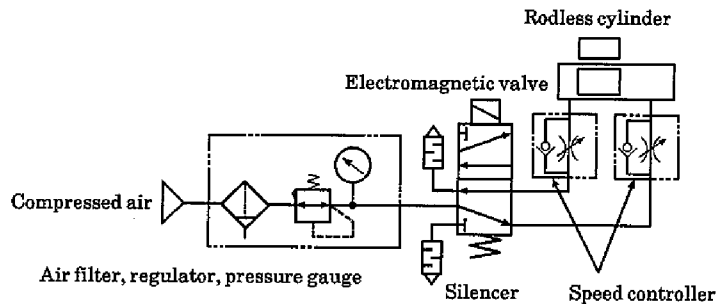
③ Regularly apply grease to the sliding portion of the lock lever.



1.2 Basic Circuit Chart

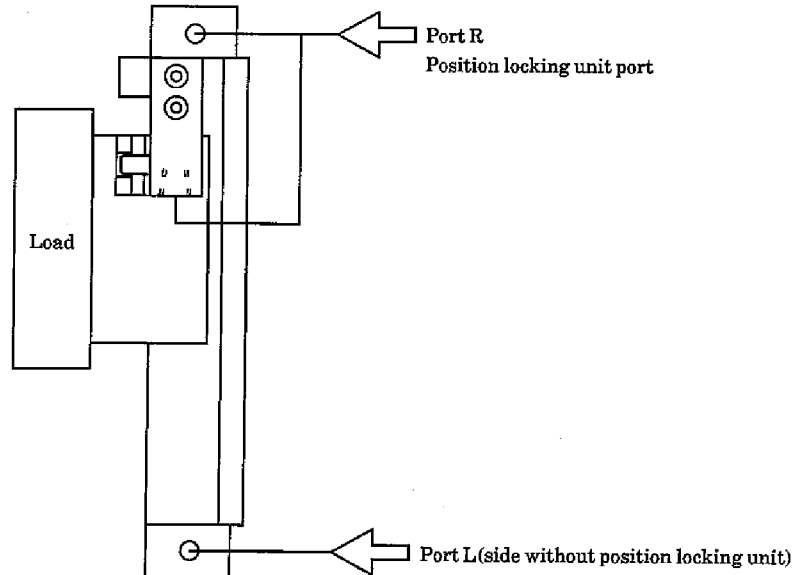
Basic circuit chart (no lubrication)

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.)

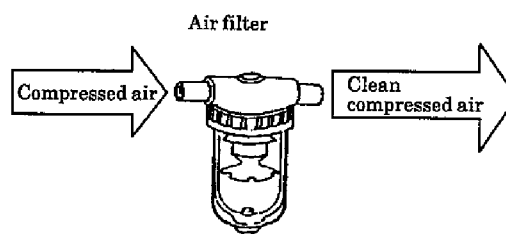




2. CAUTION

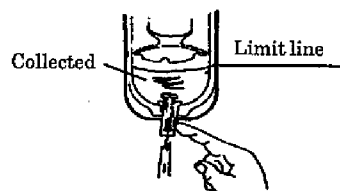
2.1 Operation Fluid(preferably $5\mu\text{m}$ or less)

- 1) To obtain clean and 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 ($5\mu\text{m}$ or smaller desirable), fluid volume, and installation position (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 lubricating oil may affect the packing, leading to malfunction. After lubrication starts, be careful about oil shortage for it destabilizes the operation.

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



3. OPERATION

- 1) Be sure that the supply pressure to the cylinder is between the min. operation pressure and the max. operate pressure as described in 1.1 Specifications.
- 2) Adjust the piston speed by installing a speed controller as shown in the basic circuit diagram on page 2.
- 3) Cushion adjustment procedure
 - The effect of the air cushion is adjusted at the plant before delivery. To adjust the effect according to the load, use the cushion needle. Loosening the needle (turning it counterclockwise) reduces the effect.
 - When kinetic energy such as the load or speed is large, consider using a buffer device to absorb the kinetic energy.
- 4) Inertia

Exercise care not to allow the moment, including the inertia force generated when the load moves or stops, to exceed the allowable load. Otherwise, the cylinder will be damaged.

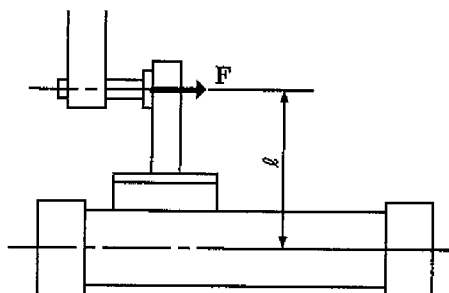
- In case of large overhang

If the overhang load is large and it therefore is necessary to stop the cylinder at the ends with a piston, the bending moment works due to the inertia force of the load even within the range of the absorption energy of the internal cushion.

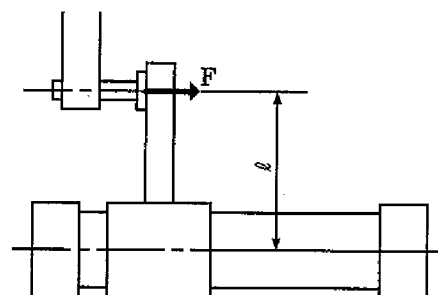
If the kinetic energy is large and an external cushion is used, apply the cushion as close to the center of the work as possible.
- When using an external stopper

Select an external stopper taking the bending moment by the cylinder thrust into consideration.

【 Moment working when the cylinder is stopped by an external stopper 】



$$M1 = F \cdot \ell$$



$$M3 = F \cdot \ell$$

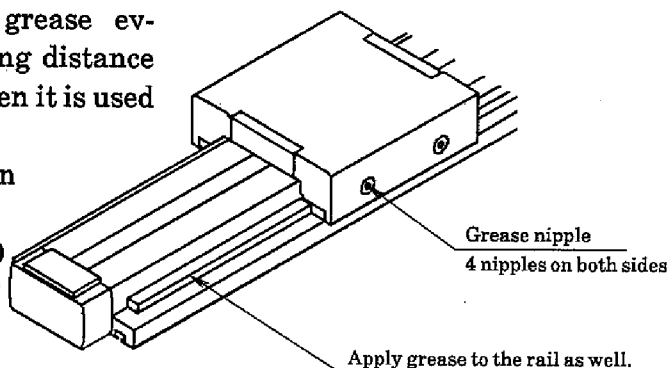
F : Cylinder thrust

ℓ : Distance from the center of cylinder to stopper

5) Guide

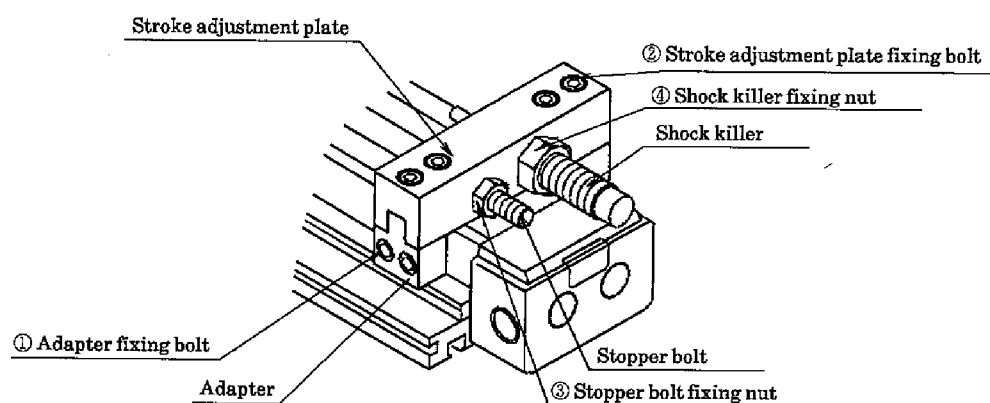
- The preload of the guide is adjusted at the plant before delivery. Do not adjust it during operation unless otherwise required.
- Apply a lithium base grease every 100 km of traveling distance (about six months) when it is used regularly.

Recommend grease gun
THK Corporation:
Grease gun unit MG70
Muzzle shape Model P

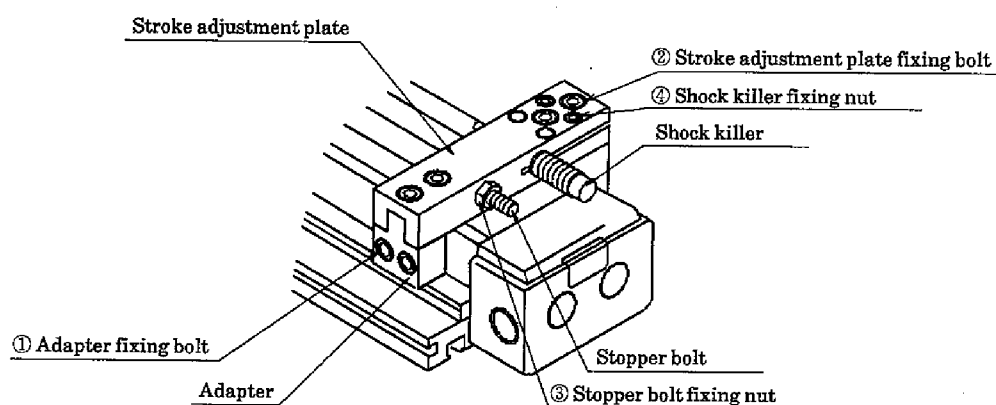


6) Unit adjustment for all stroke adjustment

- Full stroke adjustment, with standard shock absorber
(SRM3-**-**-A1)



- Full stroke adjustment, with light load shock absorber
(SRM3-**-**-E1)



3 OPERATION

(1) Moving the stroke adjustment unit

By loosening the adapter fixing bolt and the stroke adjustment plate fixing bolt, the stroke adjustment unit can be moved.

(2) Locking the stroke adjustment unit

- After moving the stroke adjustment unit to the intended position, tighten the adapter fixing bolt and the stroke adjustment plate fixing bolt to the torque specified in Table 1.

The stroke adjustment unit may slip out of position if the bolts are tightened to a torque lower than the specified value.

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

Tightening torque	① Adapter fixing bolt	② Stroke adjustment plate fixing bolt
Model	N · m	N · m
SRM3-25	6.2~7.6	6.2~7.6
SRM3-32	6.2~7.6	6.2~7.6
SRM3-40	10.4~12.8	10.4~12.8
SRM3-63	19.4~23.8	19.4~23.8

- Tighten the stroke adjustment plate fixing bolt with the adapter and the tube in close contact with each other. Then, tighten the adapter fixing bolt.

(3) Stroke adjustment by stopper bolt

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 and Table 3 below.

Table 2: Tightening torques of the stopper bolt fixing nut and the shock absorber fixing nut of cylinders with a standard shock absorber (SRM3-※-A,A1,A2).

Tightening torque	④ Stopper bolt fixing nut	⑤ Shock killer fixing nut
Model	N · m	N · m
SRM3-25-A	4.5~6	4.6~6
SRM3-32-A	9~12	7.5~10
SRM3-40-A	22~30	22~30
SRM3-63-A	110~143	55~70

Table 3: Tightening torques of the stopper bolt fixing nut and the shock absorber fixing nut of cylinders with a light load shock absorber (SRM3-※-E,E1,E2).

Tightening torque	④ Stopper bolt fixing nut	⑤ Shock killer fixing nut
Model	N · m	N · m
SRM3-25-E	4.5~6	1~1.2
SRM3-32-E	4.5~6	1~1.2
SRM3-40-E	9~12	2.3~2.8
SRM3-63-E	22~30	4.6~5.6

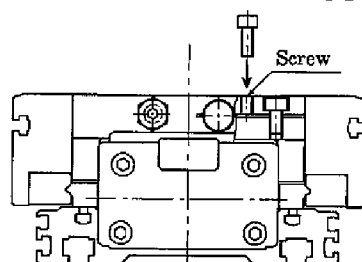
(4) Adjustment of the shock killer

● Cylinder with a standard shock absorber

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

● Cylinder with a light load shock absorber

Tighten the shock absorber fixing bolt to the torque specified in Table 3. If the split clamping portion is deformed as a result of excessive tightening, drive a bolt into the screw shown in the figure below to loosen the split clamping portion.



Model	Screw size
SRM3-25	M3
SRM3-32	M3
SRM3-40	M4
SRM3-63	M5

7) Cushion characteristics and kinetic energy

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

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

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

Note) This is how the kinetic energy is calculated.

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

V_a : 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, V_m , is obtained by the following:

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

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

ω : Cylinder load rate

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



(2) SRM3 cushion characteristics

Table 4. Tolerable absorption energy of cushion (E1)

Tube bore (mm)	Effective cushion length (mm)	Tolerable energy absorption J	
		With cushion	Without cushion
φ25	20.9	1.40	0.015
φ32	23.5	2.57	0.030
φ40	23.9	4.27	0.050
φ63	29.6	17.4	0.138

(3) Shock absorber

Table 6 shows a list of the shock absorbers that are used with an SRM3 shock absorber.

Use the shock absorbers within their specifications as shown in Table 5.

Table 5. Specifications

Shock killer model		NCK-00-0.7-C	NCK-00-1.2	NCK-00-2.6	NCK-00-7	NCK-00-12	
Item							
Classification		No adjuster, spring return type					
Max. absorption energy		7	12	26	70	120	
	MPa						
Stroke		8	10	15	20	25	
	mm						
Absorption energy per hour		12,600	21,600	39,000	84,000	86,400	
	J						
Max. collision speed		1.5	2.0		2.5	3.0	
	m/s						
Max. repetition frequency		30		25	20	12	
	count/min						
Ambient operation temp.		5 to 60					
	°C						
Return spring force	When extended	N	2	2.9	5.9	9.8	16.3
	When com-pressed to the limit	N	4.3	5.9	11.8	21.6	33.3
Return time		s	0.3 or less			0.4 or less	

The tolerable absorption energy of the SRM3 cushion depends on the collision speed. Keep the tolerable absorption energy within 1/2 of the maximum absorption energy shown in Table 2 when the collision speed is between 100mm/s and 1500mm/s.

Table 6. Applicable shock absorber model numbers

Model	Applicable shock absorber model numbers	
	Standard type (-A)	Light load type (-E)
SRM3-25	NCK-00-1.2	NCK-00-0.7-C
SRM3-32	NCK-00-2.6	NCK-00-1.2
SRM3-40	NCK-00-7	NCK-00-2.6
SRM3-63	NCK-00-12	NCK-00-7

(4) Adjustment of the shock killer

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

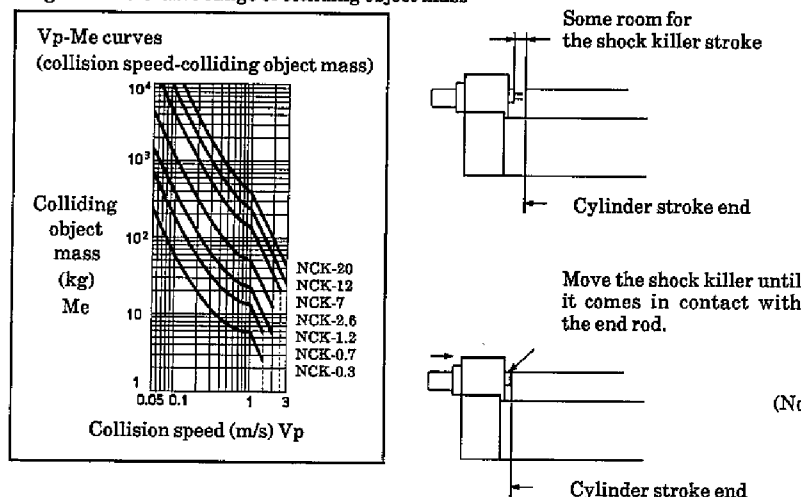
(5) Checking of the tolerable collision energy of the shock killer

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

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

	Horizontal move	Vertical descent	Vertical ascent	● Signs E : Collision energy J Me: Colliding mass kg m : Work mass kg F : Cylinder thrust N V : Collision speed (m/s) St : Shock killer stroke (m) g : Gravity acceleration 9.8(m/s ²)
Examples				
Colliding mass Me (kg)	$Me = m + \frac{2F \cdot St}{V^2}$	$Me = m + \frac{2 \cdot St(F + mg)}{V^2}$	$Me = m + \frac{2 \cdot St(F - mg)}{V^2}$	
Collision energy E (J)	$E = \frac{mV^2}{2} + F \cdot St$	$E = \frac{mV^2}{2} + (F + mg) \cdot St$	$E = \frac{mV^2}{2} + (F - mg) \cdot St$	

Fig. 1 Tolerable range of colliding object mass



3 OPERATION

(6) Precautions for use

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

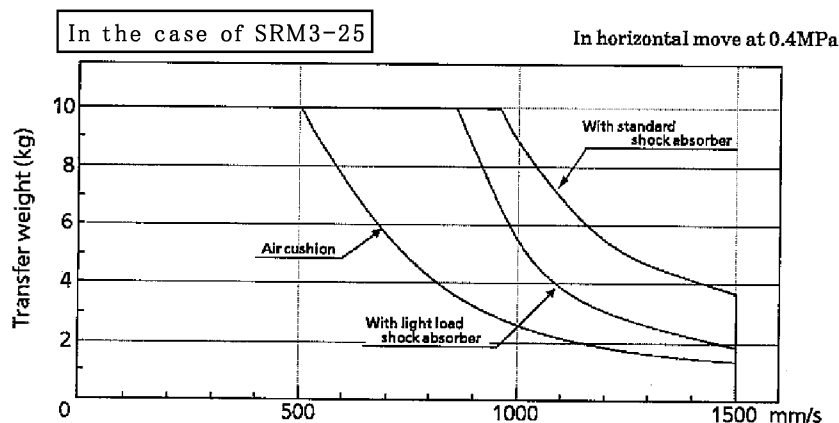
Table 7. Initial settings of SRM3 cylinders with shock absorber

Model	Standard type (-A)		Light load type (-E)	
	Tolerable energy (J)	Effective stroke (mm)	Tolerable energy (J)	Effective stroke (mm)
SRM3-25	10	9	5.7	7
SRM3-32	18	13	10	9
SRM3-40	50	16.5	18	13
SRM3-63	86	21	50	16.5

(7) Transfer weight – speed characteristic of cylinder with cushion and shock absorber

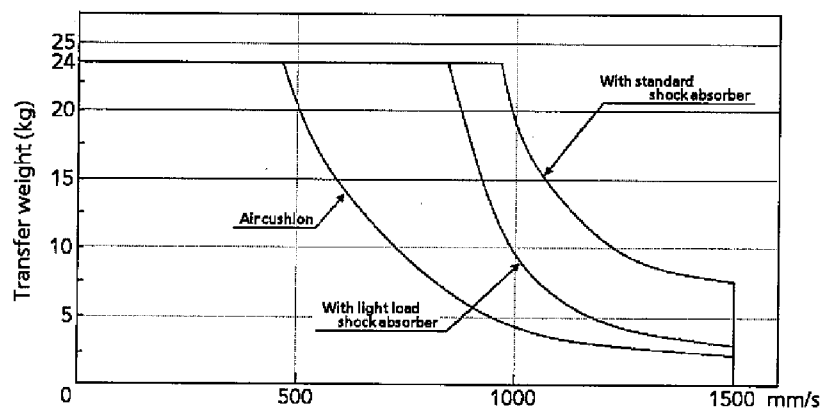
The following figure shows the transfer weight-speed characteristic of the cylinder with a cushion and shock absorber. The characteristic, however, varies depending on the operating conditions. Confirm that the characteristic is less than the tolerable value shown in Table 2.

【 Transfer weight – speed characteristic of cylinder with SRM3 cushion and shock absorber 】



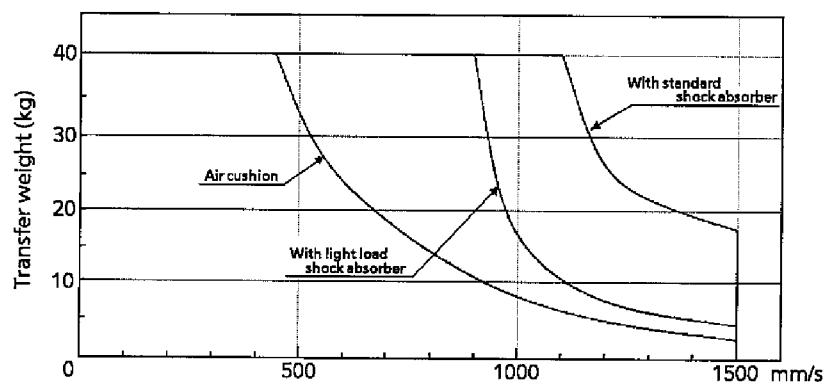
In the case of SRM3-32

In horizontal move at 0.4MPa



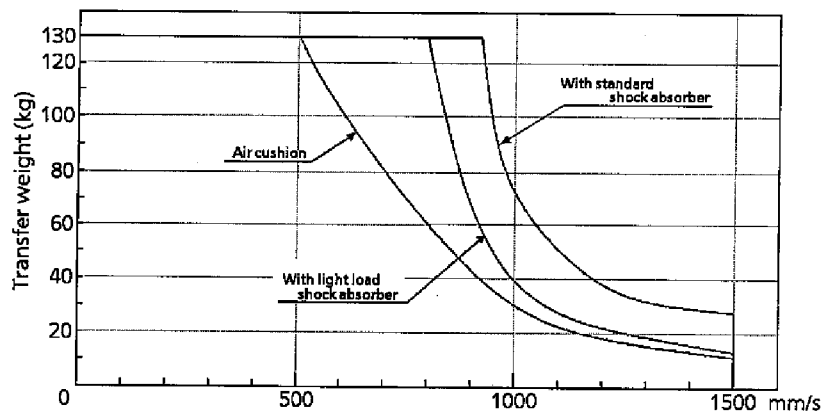
In the case of SRM3-40

In horizontal move at 0.4MPa



In the case of SRM3-63

In horizontal move at 0.4MPa

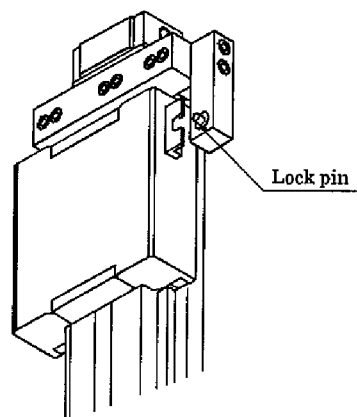


3 OPERATION

8) Precautions for operating cylinder with position locking function

(1) Manual release

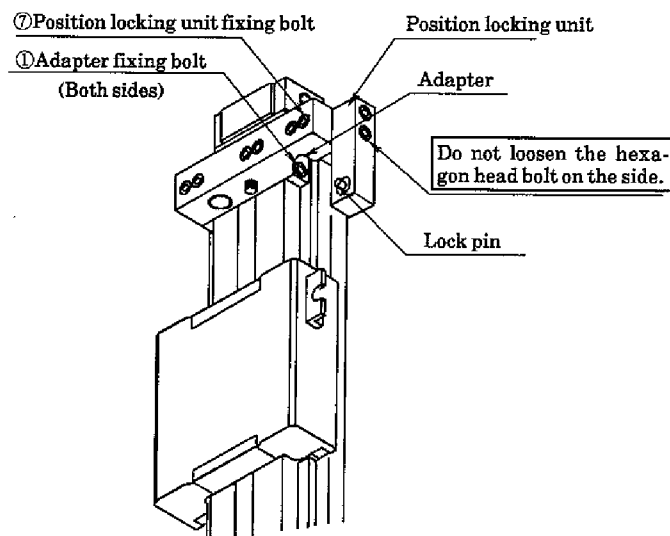
Using a bar, push the lock pin out of the position locking unit. Before releasing the lock, supply pressure to port L to unload the locking unit. If pressure is supplied to Port R while both Port R and Port L are ventilated and the piston is locked, the lock will be released to eject the table with such a force that it might injure the operator.



(2) Solenoid valve

- If the cylinder is held with the locking unit pressurized, the lock pin may come off and a serious accident will result. Do not use a 3-position closed center solenoid valve or solenoid valve with 3-position load ports open to the center port.
- 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.
- If the lowering speed is increased by a quick exhaust valve, the cylinder starts to operate earlier than the lock pin, resulting in a failure of release. In such a case, install an individual valve for controlling the position locking unit to maintain the timing.

(3) Stroke adjustment procedure



Adjust the stroke by loosening the position locking unit fixing bolt - shown in the above figure. Do not loosen the side hexagon head bolt because the position locking unit lock pin may become dislocated.

- Loosening the adapter fixing bolt enables the position locking unit with a shock absorber (A, A1, A2, E, E1, E2) to move. Fine adjustment of the stroke with the shock absorber makes it impossible to keep the position locking position and ensure locking. Make fine adjustments using the adapter fixing bolt.
- After moving the stroke adjustment unit to the intended position, tighten the adapter fixing bolt to the torque specified in the following table.

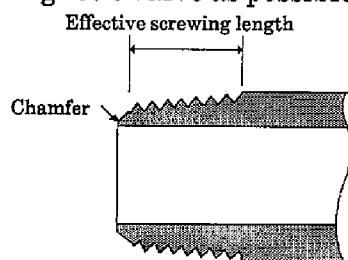
The stroke adjustment unit may slip out of position if the bolt is tightened to a torque lower than the specified value.

Model	① Adapter fixing bolt tightening torque
	⑦ Position locking unit fixing bolt tightening torque N · m
SRM3-Q-25	6.2 ~ 7.6
SRM3-Q-32	6.2 ~ 7.6
SRM3-Q-40	10.4 ~ 12.8
SRM3-Q-63	19.4 ~ 23.8

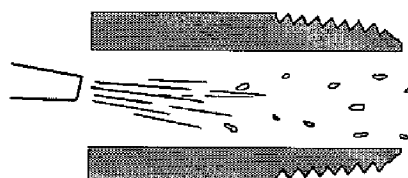
4. INSTALLATION

4.1 Piping

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

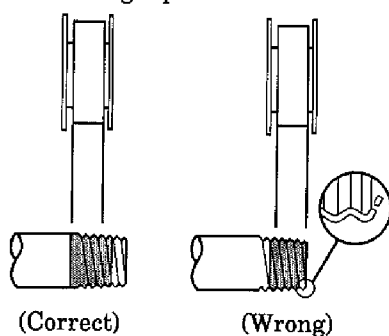


- 5) Before connecting the pipe, be sure to flash it (air blow) in order to remove chips and other foreign matters from the inside.

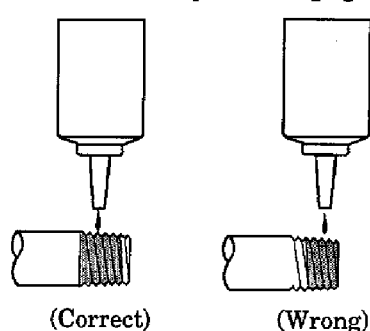


- 6) Sealing tape or a sealing agent is used for piping. Be sure to leave two threads from the end of the pipe as shown in the drawings so as to prevent fragments of the tape or the agent from entering the pipe or the equipment.

● Sealing tape



● Solid or liquid sealing agent



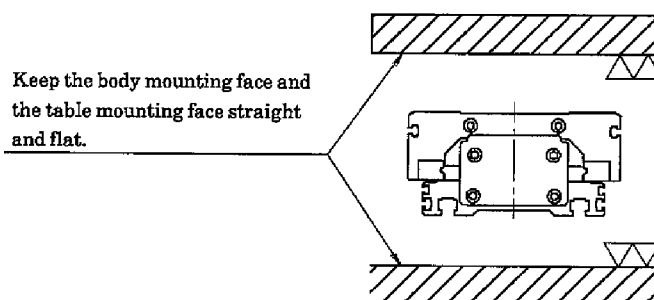
4.2 Installation

- 1) The larger the cylinder size, the heavier its weight. Since the SRM3-40 and the SRM3-63 are very heavy, handle them with extreme care. Use a lifting sling to lift a cylinder weighing 15 kg or heavier.

(Reference)

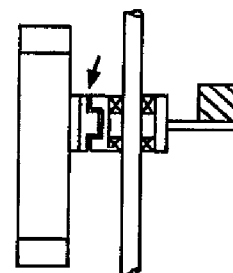
Model	Weight
SRM3-40B-2000	Approx. 30kg
SRM3-63B-2000	Approx. 58kg

- 2) Exercise care not to cause damage or flaws to the body (tube) mounting face and the end plate face, which make the faces uneven.



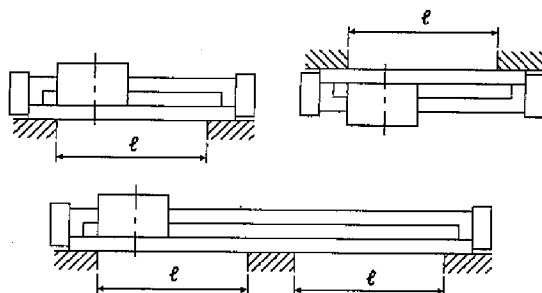
- 3) Operate this cylinder at the ambient temp. of 5 to 60 °C.
- 4) Be careful not to bump the cylinder tube against an object. The tube, when distorted, causes malfunction.
- 5) When using the guide, be sure that the cylinder and the guide are set in such a way that the center shift between them can 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.



- 6) Intervals between supports

The deflection of the tube becomes large if the stroke is long and the load or bending moment is large. Hold the tube at the intervals specified in the table below.

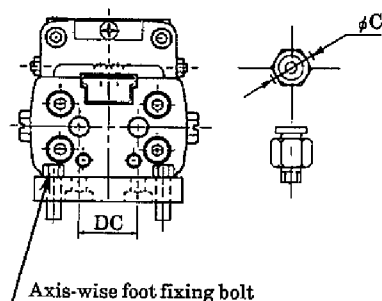


Model	Recommended support interval (ℓ) mm
SRM3-25	400
SRM3-32	400
SRM3-40	500
SRM3-63	600

4 INSTALLATION

4.3 Piping Ports

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



Item	Port position	Outer diameter of usable joint ϕC
Tube bore (mm)	DC	OO
$\phi 25$	26	26 or less
$\phi 32$	27	27 or less
$\phi 40$	35	35 or less
$\phi 63$	—	—

- 2) Piping port position and operation direction

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

L side

R side

● Option markings (D, S for bottom piping)

L side

R side

Ⓡ indicates the R-side pressure port, and Ⓛ the L-side pressure port.

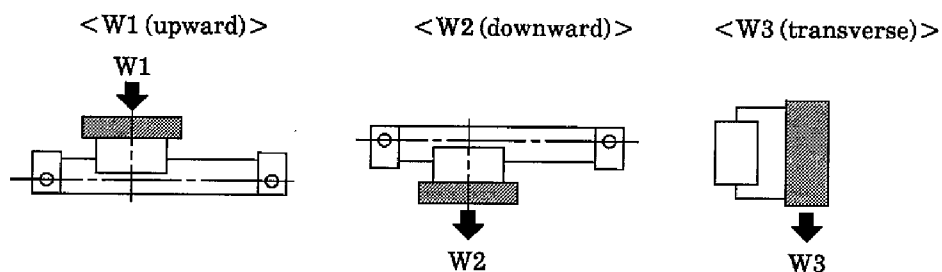
At the time of shipment, all the ports except one each at Ⓡ and Ⓛ were sealed by plugs. Remove the plugs for connection to other ports, but bottom piping is not possible. Choose options (D, S) for bottom piping if it is necessary. Ⓛ is available only 25 mm, 32 mm and 40 mm diameter sizes. The cylinder with a 63-mm-diameter Ⓛ can not manufactured.

Ⓡ indicates the R-side pressure port, and Ⓛ the L-side pressure port.

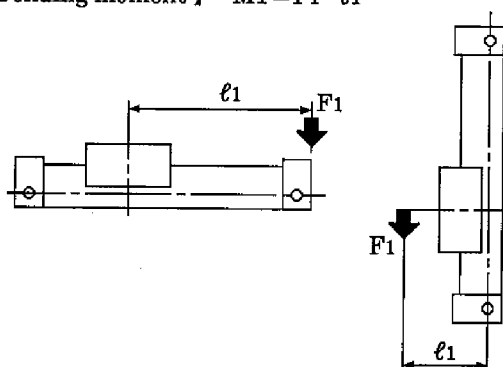
No piping available except for Ⓡ and Ⓛ as there are no other ports.

4.4 Expression for Calculating Each Moment

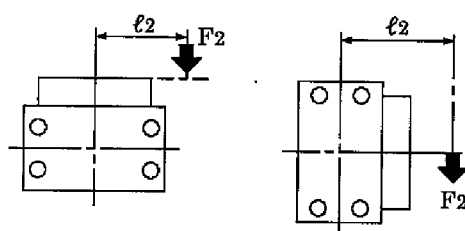
【 Vertical load 】



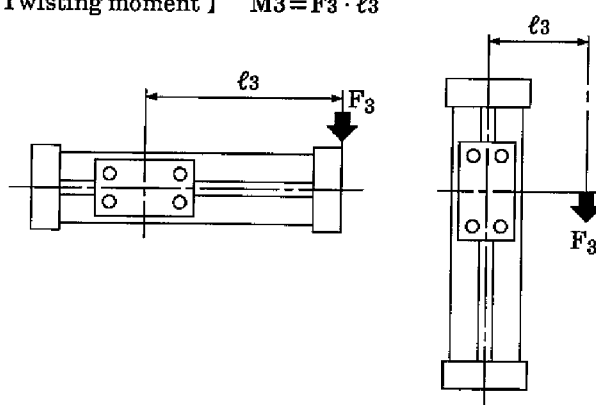
【 Bending moment 】 $M1 = F1 \cdot \ell_1$

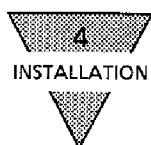


【 Lateral bending moment 】 $M2 = F2 \cdot \ell_2$



【 Twisting moment 】 $M3 = F3 \cdot \ell_3$





4.5 Maximum Allowable Loads and Moments

Item Tube bore (mm)	Vertical load W ₁ max : N	Vertical load W ₂ max : N	Vertical load W ₃ max : N	Bending moment M ₁ max : N · m	Lateral bending M ₂ max : N · m	Twisting moment M ₃ max : N · m
φ25	100	80	100	16	18	16
φ32	240	190	240	25	28	25
φ40	400	320	400	50	60	50
φ63	1300	1000	1300	200	260	200

The above table shows the maximum allowable loads and moments. As shown in Figures 1 to 6, they depend on the operating speed condition. (The left zone below each characteristic curve in Figures 1 to 6 represents the allowable load range.)

Fig. 1
Allowable loads for W1, W2 and W3 of SRM3-25 and SRM3-32

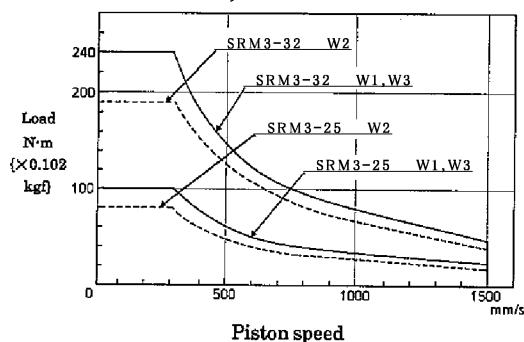


Fig. 2
Allowable loads for W1, W2 and W3 of SRM3-40 and SRM3-63

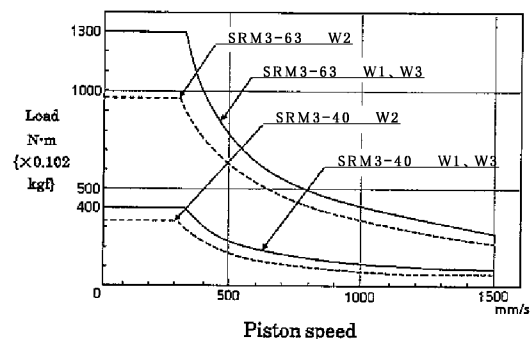


Fig. 3
Allowable loads for M1 and M3 of SRM3-25 and SRM3-32

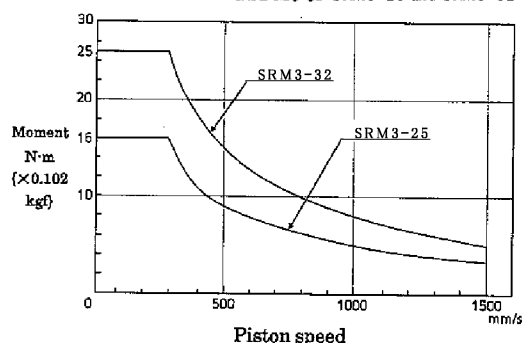


Fig. 4
Allowable loads for M1 and M3 of SRM3-40 and SRM3-63

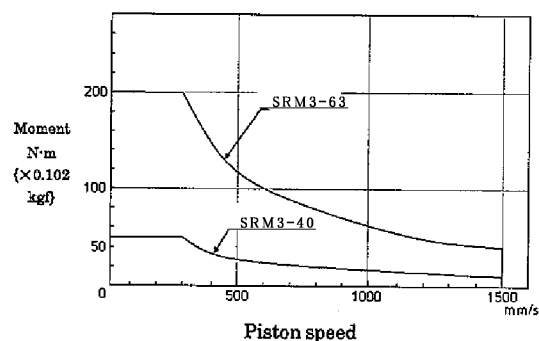


Fig. 5
Allowable loads for M2 of SRM3-25 and SRM3-32

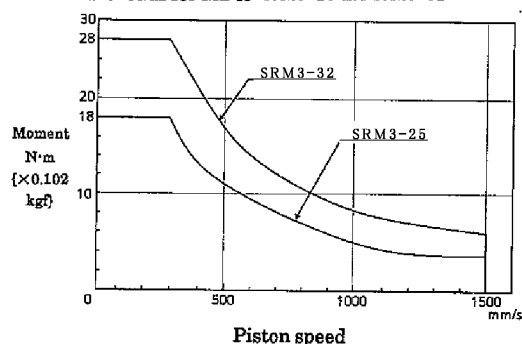
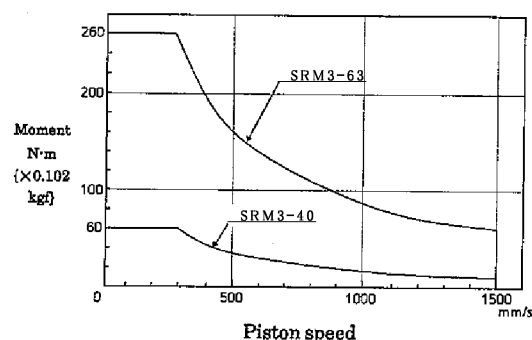


Fig. 6
Allowable loads for M2 of SRM3-40 and SRM3-63

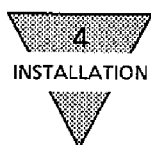


Divide each load by the allowable value read from each of Figures 1 to 6, and calculate the load and the moment factor. Confirm that the total value is 1.0 or less.

Expression

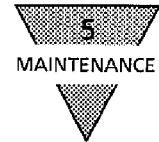
$$\frac{W}{W_{\max'}} + \frac{M_1}{M_{1\max'}} + \frac{M_2}{M_{2\max'}} + \frac{M_3}{M_{3\max'}} \leq 1.0$$

$W_{\max'}$, $M_{1\max'}$, $M_{2\max'}$, $M_{3\max'}$: Readings in Figures 1 to 6



4.6 Others

- 1) 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.
- 2) 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.
- 3) Operating a unit with excessive inertia will damage the cylinder or cause it to malfunction. Use the cylinder within the allowable load range.
- 4) Exercise care not to cause any flaws or damage to the cylinder. The cylinder will malfunction.
- 5) In such an operating state where negative pressure is produced within the cylinder due to external force or inertia force, the seal belt may become detached, resulting in external air leakage or other malfunction.

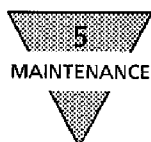


5. MAINTENANCE

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
 - Ⓔ Change in table play
 - Ⓕ Stroke
 - Ⓖ Loose round head screw for the switch, or its position change
 - Ⓗ Cracks in the connecting part of the switch lead wire and the switch
 - Ⓘ Presence of magnetic material, such as cut chips, sticking to the switch mount position.

If any problems are detected, refer to "5.2, Troubles and corrective measures" and implement proper measures. Fasten any loose sections if there are any.



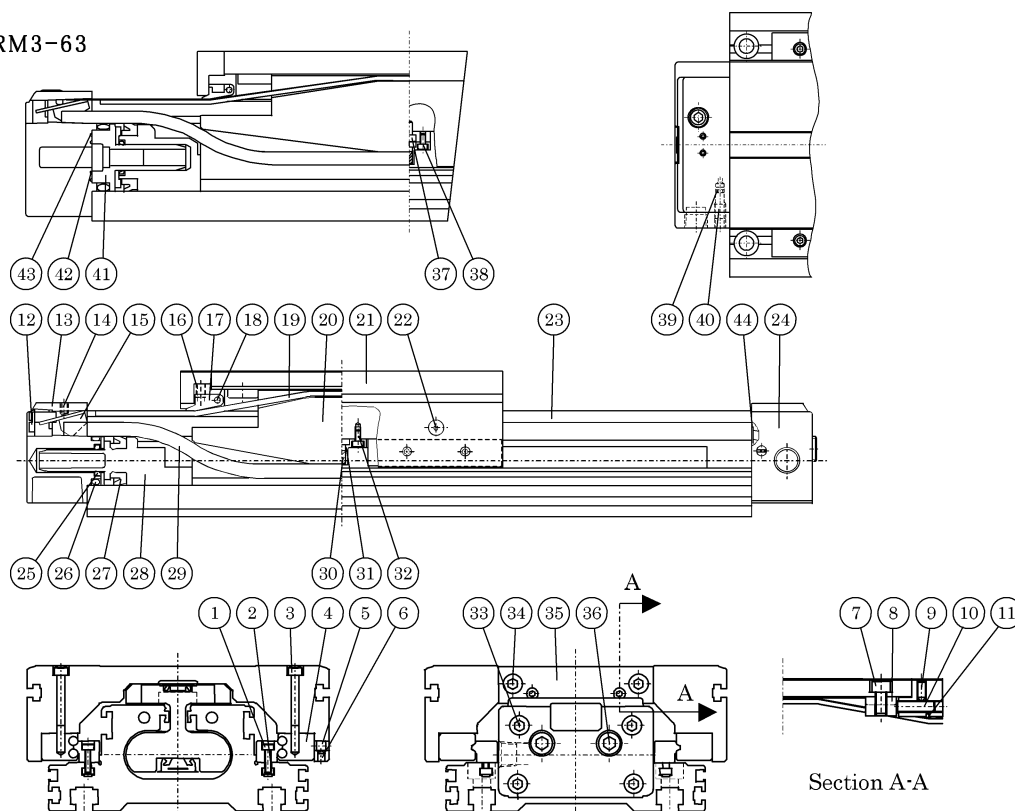
5.2 Troubles and Corrective Measures

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 fitting
	Damaged piston packing	Replace the packing
	Damaged seal belt	Replace the belt
Jerky movement	Incorrect mount centering	Correct the fitting
	Excessive moment	Set the guide, correct fitting
	Large load	Increase pressure or tube bore tube bore
	Speed control valve is used for meter-in circuit	Change the position of speed control valve for meter - out circuit.
Damage, distortion	Impact from high-speed operation	Reduce the speed, lighten the load, increase cushion capacity (set external cushion mechanism)
	Excessive moment	Set the guide, correct fitting
Switch does not function	Incorrect Switch position	Reset Switch to HD, RD position. See Chapter 7 "Caution for using Switch cylinder"
	Switch is electrically damaged.	Check the circuit to prevent excess current and voltage (Switch replacement). Check if the lead wire is bent too much, causing a short circuit inside (Switch replacement)
	Switch is mechanically damaged.	Replace the Switch, remove outside obstacles.
	Problem with magnetic flux distribution for Switch activation	Remove magnetic materials (iron powder in large amount, etc.) from near the Switch

5.3 Disassembly

- 1) Internal structural drawing and parts list
 - Internal structural drawing and parts list of the standard model (SRM3)

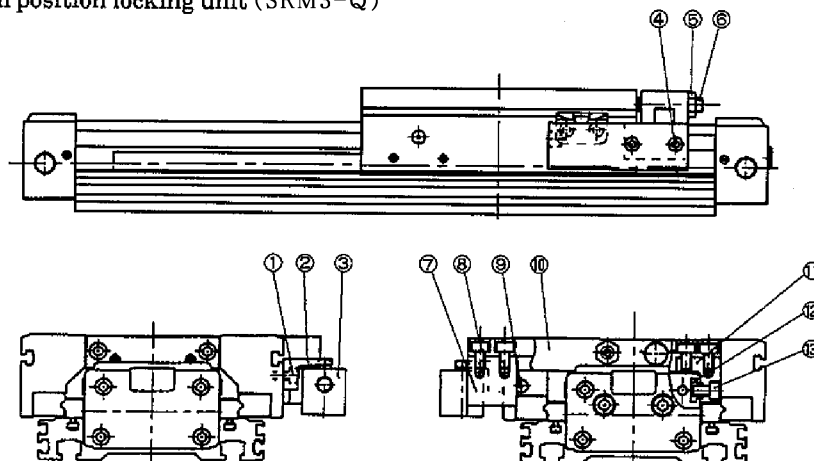
SRM3-63



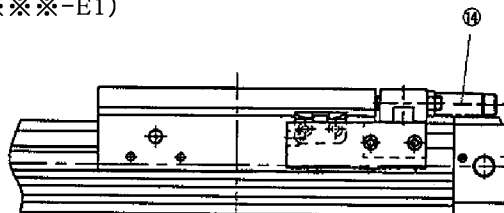
No.	Part name	Material	No.	Part name	Material
1	Hex. head bolt	Alloy steel	23	Cylinder tube	—
2	Nut rail	Steel	24	Cover (R) assembly	—
3	Hex. head bolt	Alloy steel	25	Cushion packing	Urethane rubber
4	High-accuracy guide	Steel	26	Cylinder gasket	Nitrile rubber
5	Hex. cap setscrew (flat point)	Alloy steel	27	Piston packing	Nitrile rubber
6	Hex. cap setscrew (cone point)	Alloy steel	28	Piston	Asetal resin
7	Hex. head bolt	Alloy steel	29	Seal belt	Urethane rubber
8	Yoke holder	Steel	30	Magnet	Special alloy
9	Hex. cap setscrew (cone point)	Alloy steel	31	Magnet case	Polyamide
10	Hex. cap setscrew (flat point)	Alloy steel	32	Hex. head bolt	Stainless steel
11	Dust wiper	Asetal resin	33	Hex. head bolt	Alloy steel
12	Belt cover	Polyamide	34	Hex. head bolt	Alloy steel
13	Cover (L) assembly	—	35	Table cover	Steel
14	Hex. cap setscrew (flat point)	Alloy steel	36	Plug	Steel
15	Belt spacer	Steel	37	Hex. head bolt	Stainless steel
16	Spring	Steel	38	Spacer	Aluminum alloy
17	Belt tension	Asetal resin	39	Needle gasket	Nitrile rubber
18	Parallel pin	Steel	40	Cushion needle	Steel
19	Dust-proof belt	Stainless steel + nitrile rubber	41	Cushion ring	Asetal resin
20	Yoke	Aluminum alloy	42	Cushion ring gasket (1)	Nitrile rubber
21	Table	Aluminum alloy	43	Cushion ring gasket (2)	Nitrile rubber
22	Grease nipple (ball cup)	Aluminum alloy	44	O ring	Nitrile rubber

● Inside structure drawing of cylinder with position locking unit (SRM3-Q) and parts list

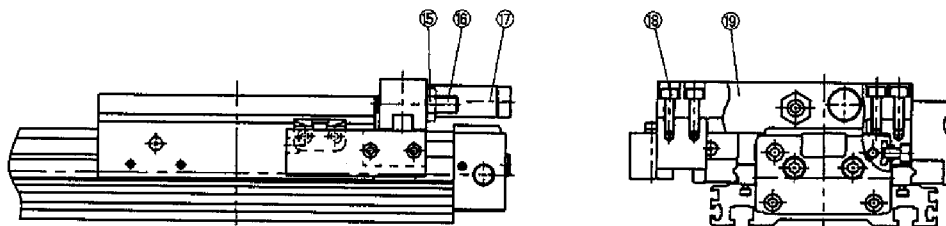
- With position locking unit (SRM3-Q)



- With position locking unit, full stroke adjustment unit and light load shock absorber (SRM3-Q-※※-※※※-E1)



- With position locking unit, full stroke adjustment unit and standard shock absorber (SRM3-Q-※※-※※※-A1)

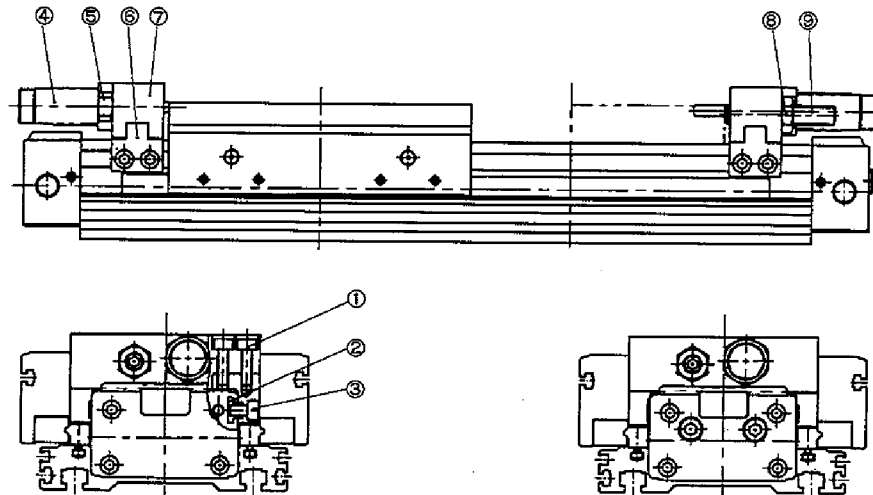


No.	Part name	Material
1	Hex. head bolt	Alloy steel
2	Lock lever	Alloy steel
3	Position locking unit assembly	
4	Hex. head bolt	Alloy steel
5	Hex. nut	Steel
6	Hex. cap set screw	Alloy steel
7	Fixing block	Aluminum alloy
8	Hex. head bolt	Alloy steel
9	Grease nipple (ball cup)	※

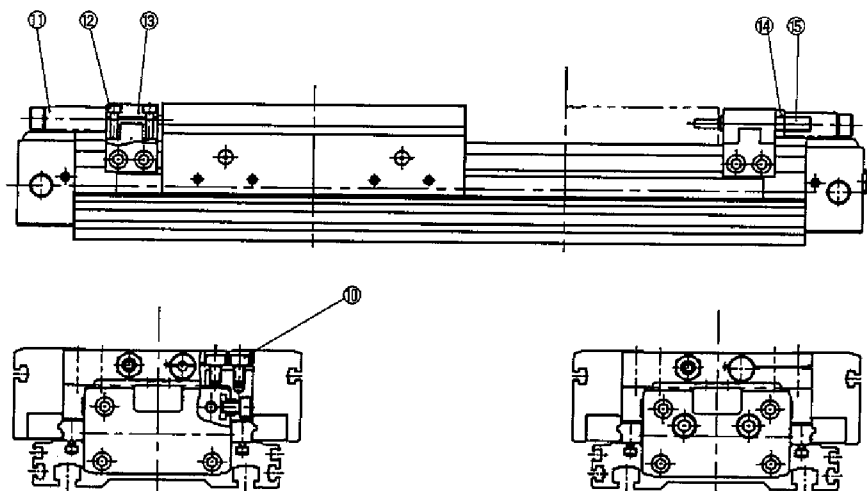
No.	Part name	Material
10	Plate (4)	Aluminum alloy
11	Adapter	Steel
12	Adapter nut	Steel
13	Hex. head bolt	Alloy steel
14	Shock killer	
15	Hex. nut	Steel
16	Hex. cap set screw	Alloy steel
17	Shock killer	
18	Hex. head bolt	Alloy steel
19	Plate (2)	Aluminum alloy

※ The SRM3-Q-25 is not equipped with a grease nipple.

- Inside structure drawing of cylinder with full stroke adjustment unit and parts list
- With full stroke adjustment unit and standard shock absorber
(SRM3-※※-※※※-A)



- With full stroke adjustment unit and light load shock absorber
(SRM3-※※-※※※-E)



No.	Part name	Material
1	Hex. head bolt	Alloy steel
2	Adapter nut	Steel
3	Hex. head bolt	Alloy steel
4	Shock killer	
5	Hex. nut	Steel
6	Adapter	Steel
7	Plate (1)	Aluminum alloy
8	Hex. nut	Steel

No.	Part name	Material
9	Hex. cap set screw	Alloy steel
10	Hex. head bolt	Alloy steel
11	Shock killer	
12	Hex. head bolt	Alloy steel
13	Plate (3)	Aluminum alloy
14	Hex. nut	Steel
15	Hex. cap set screw	Alloy steel



Repair kits list for the standard (SRM3)

Tube bore (mm)	Kit No.	⑪	⑲	②⑤	②⑥	②⑦
		Dust wiper	Dust-proof belt	Cushion packing	Cylinder gasket	Piston packing
φ 25	SRM3-25K-※	F4-261251	F4-261261-※	F4-670392	P-22-A	F3-222049
φ 32	SRM3-32K-※	F4-261252	F4-261262-※	F4-670393	P-29	F3-222050
φ 40	SRM3-40K-※	F4-261253	F4-261263-※	F4-670394	P-38	F3-222051
φ 63	SRM3-63K-※	F4-261255	F4-261265-※	F4-670395	P-58	F3-222053

Tube bore (mm)	Kit No.	②⑨	③⑩	④②	④③	④④
		Seal belt	Needle gasket	Cushion ring gasket (1)	Cushion ring gasket (2)	O ring
φ 25	SRM3-25K-※	D4-188572-※	1.15×1.00	—	—	4.57×1.02
φ 32	SRM3-32K-※	D4-188573-※	1.15×1.00	—	—	5.79×1.02
φ 40	SRM3-40K-※	D4-188574-※	2.00×1.25	—	—	6.50×1.00
φ 63	SRM3-63K-※	D4-188575-※	P-3	F4-221985	9.40×1.02	9.40×1.02

2) Procedures for replacement with repair kits

Common procedures

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

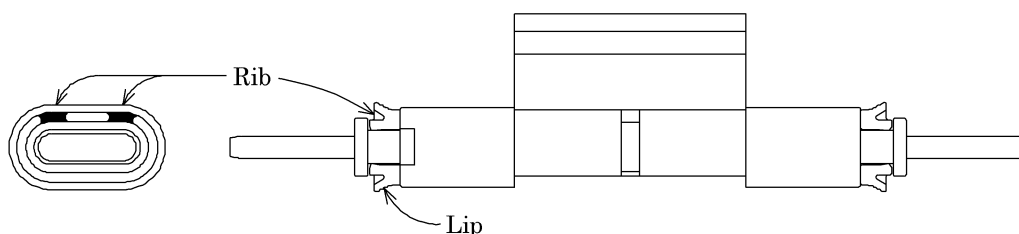
Recommended grease: Daphne Eponex No.1 Idemitsu Kosan
Duplex No.1 Kyodo Resin

(1) Piston packing replacement

When detaching the piston packing ②⑦, 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.

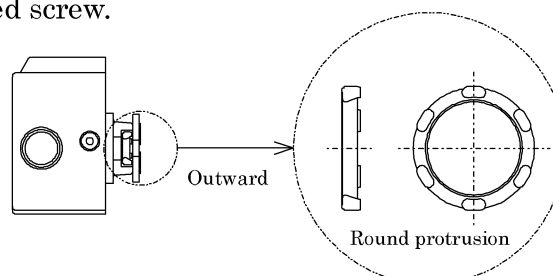


Note: Fitting the piston packing ②⑦ to the single piston yoke Assy unit will make it difficult to mount the piston yoke Assy and the seal belt ②⑨ on the cylinder ②③. To avoid this inconvenience, follow 3) Assembly procedures of the standard SRL3 described the next page.

(2) Cushion packing replacement

● SRM3-25 to 40

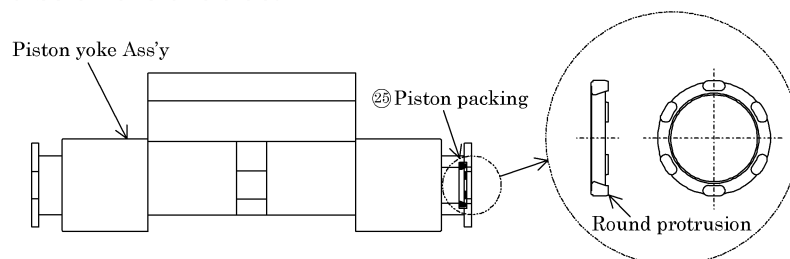
The cushion packing ②⑤ should be set in the proper direction. Be sure that the round protrusion faces outward (the protrusion is visible), and, with the cover ⑬ in place, fit the cushion adaptor to the cover and fasten the cross-recessed screw.



● SRM3-63

Use a stick with a pointed end to remove the cushion packing ②⑤ from the holes of the piston yoke Ass'y. 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).

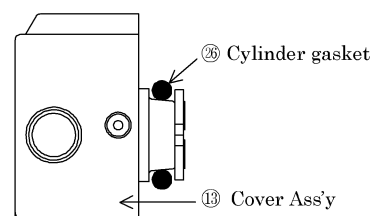
Next, fit a new cushion packing into the groove. The round protrusion should be on the out side.



(3) Cylinder gasket replacement

● SRM3-25 to 40

Take out the cylinder gasket ②⑥ from the cover Ass'y ⑬ 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).



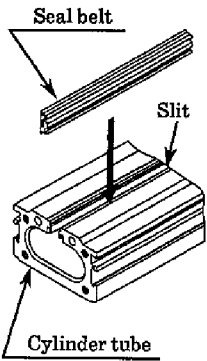
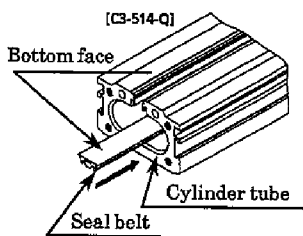
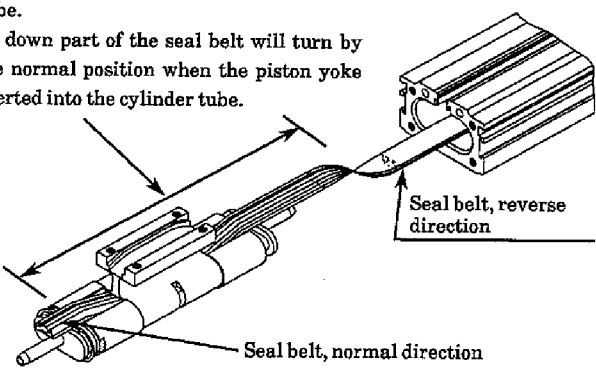
● SRM3-63

Loosen the cross-recessed screw and remove the cushion ring ④① from the cover Ass'y ⑬. Take out the cushion ring gasket 1, 2 ④②④③ and the cylinder gasket ②⑥ between the cover Ass'y ⑬ and the cushion ring ④① and replace it with a new one.

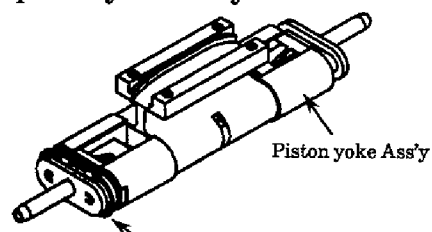
Fit the cushion ring ④① and fasten the cross-recessed screw.

3) Assembly procedures

(1) Insert the seal belt into the cylinder tube.

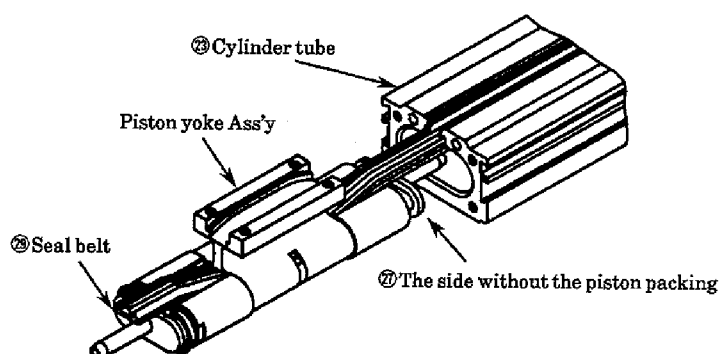
Cylinder stroke	Assembly procedures
2 m or less	 <p>Seal belt</p> <p>Slit</p> <p>Cylinder tube</p> <p>Insert the seal belt through the slit of the cylinder tube.</p>
Over 2 m	 <p>[C3-514-Q]</p> <p>Bottom face</p> <p>Seal belt</p> <p>Cylinder tube</p> <p>Turn the seal belt upside down and insert it.</p> <p>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.</p> <p>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.</p>  <p>Seal belt, reverse direction</p> <p>Seal belt, normal direction</p>

- (2) Mount one piston packing ⑳ onto the piston yoke Ass'y .
(Fit the packing in the proper direction. Refer to 2) Repair kits replacement procedures, (1) Piston packing replacement.)

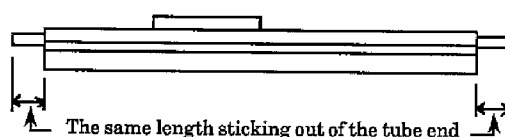


Set the piston packing only on one side

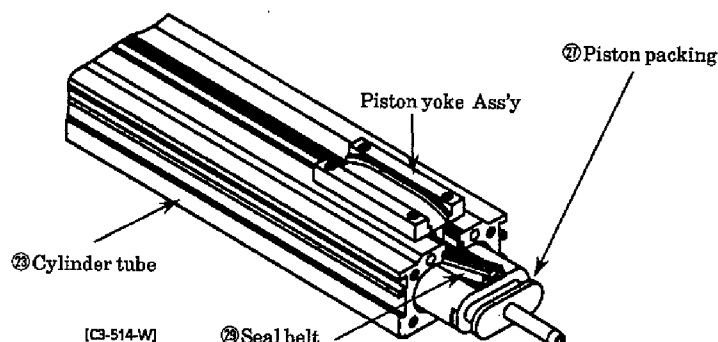
- (3) Insert the seal belt ㉑ into the piston yoke Ass'y ㉒. Be sure that the side of the piston yoke Ass'y without the piston packing faces the cylinder tube ㉓, and that the flat side of the seal belt faces downward.



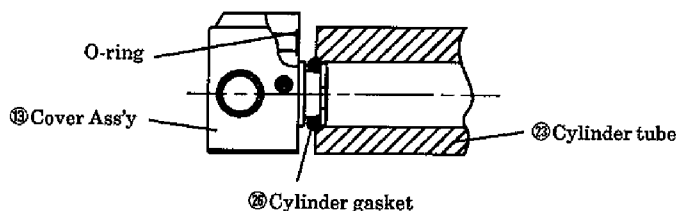
- (4) Insert the piston yoke Ass'y together with the seal belt ㉑ into the cylinder tube ㉓. Adjust the seal belt position so that the same length of the belt sticks out of the either end of the cylinder tube.



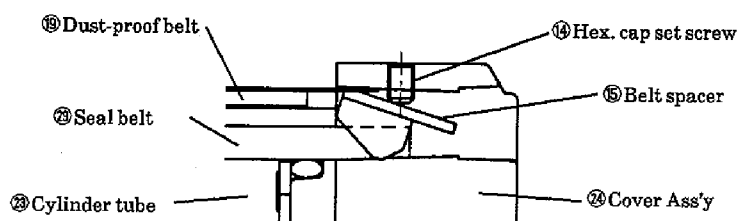
- (5) Push the piston yoke in the direction so that the side without the packing comes out of the cylinder tube ㉓, and fit the packing ㉒ into the groove, as illustrated below.



- (6) Push the piston yoke Ass'y back into the center of the cylinder tube. Next, attach the cover Ass'y ⑬ to the cylinder tube and secure it by the hex. head bolt ⑭. Be careful not to pinch the cylinder gasket ⑮ between the cover Ass'y and the cylinder tube. Do not lose the O-ring.



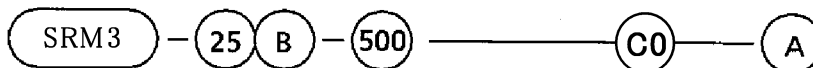
- (7) Set the dust-proof belt ⑩ in the cylinder ② tube slit in a way that the same length of the belt sticks out of either side. Next, insert one end of the dust-proof belt into the gap between the cylinder tube and the cover Ass'y ⑬.
- (8) Put the belt spacer ⑤ through the window of the cover Ass'y ⑭ (the side onto which one end of the dust-proof belt ⑩ has been inserted), push it until its end hits the end face of the cylinder tube ②. Fasten it by the hex. cap set screw.



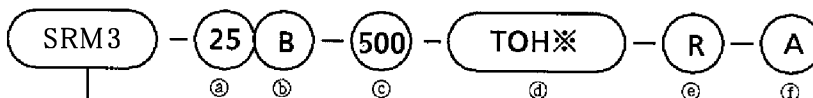
- (9) Push the dust-proof belt ⑩ through the slit of the cylinder tube ② from the side fastened by the belt spacer ⑤, and insert the opposite end into the gap between the cylinder tube and the cover Ass'y ⑭. Be sure that the dust-proof belt is not slack at the piston yoke Ass'y.
- (10) Fit a new dust wiper ⑪ in the groove of the table Ass'y. Next, place the table Ass'y on the piston yoke Ass'y and fasten it there by the hex. head bolt ③. Be careful not to drop the dust wiper.
- (11) Insert the belt spacer ⑤ through the cover Ass'y ⑭ window and secure the dust-proof belt ⑩ in the same manner as (9) above.
- (12) Fit the belt cover ⑫ into the cover Ass'y ⑭.

6. HOW TO ORDER

•No switch



•With switch



Basic models		㉓ Tube bore (mm)		㉔ Cushion		㉕ Stroke (mm)		
SRM3	Standard	25	φ 25	B	Both side cushion	Standard stroke		Max. stroke
SRM3-Q	With position locking	32	φ 32	R	R side cushion	φ25, φ32	φ40, φ63	
		40	φ 40	L	L side cushion			
		63	φ 63	N	No cushion			
						200	200 1100	φ25, φ32 1000 φ40, φ63 2000
						300	300 1200	
						400	400 1300	
						500	500 1400	
						600	600 1500	
						700	700 1600	
						800	800 1700	
						900	900 1800	
						1000	1000 1900	
							2000	

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

④ Switch type					
Lead wire straight	Lead wire L	Application			Lamp
T0H※	T0V※	Replay, PC	Contact	2-wire	1-color display
T5H※	T5V※	Replay, PC, IC circuit, serial connection			No lamp
T2YH	T2YV	PC	Non-contact	3-wire	2-color display
T3YH	TY3V	Relay, PC, IC circuit, small electromagnetic valve			3-color display
T2YD		PC			2-color display

The mark ※ indicates the length of the lead wire.

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

When cylinder switch is not specified, choose the following sign.

C0	Contact specification
C1	Non-contact specification

⑦ No. of switches		⑧ Option, accessory	
R	R side 1 SW	A	All stroke adjustment both sides, with shock killer
L	L side 1 SW	A1	All stroke adjustment R side only, with shock killer
D	2 SW	A2	All stroke adjustment L side only, with shock killer
T	3 SW	A3	All stroke adjustment to be fitted later (φ12 to φ25, note 5)
4	4 SW	E	All stroke adjustment on both sides, with light load shock absorber
5	5 SW	E1	All stroke adjustment on R side only, with light load shock absorber
		E2	All stroke adjustment on L side only, with light load shock absorber
For four or more switches, indicate the number by numeral.		No mark	Port position F, cushion needle position F (standard)
		R	Port position R, cushion needle position F (central port)
		B	Port position F, cushion needle position B
		T	Port position R, cushion needle position B (central port)
		D	Port position D, cushion needle position F (φ25 to φ100)
		S	Port position D, cushion needle position D (φ32 to φ100)

6 HOW TO ORDER

● Shock killer unit marking

Model	Single shock absorber model number	
	Standard type (-A)	Light load type (-E)
SRM3-25	NCK-00-1.2	NCK-00-0.7-C
SRM3-32	NCK-00-2.6	NCK-00-1.2
SRM3-40	NCK-00-7	NCK-00-2.6
SRM3-63	NCK-00-12	NCK-00-7

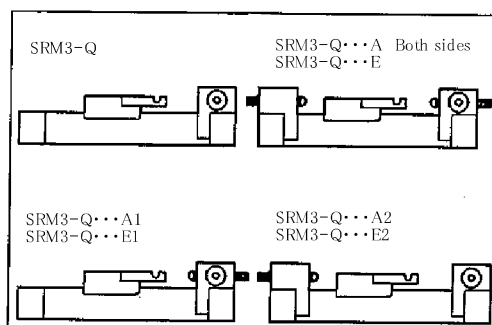
● All-stroke adjustment kit marking (applied to option mark A3)

SRM3 — Tube bore — ※
(Specify A1 or E1 in the section indicated by ※)

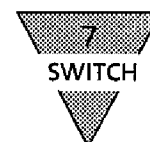
● Repair kits marking

SRM3 — Tube bore K — Stroke

- Note 1:** Refer to the internal structural drawings, p.23 to 26, for the markings to indicate the port and cushion needle positions.
- Note 2:** The full stroke adjustment unit fixture cannot be attached after the cylinder is mounted. This option is equipped with a mounting plate nut to enable the attachment of the fixture after cylinder mounting.
- Note 3:** 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; while the L side with the all-stroke adjustment and the shock killer (see the drawing below).



- Note 4:** Once the cylinder switch is mounted before delivery, it cannot be changed from a reed switch to a proximity switch and vice versa.
- Note 5:** Port R (common port) is available only in 25 mm, 32 mm and 40 mm diameter sizes. The cylinder with a 63-mm-diameter common port will be out soon.

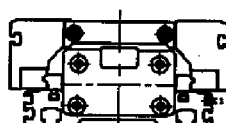


7. CAUTION FOR OPERATING CYLINDER SW

7.1 Common Characteristics of Contact and Non-contact Cylinder Switches

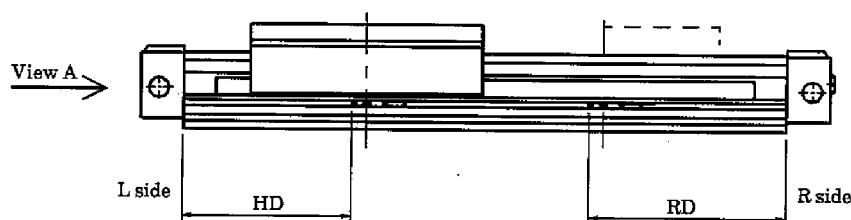
- 1) The cylinder switches were set at the position (for max. sensitivity) as indicated in the table below at the time of their shipment. Before operation, however, it is recommended to check the position of each switch. If the switch and the cylinder have been purchased separately, or if another switch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

View A

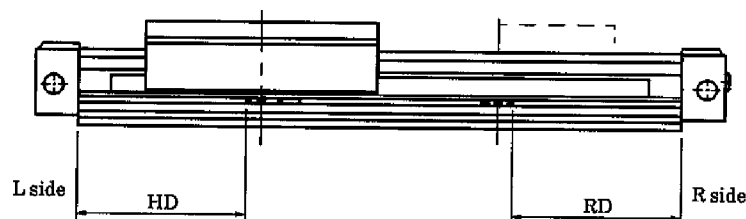


Marking	HD	RD
Model		
SRM3-25	87.5	108.5
SRM3-32	95.5	116.5
SRM3-40	120.5	141.5
SRM3-63	176.5	197.5

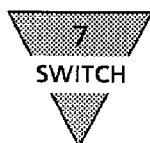
- Lead wire straight



- Lead wire L



- 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.



- 4) Tighten the switch fixing screw of the T0 and the T5 to 0.1 to 0.2 N.m using a keystone tip screwdriver (screwdriver for watches, precision screwdriver, etc.) with a handle diameter of 5 to 6 mm, a tip width of 2.4 mm or less and a tip thickness of 0.3 mm or less.

Tighten the switch fixing screw of the T2Y and the T3Y to 0.5 to 0.7 N.m.

5) Middle-stroke detection

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

① T0※, T5※

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

② 2-color display non-contact switch T2Y、T3Y

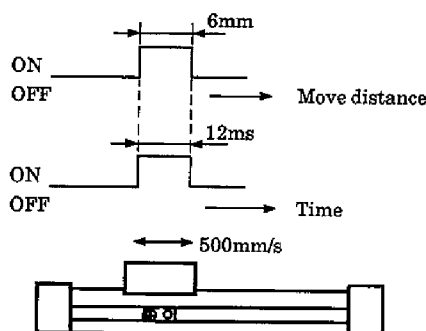
Move the switch and fasten it where the green light comes on (max. sensitivity point).

- The 2-color display non-contact switch indicates the operation range by turning on a red light and the max. sensitivity range (SW set position for max. sensitivity) by a green light. This makes SW setting very easy.

Electricity is on even while the red light is on, posing no problem to the operation of the switch.

- (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.

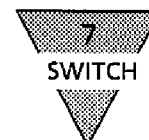
Exact responses from control circuits (relay circuit, program-mable controller, program)?



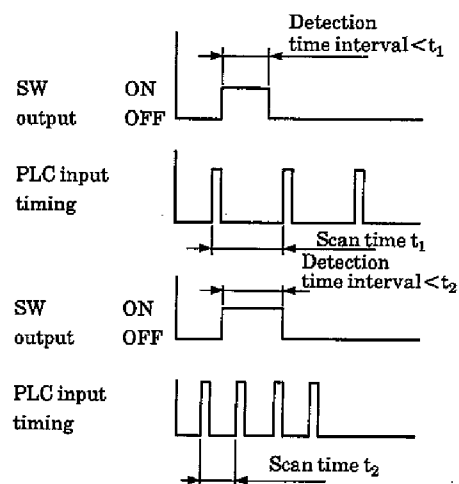
- The cylinder switch has the response speed of faster than 1ms, but the detection time interval can be made greater than the one obtained by the following formula.

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

Ex. When the operation range is 6 mm and the cylinder speed 500 mm/s, then the detection time interval is only 12 ms (see the drawing above).



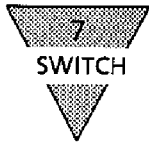
- It is necessary, therefore, to take in the signal without fail within this short time interval. Use a self-hold circuit or other means suitable to the situation.
- With PC inputting, in particular, it is necessary that not only the response time of the input/output circuit, but the program scanning time are shorter than this detection time interval (see the drawing).



[C3-701-D]

- The table below shows the operation ranges of the switches.

Item Tube bore (mm)	Operation range	
	Proximity 2-color display switch (T※Y※・※)	Reed switch (T0H/V、T5H/V)
φ25	6 to 11	5.5 to 11
φ32	5.5 to 10	5.5 to 10
φ40	5.5 to 10	5.5 to 9
φ63	6 to 10.5	5.5 to 10

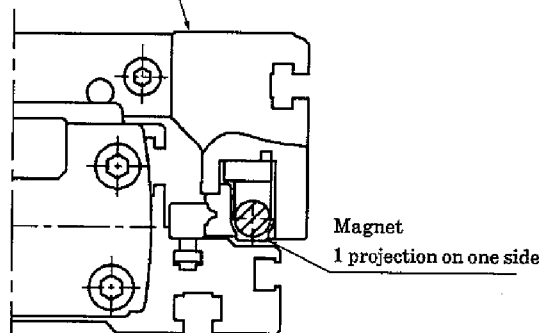


6) Switch operation

Note : Once the cylinder switch is mounted before delivery, it cannot be changed from a reed switch to a proximity switch and vice versa. When the cylinder switch is not specified (no mark), a cylinder equipped with a reed switch will be delivered.

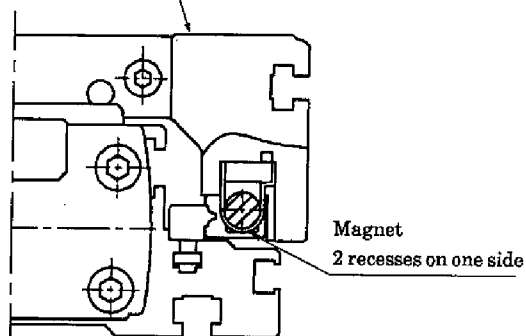
Switch model number

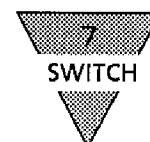
C0, T0※ and T5



Switch model number

C1, T※Y and T2YD



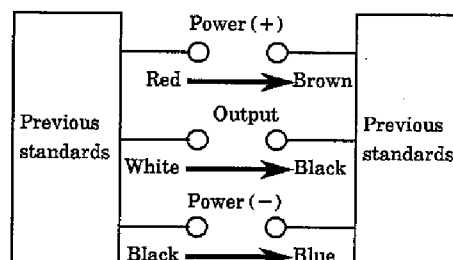


7.2 Caution for Operation (cylinder switch)

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

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

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



7.3 Caution for Operation

(non-contact switches: T2YH, T2YV, T3YH, T3YV, T2YD)

1) Wiring

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

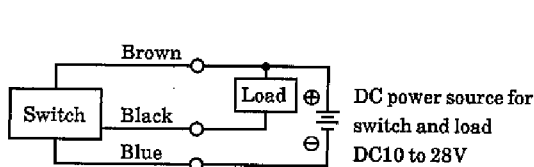


Fig.1 T3Y basic circuit 1 (same power for SW and load)

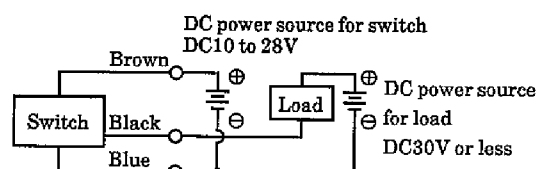
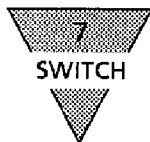


Fig.2 T3Y basic circuit 2 (separate power for SW and load)



2) Output circuit protection

- With an inductive load (relay, electromagnetic valve), surge voltage occurs when the switch is turned off. To protect the circuit, be sure to install a protection circuit shown in Fig. 3.
- With a capacity load (capacitor), rush current occurs when the switch is turned on. Be sure to install a protection circuit shown in Fig. 4.
- If the total length of the lead wires exceeds 10 m, be sure to install a protection circuit as shown in Fig. 5 and 6 (for T2Y※) and Fig. 7 (for T3Y※).

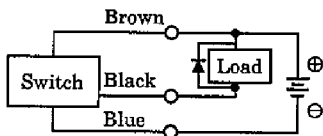


Fig.3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)

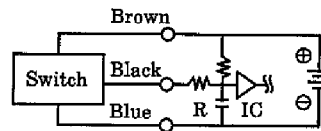


Fig.4 An example of using capacitor type load together with current regulating resistor R. Comply with the following formula to figure out required R.

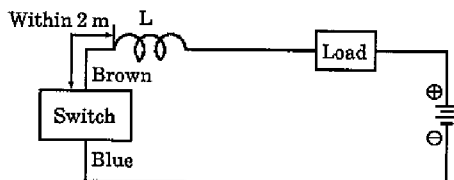
$$\frac{V}{0.10} = R(\Omega)$$


Fig.5 • Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
• Install it nearby the switch (within 2 m).

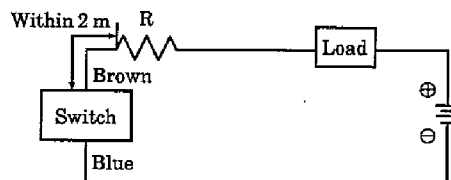


Fig.6 • Dash current restriction resistor
R = As much large resistor as the load circuit can afford.
• Install it nearby the switch (within 2 m).

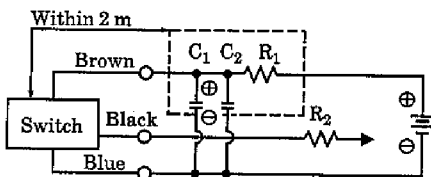
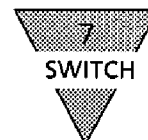


Fig.7

- Electric power noise absorptive circuit
C₁ = 20 to 50 μF electrolytic capacitor (withstanding 50V or more)
C₂ = 0.01 to 0.1 μF ceramic capacitor
- Dash current restriction resistor
R₁ = 20 to 30 Ω
R₂ = As much large resistor as the load circuit can afford.
- Install it nearby the switch (within 2 m).



3) Connection to programmable controller (sequencer)

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

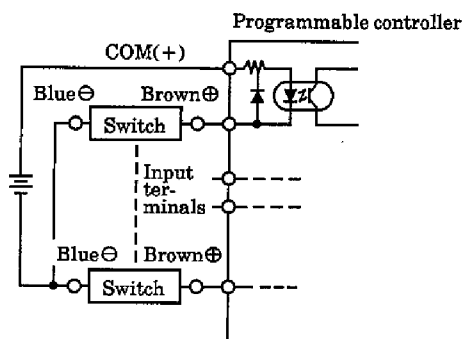


Fig. 8 An example of T2Y※ connection to source input type (an external power source)

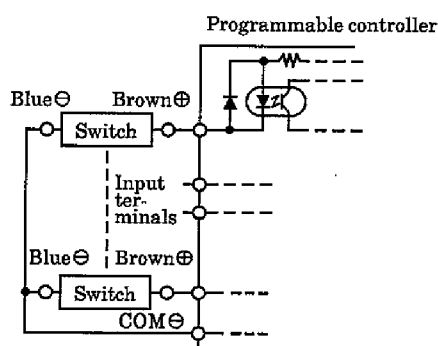


Fig. 9 An example of T2Y※ connection to source input type (an internal power source)

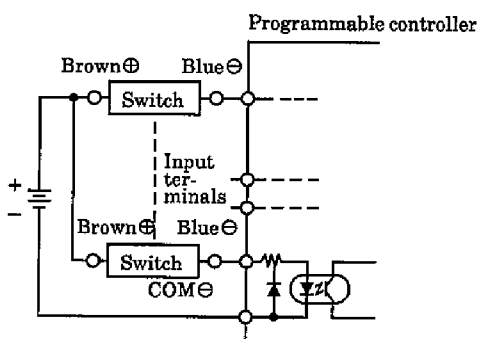


Fig. 10 An example of T2Y※ connection to sink input type

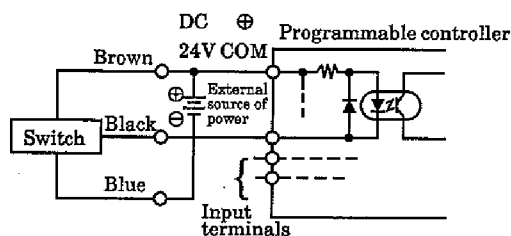


Fig. 11 An example of T3Y※ connection to source input type (an external power source)

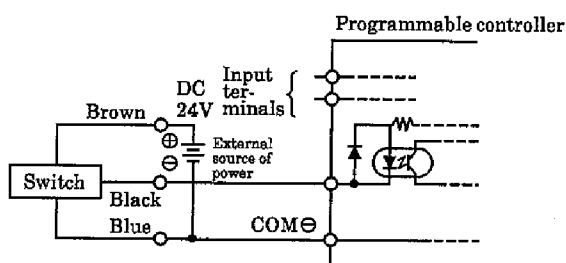
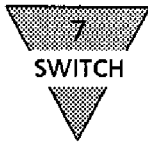
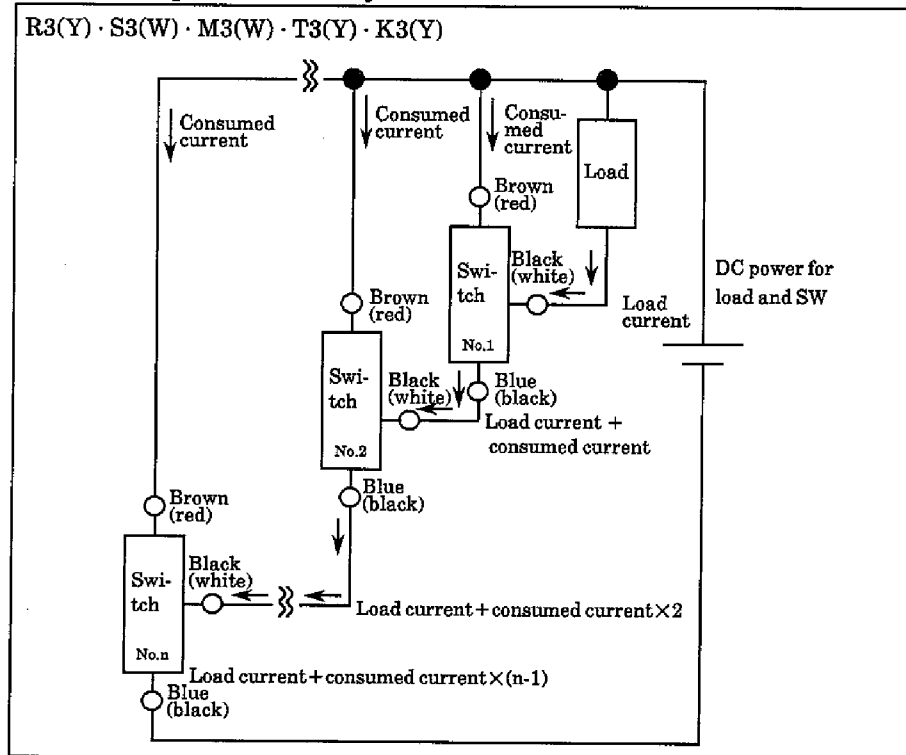


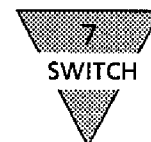
Fig. 14 An example of T3Y※ connection to source input type (an internal power source)
The T3Y※ switch cannot be connected to the sync. input sequencer.



4) Serial connection

- (1) When the T2Y※ are connected serially, the total voltage drop by these switches is the sum of the voltage drop at each of all these switches. The voltage that applies to the load side equals the power voltage minus the total voltage drops by the switches. Check the input specifications of the programmable controller, which is a load, in determining the connection quantity in determining the number of switches.
- (2) In serially connecting several 3-wire non-contact switches, the same principle as the 2-wire types above applies regarding the total voltage drops by switches. The amount of the current that runs through the switches is the sum of the current consumed by the switches and that consumed by the load. In determining the connection quantity, check the specifications of the load so that the current will not exceed the max. load current of the switch.
- (3) The lamp comes on only when all the switches are on.





5) Parallel connection

With the T2Y※ the amount of leak current increases by the number of switches connected. During the on-off interval of one switch, the voltage at both ends of the parallel switch drops to the internal voltage drop level, which is lower than the load voltage range, when the switch is turned on. Because of this, the other switches cannot be turned on. Check the input specifications of the programmable controller to be connected as a load.

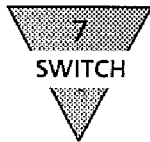
This is not the problem with the T3Y※. Their leak current increases by the number of switches connected, as in the case of the T2Y※ but the amount of the leak current is so small (less than 10 micro-amperes) that it does not affect the operation in any way. There is no problem of the lamp becoming dim or unable to be turned on.

6) Magnetic environment

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

7) Lead wire protection

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



7.4 Caution for Operation(contact switches:T0V, T0H, T5V, T5H)

1) Lead wire connection

Do not connect the lead wire of the switch directly to the power, but always insert a load serially. With the T0※, pay attention to the following ① and ②.

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

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

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

2) Contact capacity

Be sure that the use of load will not exceed the max. contact capacity of the switch. If the current level is smaller than the rated current value, the T0※ lamp may not come on.

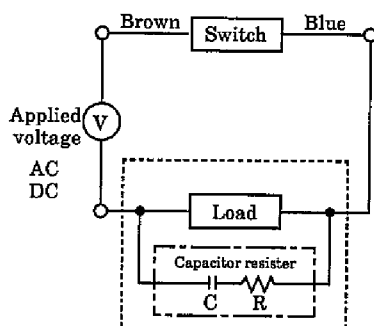
3) Contact protection

In using a relay or other inductive load, be sure to install the contact protection circuit as shown in Fig. 1 and Fig. 2 below.

If the total length of the wires exceed the figures of Table 1, install the contact protection circuit as shown in Fig. 3 and Fig. 4.

Table 1

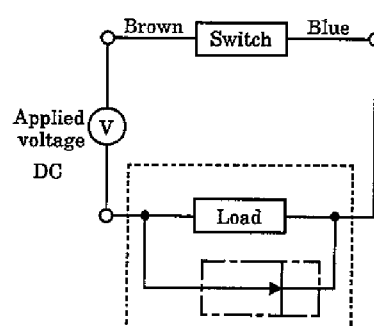
Voltage	Wire length
DC	50m
AC	10m



- [Dashed box] User circuit
 [Solid box] Protective circuit (Spark absorbing circuit)

Recommended value C (Capacitor) = 0.033 to 0.1 μ F
 R (Resistor) = 1 to 3k Ω
 XEB1K1 Okaya Denki Mfg. or equivalent

Fig. 1 When capacitor resistor is used.



- [Dashed box] User circuit
 [Solid box] Protective circuit

Rectifying diode, general use
 Hitachi Mfg. product V06C or equivalent

Fig.2 When diode is used.