Discontinue

CKD

SM－220291－A

# INSTRUCTION MANUAL

## SUPER RODLESS CYLINDER

## SRM

- 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 3rd edition

Discontinue

# For Safety Use

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

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

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

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

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

## ⚠ Precautions

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

# INDEX

SRM
Super Rodless Cylinder
Manual No. SM-220291-A



NOTE : Letters & figures enclosed within Gothic style bracket (examples such as [C2-4PP07] · [V2-503-B] etc. ) are editorial symbols being unrelated with contents of the book.

# 1. PRODUCT

## 1.1 Specifications

| Model code / Item | | SRM Standard · with switch | | | SRM-Q 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 φ25, 32, 40 0.15<br>Equivalent of φ63 0.1 | | | | | |
| Proof pressure MPa | | 1.05 | | | | | |
| Ambient temperature ℃ | | 5 to 60 | | | | | |
| Port size | Tube Bore | Equivalent of φ25 | Equivalent of φ32, 40 | Equivalent of φ63 | Equivalent of φ25 | Equivalent of φ32, 40 | Equivalent of φ63 |
| | 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.

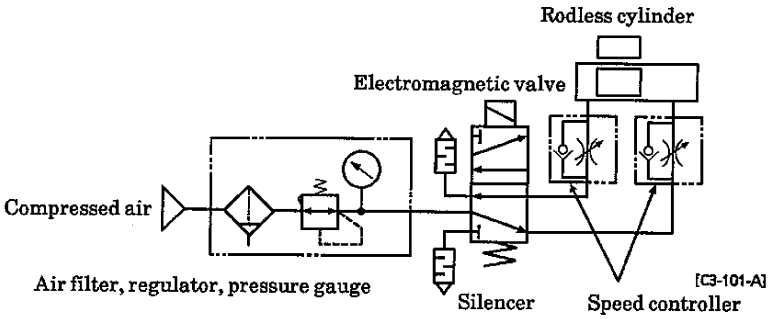
Note 2 : ① Reduce the speed of entering into the position locking unit to 500mm/s or less when operating the cylinder at a speed between 500mm/s and 1500mm/s.

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

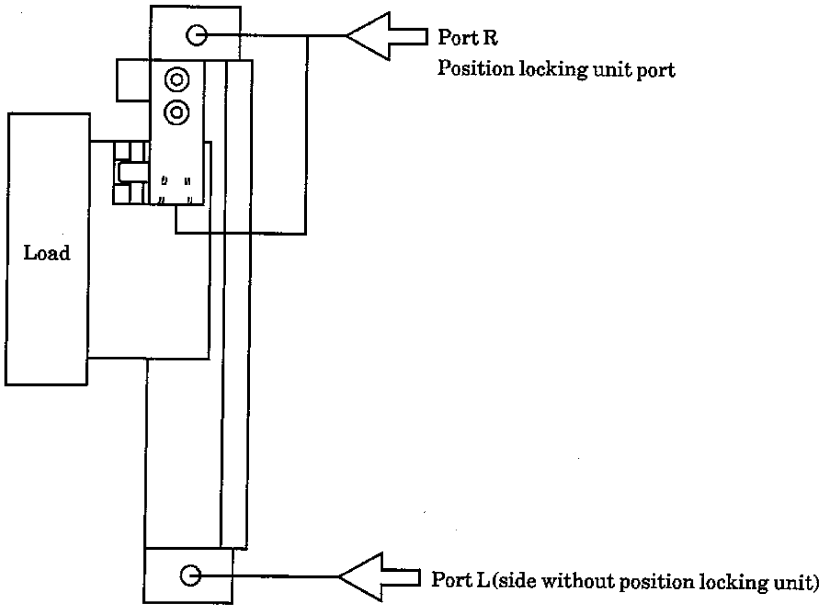
③ Regularly apply grease to the sliding portion of the lock lever.

## 1.2 Basic Circuit Chart

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



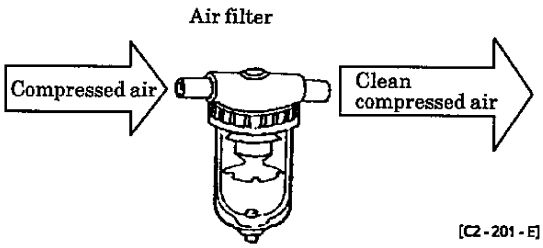

The model with the position locking mechanism requires an air pipe for linking with the position locking unit. Use a tee or other means to make the pipe branch off to the R side of the rodless cylinder and to the position locking unit.
(The circuit before the speed controller is the same as the above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



# 2. CAUTION

## 2.1 Operation Fluid(preferably 5$\mu$m or less)

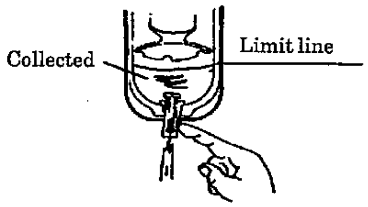
1) To obtain clean and air, make the compressed air go through an air filter first. In installing the filter within the circuit, take the following into consideration: filtering ability (5$\mu$m or smaller desirable), fluid volume, and installation position (near the direction-control valve).



[C2-201-E]

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

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.



[C2-201-F]

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

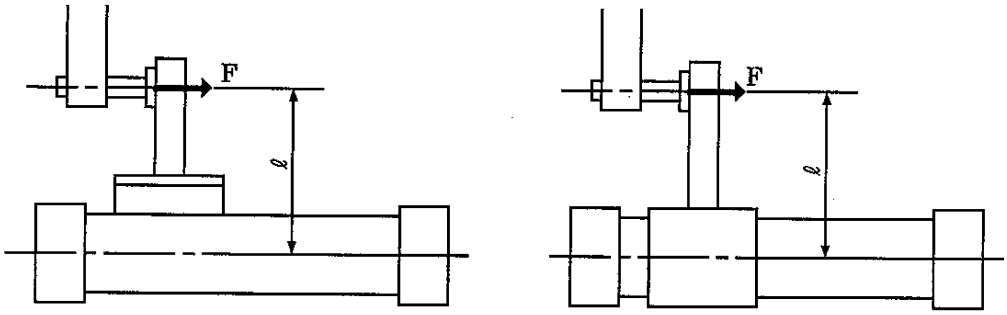
- The effect of the air cushion is adjusted at the plant before delivery. To adjust the effect according to the load, use the cushion needle.
  Loosening the needle (turning it counterclockwise) reduces the effect.
- When kinetic energy such as the load or speed is large, consider using a buffer device 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 】

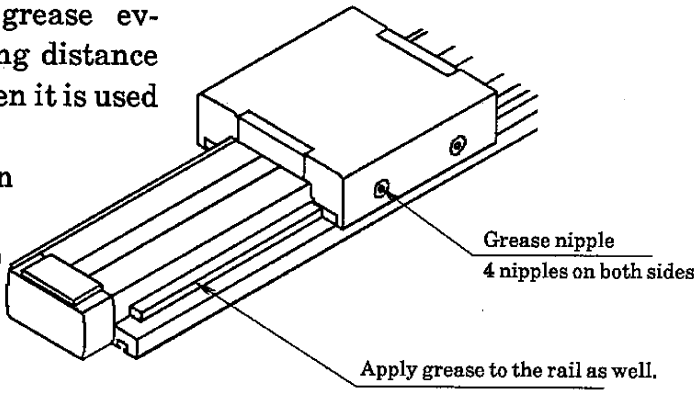



M1 = F·ℓ

M3 = F·ℓ
F : Cylinder thrust
ℓ : Distance from the center of cylinder to stopper

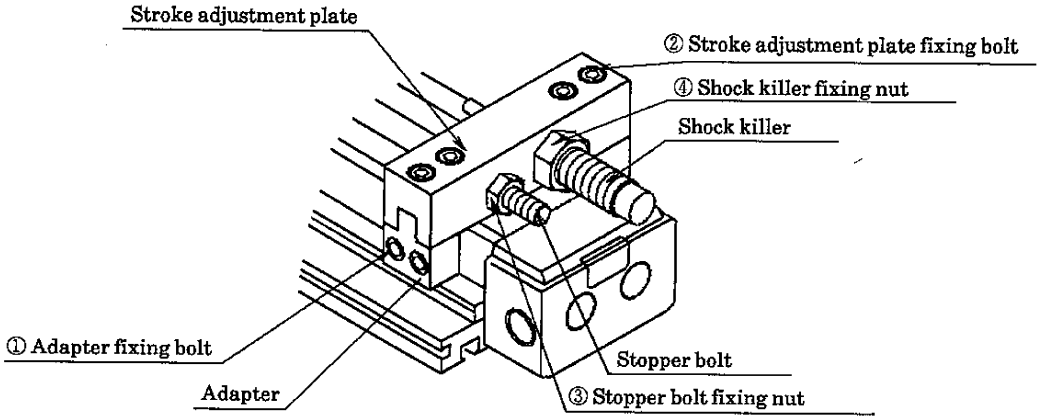
5) Guide

- 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

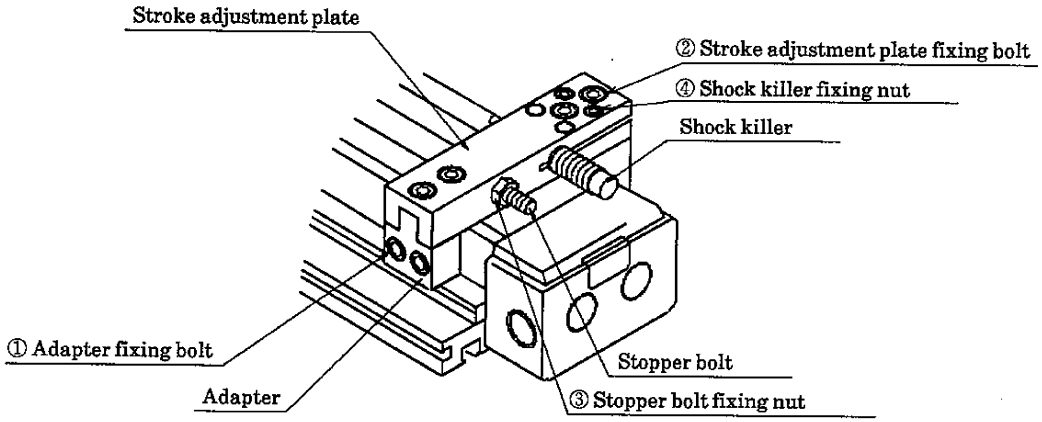



6) Unit adjustment for all stroke adjustment

- Full stroke adjustment, with standard shock absorber (SRM-※※-※※※-A1)




- Full stroke adjustment, with light load shock absorber (SRM-※※-※※※-E1)



(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 / Model | ① Adapter fixing bolt N · cm | ② Stroke adjustment plate fixing bolt N · cm |
|---|---|---|
| SRM-25 | 460 to 560 | 460 to 560 |
| SRM-32 | 460 to 560 | 460 to 560 |
| SRM-40 | 770 to 950 | 770 to 950 |
| SRM-63 | 1900 to 2400 | 1900 to 2400 |

- 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 (SRM-※※-A, A1, A2).

| Tightening torque / Model | ④ Stopper bolt fixing nut N · cm | ⑤ Shock killer fixing nut N · cm |
|---|---|---|
| SRM-25-A | 450 to 600 | 450 to 600 |
| SRM-32-A | 900 to 1200 | 750 to 1000 |
| SRM-40-A | 2200 to 3000 | 2200 to 3000 |
| SRM-63-A | 11000 to 14300 | 5500 to 7000 |

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

| Tightening torque / Model | ④ Stopper bolt fixing nut N · cm | ⑤ Shock killer fixing nut N · cm |
|---|---|---|
| SRM-25-E | 450 to 600 | 100 to 120 |
| SRM-32-E | 450 to 600 | 100 to 120 |
| SRM-40-E | 900 to 1200 | 230 to 280 |
| SRM-63-E | 2200 to 3000 | 460 to 560 |

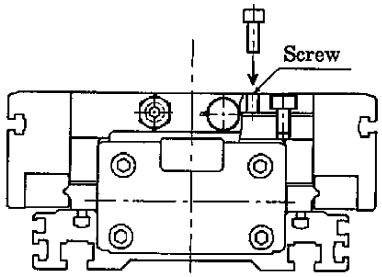
(4) Adjustment of the shock killer

●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 |
|---|---|
| SRM-25 | M3 |
| SRM-32 | M3 |
| SRM-40 | M4 |
| SRM-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 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)

$\omega$ : Cylinder load rate

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

(2) SRM 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 SRM shock absorber.

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

Table 5. Specifications

| Shock killer model / Item | | NCK-00-0.7-C | NCK-00-1.2 | NCK-00-2.6 | NCK-00-7 | NCK-00-12 |
|---|---|---|---|---|---|---|
| Classification | | No adjuster, spring return type | | | | |
| Max. absorption energy MPa | | 7 | 12 | 26 | 70 | 120 |
| Stroke mm | | 8 | 10 | 15 | 20 | 25 |
| Absorption energy per hour J | | 12,600 | 21,600 | 39,000 | 84,000 | 86,400 |
| Max. collision speed m/s | | 1.5 | 2.0 | | 2.5 | 3.0 |
| Max. repetition frequency count/min | | 30 | | 25 | 20 | 12 |
| Ambient operation temp. ℃ | | 5 to 60 | | | | |
| 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 SRM 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) |
| SRM-25 | NCK-00-1.2 | NCK-00-0.7-C |
| SRM-32 | NCK-00-2.6 | NCK-00-1.2 |
| SRM-40 | NCK-00-7 | NCK-00-2.6 |
| SRM-63 | NCK-00-12 | NCK-00-7 |

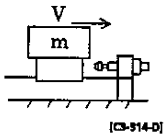
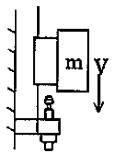
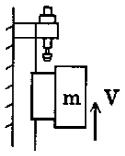
(4) Adjustment of the shock killer

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 Me and collision energy E and check that Me 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.

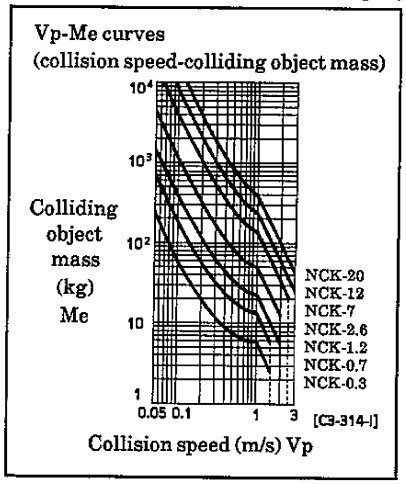
Note that the tolerable ranges of Me and E vary depending on the speed of collision.

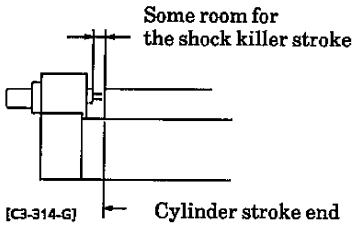
| | Horizontal move | Vertical descent | Vertical ascent |
|---|---|---|---|
| Examples |   [C3-314-D] |   [C3-314-E] |   [C3-314-F] |
| Colliding mass Me (kg) | $Me=m+\frac{2F\cdot St}{V^2}$ | $Me=m+\frac{2\cdot St(F+mg)}{V^2}$ | $Me=m+\frac{2\cdot St(F-mg)}{V^2}$ |
| Collision energy E (J) | $E=\frac{mV^2}{2}+F\cdot St$ | $E=\frac{mV^2}{2}+(F+mg)\cdot St$ | $E=\frac{mV^2}{2}+(F-mg)\cdot St$ |

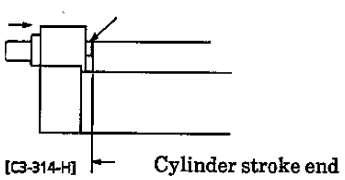
● Signs

| | | |
|---|---|---|
| E | : Collision energy | J |
| Me | : Colliding mass | kg |
| m | : Work mass | kg |
| F | : Cylider thrust | N |
| V | : Collision speed | (m/s) |
| St | : Shock killer stroke | (m) |
| g | : Gravity acceleration | 9.8(m/s²) |

Fig. 1 Tolerable range of colliding object mass




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

(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 SRM cylinders with shock absorber

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

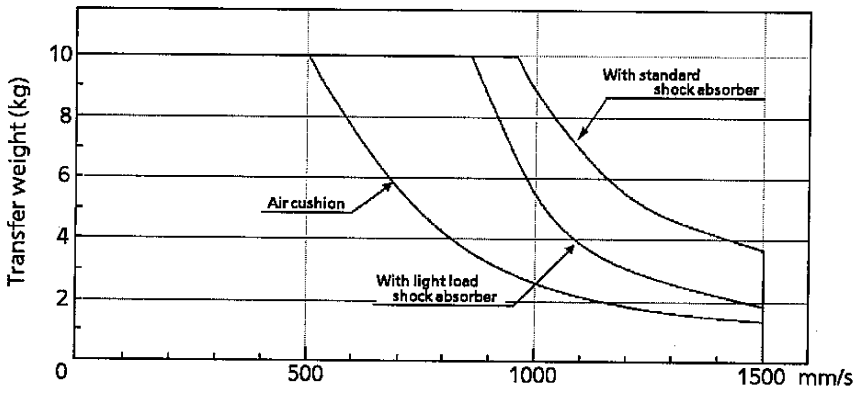
(7) Transfer weight – speed characteristic of cylinder with cushion and shock absorber

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 SRM cushion and shock absorber】

In the case of SRM-25

In horizontal move at 0.4MPa

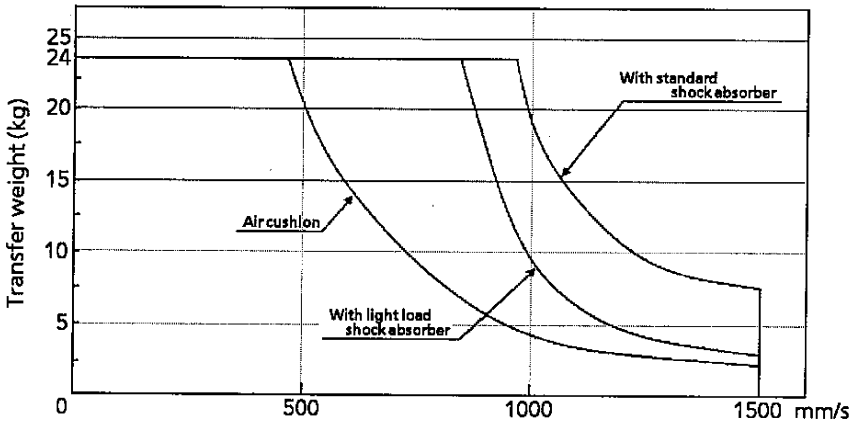


Discontinue



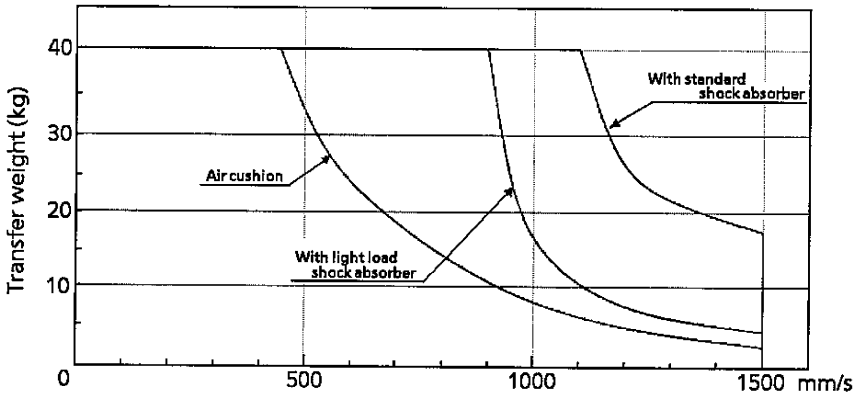
In the case of SRM-32

In horizontal move at 0.4MPa



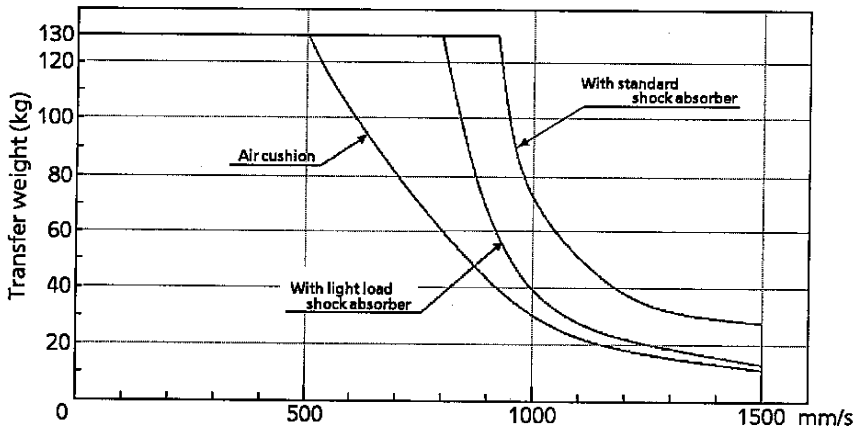

In the case of SRM-40

In horizontal move at 0.4MPa




In the case of SRM-63

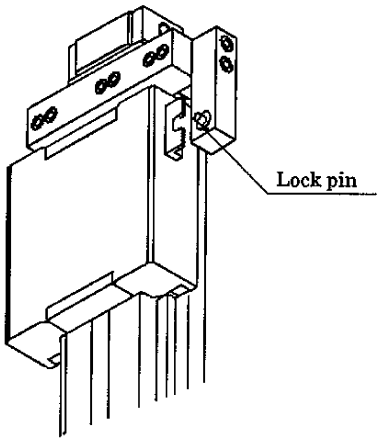
In horizontal move at 0.4MPa



8) Precautions for operating cylinder with position locking function

(1) Manual release

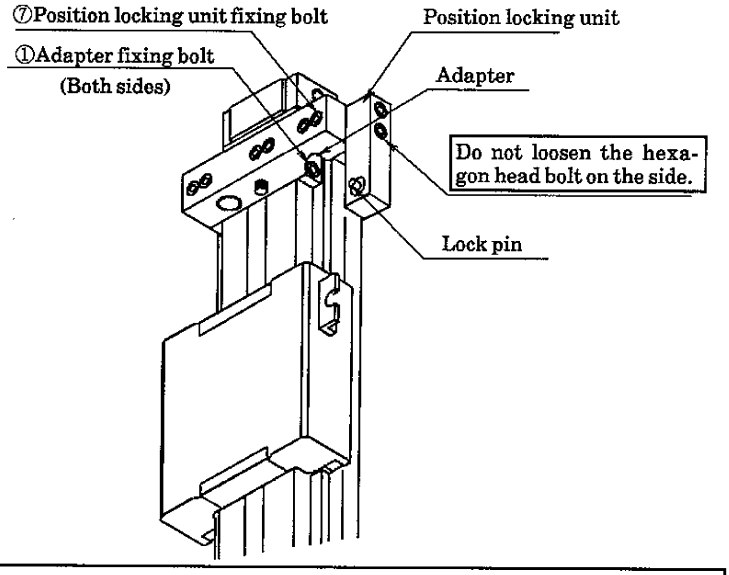
Using a bar, push the lock pin out of the position locking unit. Before releasing the lock, supply pressure to port L to unload the locking unit. If pressure is supplied to Port R while both Port R and Port L are ventilated and the piston is locked, the lock will be released to eject the table with such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

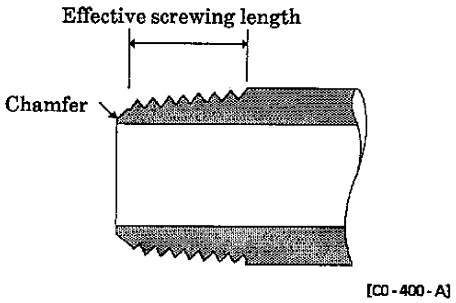
  The stroke adjustment unit may slip out of position if the bolt is tightened to a torque lower than the specified value.

| Model | ① Adapter fixing bolt tightening torque<br>⑦ Position locking unit fixing bolt tightening torque<br>N · cm |
|---|---|
| SRM-Q-25 | 460 to 560 |
| SRM-Q-32 | 460 to 560 |
| SRM-Q-40 | 770 to 950 |
| SRM-Q-63 | 1900 to 2400 |

# 4. INSTALLATION

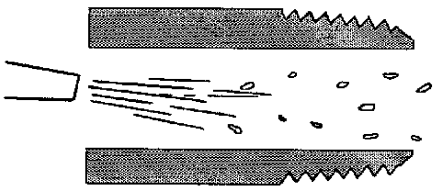
## 4.1 Piping

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.

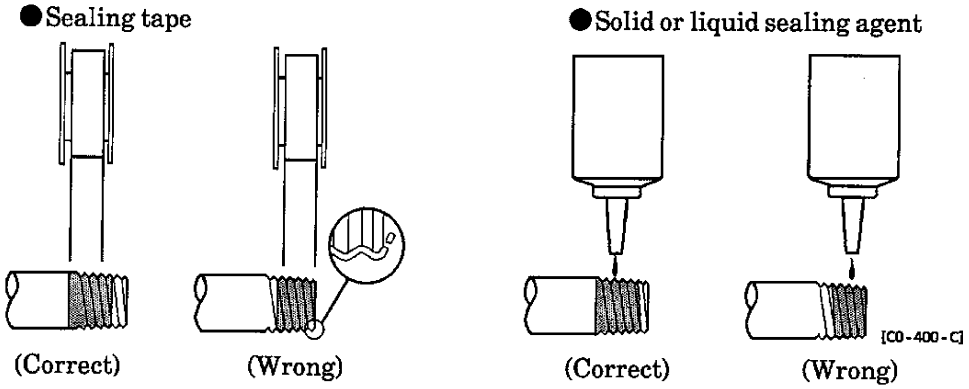


[C0-400-A]

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


[C0-400-B]

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



[C0-400-C]

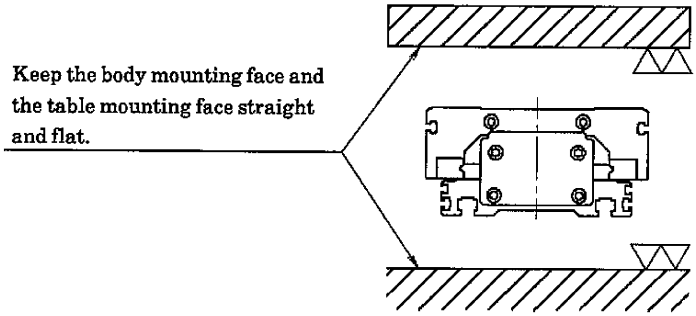
## 4.2 Installation

1) The larger the cylinder size, the heavier its weight. Since the SRM-40 and the SRM-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 |
|---|---|
| SRM-40B-2000 | Approx. 30kg |
| SRM-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.

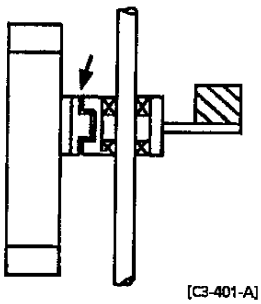



3) Operate this cylinder at the ambient temp. of 5 to 60 °C.

4) Be careful not to bump the cylinder tube against an object. The tube, when distorted, causes malfunction.

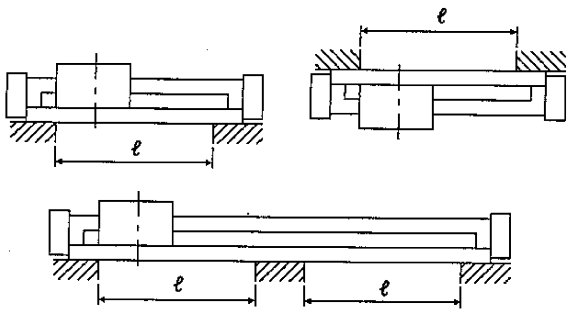
5) When using the guide, be sure that the cylinder and the guide are set in such a way that the center shift between them can be absorbed.

If the guide is directly fixed to the cylinder, the shift of the center will put excessive pressure on the cylinder and causes malfunction.


[C3-401-A]

6) Intervals between supports

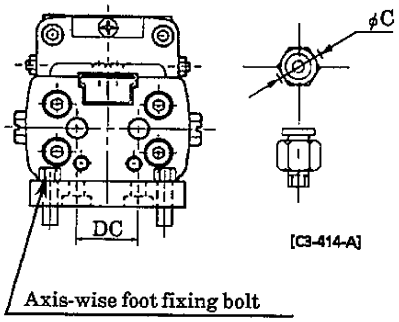
The deflection of the tube becomes large if the stroke is long and the load or bending moment is large. Hold the tube at the intervals specified in the table below.




| Model | Recommended support interval (ℓ) mm |
|---|---|
| SRM-25 | 400 |
| SRM-32 | 400 |
| SRM-40 | 500 |
| SRM63 | 600 |

## 4.3 Piping Ports

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



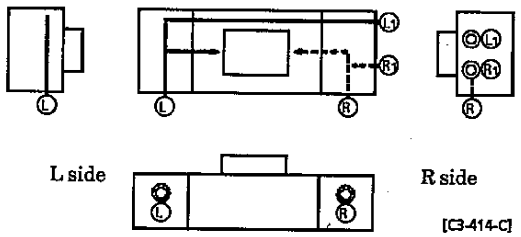

[C3-414-A]

| Item | Port position | Outer diameter of usable joint φC |
|---|---|---|
| Tube bore (mm) | DC | OO |
| φ25 | 26 | 26 or less |
| φ32 | 27 | 27 or less |
| φ40 | 35 | 35 or less |
| φ63 | 39 | 39 or less |

2) Piping port position and operation direction

Tube bores φ25 to φ63

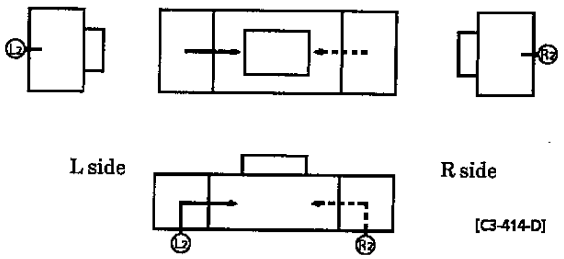
● Option markings (no marking, R, B, T)




[C3-414-C]

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

● Option markings (D, S for bottom piping)



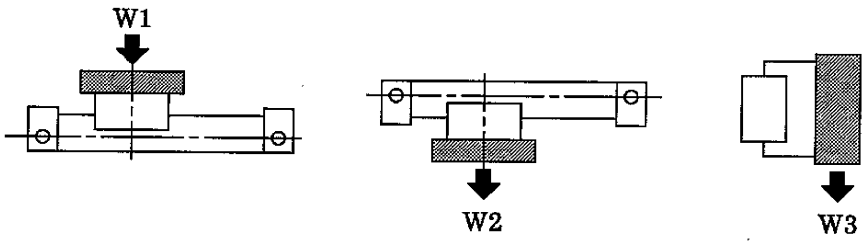

[C3-414-D]

® indicates the R-side pressure port, and Ⓛ the L-side pressure port.
No piping available except for $(R_2)$ and $(L_2)$ as there are no other ports.

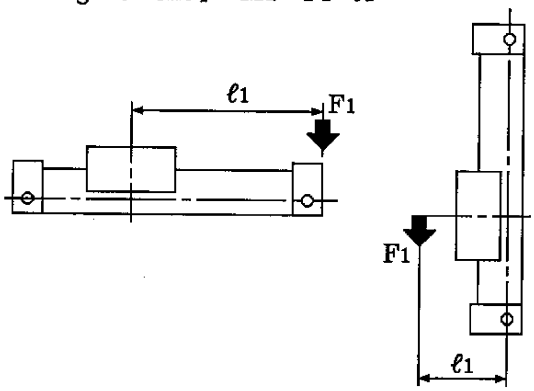
## 4.4 Expression for Calculating Each Moment

【 Vertical load 】

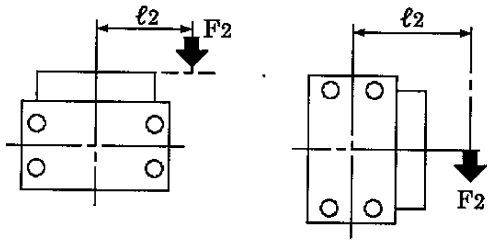
<W1 (upward)> <W2 (downward)> <W3 (transverse)>



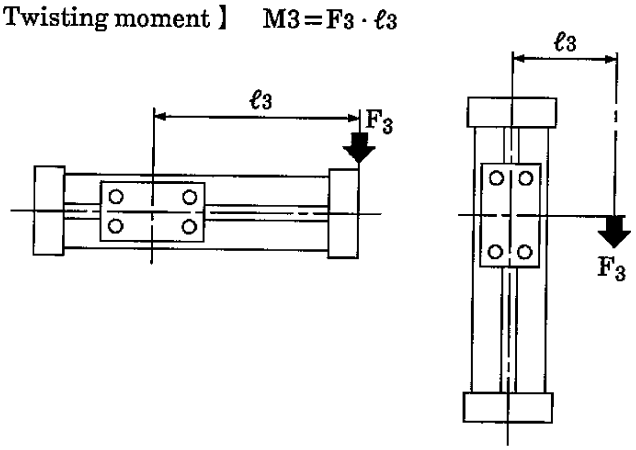

【 Bending moment 】 $M1 = F1 \cdot \ell 1$




【 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 SRM-25 and SRM-32

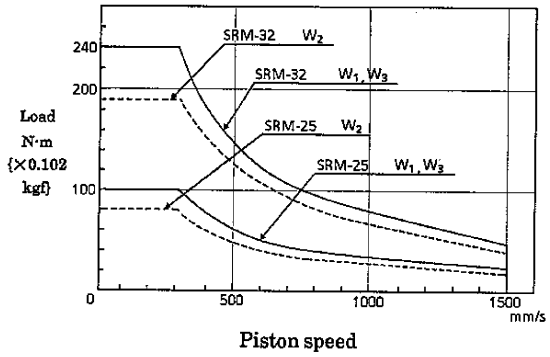



Fig. 2
Allowable loads for W1, W2 and W3 of SRM-40 and SRM-63

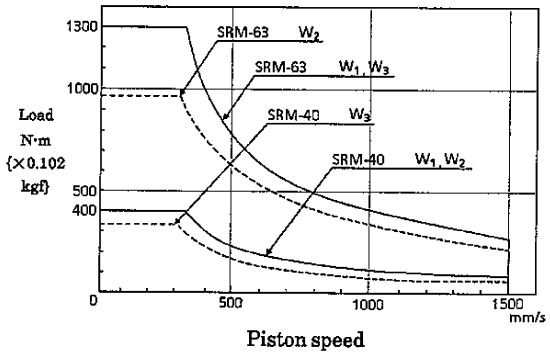



Fig. 3
Allowable loads for M1 and M3 of SRM-25 and SRM-32

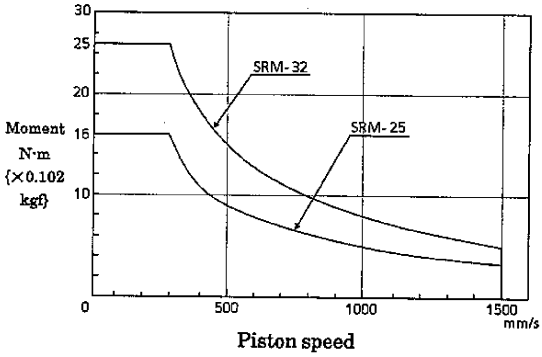



Fig. 4
Allowable loads for M1 and M3 of SRM-40 and SRM-63

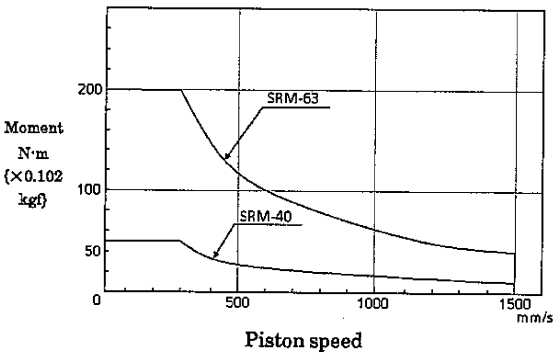



Fig. 5
Allowable loads for M2 of SRM-25 and SRM-32

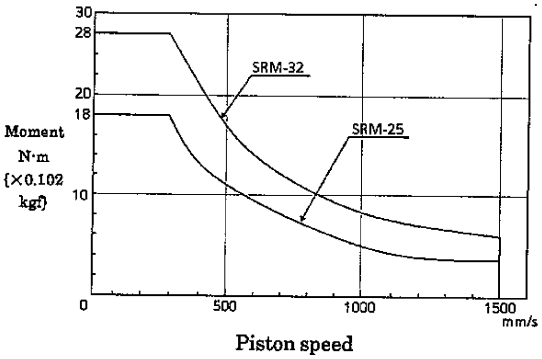
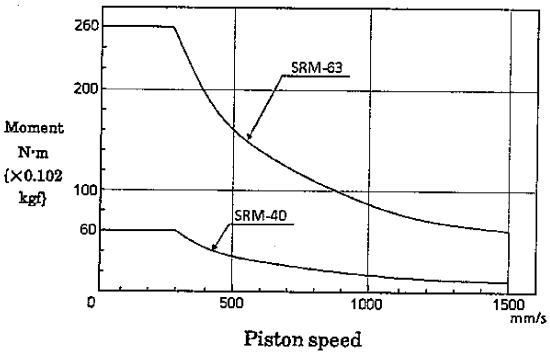



Fig. 6
Allowable loads for M2 of SRM-40 and SRM-63




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

$$\frac{W}{Wmax'} + \frac{M_1}{M_1max'} + \frac{M_2}{M_2max'} + \frac{M_3}{M_3max'} \leqq 1.0$$

Wmax', M1max', M2max', M3max' : 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 dustproof 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

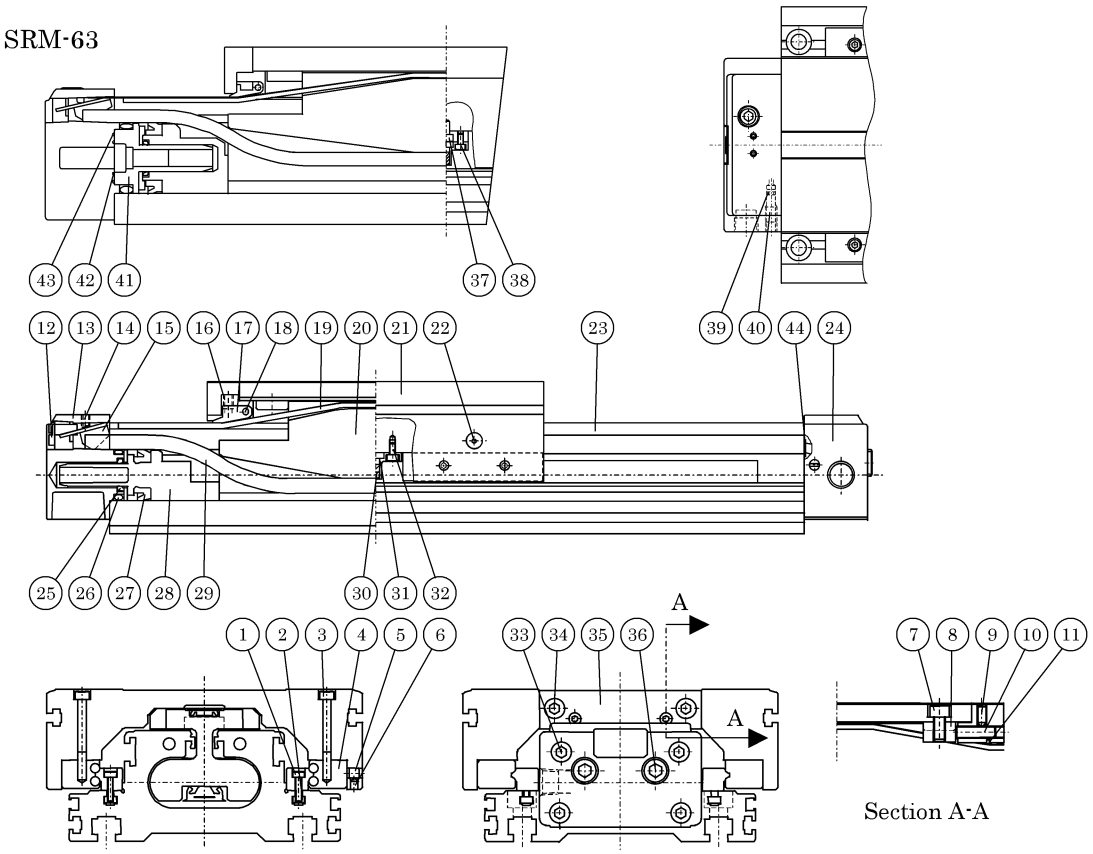
| Troubles | Causes | Measures |
|---|---|---|
| Does not operate | Absence or lack of pressure | Secure the pressure source |
| | No signal for the direction control valve | Correct the control circuit |
| | Incorrect mount centering | Correct the fitting |
| | Damaged piston packing | Replace the packing |
| | Damaged seal belt | Replace the belt |
| Jerky movement | Incorrect mount centering | Correct the fitting |
| | Excessive moment | Set the guide,<br>correct fitting |
| | Large load | Increase pressure or tube bore<br>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<br>(set external cushion mechanism) |
| | Excessive moment | Set the guide,<br>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).<br>Check if the lead wire is bent too much, causing a short circuit inside (Switch replacement) |
| | Switch is mechanically damaged. | Replace the Switch,<br>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 (SRM)

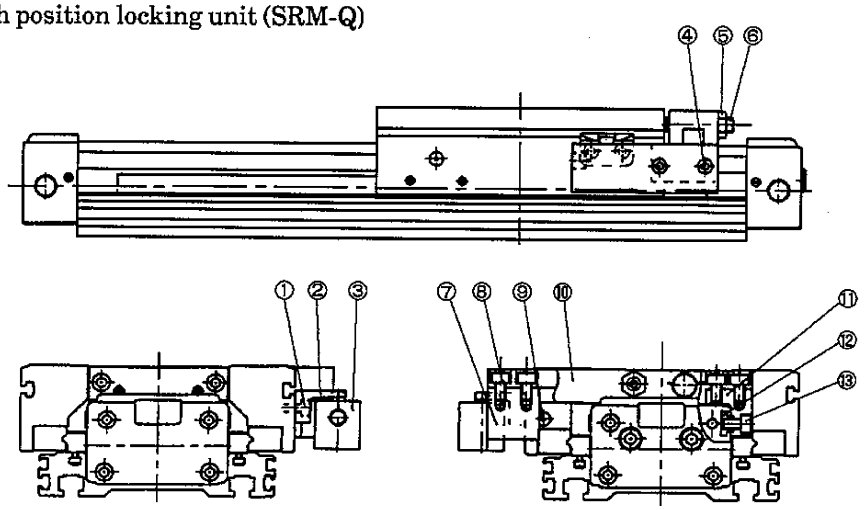
SRM-63



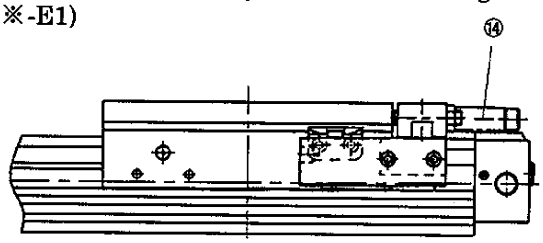

| No. | Part name | Material | No. | Part name | Material |
|---|---|---|---|---|---|
| 1 | Hex. head bolt | Alloy steel | 23 | Cylinder tube | — |
| 2 | Nut rail | Steel | 24 | Cover (R) assembly | — |
| 3 | Hex. head bolt | Alloy steel | 25 | Cushion packing | Urethane rubber |
| 4 | High-accuracy 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 |
| | | | 42 | Cushion ring gasket (1) | Nitrile rubber |
| 20 | Yoke | Aluminum alloy | 43 | Cushion ring gasket (2) | Nitrile rubber |
| 21 | Table | Aluminum alloy | 44 | O ring | Nitrile rubber |
| 22 | Grease nipple (ball cup) | Aluminum alloy | | | |

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

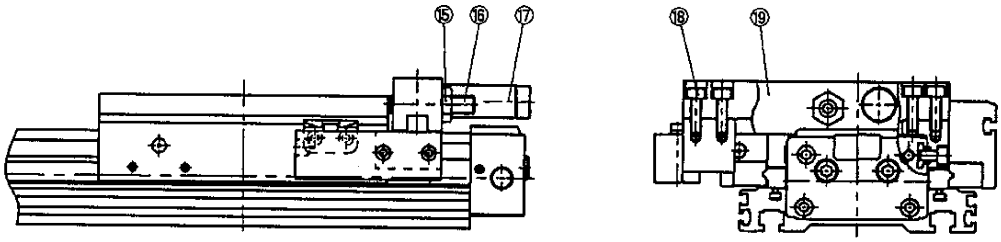
● With position locking unit (SRM-Q)




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




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



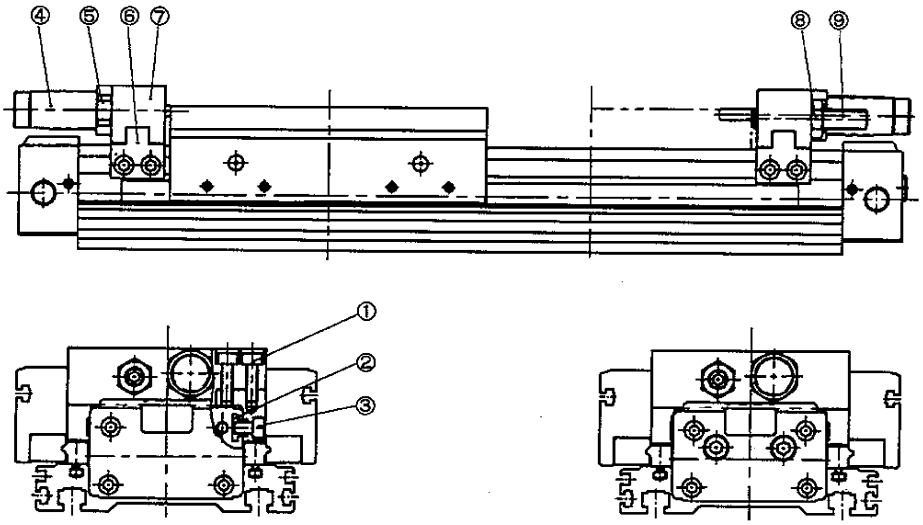

| No. | Part name | Material |
|---|---|---|
| 1 | Hex. head bolt | Alloy steel |
| 2 | Lock lever | Alloy steel |
| 3 | Position locking unit assembly | |
| 4 | Hex. head bolt | Alloy steel |
| 5 | Hex. nut | Steel |
| 6 | Hex. cap set screw | Alloy steel |
| 7 | Fixing block | Aluminum alloy |
| 8 | 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 |

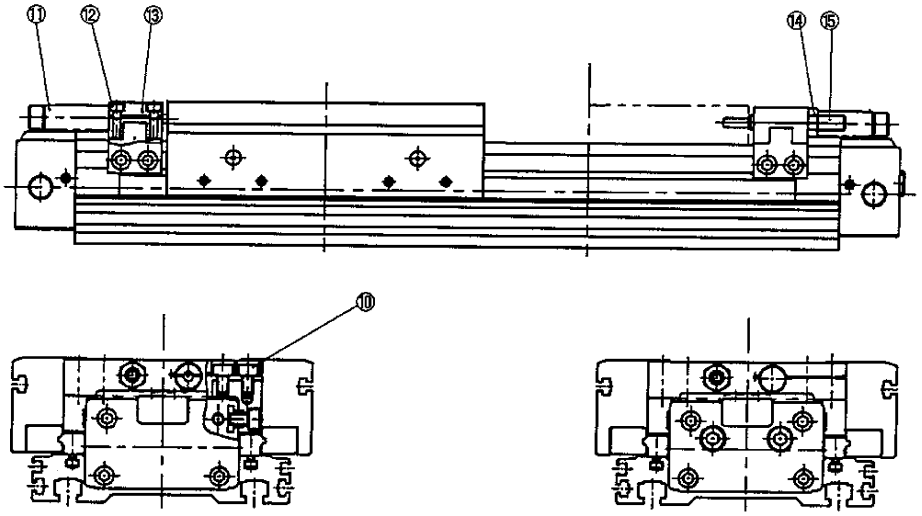
※ The SRM-Q-25 is not equipped with a grease nipple.

## ● Inside structure drawing of cylinder with full stroke adjustment unit and parts list

### • With full stroke adjustment unit and standard shock absorber (SRM-※※-※※※-A)




### • With full stroke adjustment unit and light load shock absorber (SRM-※※-※※※-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 (SRM)

| Tube bore (mm) | Kit No. | ⑪ Dust wiper | ⑲ Dust-proof belt | ㉕ Cushion packing | ㉖ Cylinder gasket | ㉗ Piston packing |
|---|---|---|---|---|---|---|
| ϕ25 | SRM-25K-※ | F4-261251 | F4-261261-※ | F4-670392 | P-22-A | F3-222049 |
| ϕ32 | SRM-32K-※ | F4-261252 | F4-261262-※ | F4-670393 | P-29 | F3-222050 |
| ϕ40 | SRM-40K-※ | F4-261253 | F4-261263-※ | F4-670394 | P-38 | F3-222051 |
| ϕ63 | SRM-63K-※ | F4-261255 | F4-261265-※ | F4-670395 | P-58 | F3-222053 |

| Tube bore (mm) | Kit No. | ㉙ Seal belt | ㉚ Needle gasket | ㊷ Cushion ring gasket (1) | ㊸ Cushion ring gasket (2) | ㊹ O ring |
|---|---|---|---|---|---|---|
| ϕ25 | SRM-25K-※ | F3-261256-※ | 1.15×1.00 | — | — | 4.57×1.02 |
| ϕ32 | SRM-32K-※ | F3-261257-※ | 1.15×1.00 | — | — | 5.79×1.02 |
| ϕ40 | SRM-40K-※ | F3-261258-※ | 2.00×1.25 | — | — | 6.50×1.00 |
| ϕ63 | SRM-63K-※ | F3-261260-※ | 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.

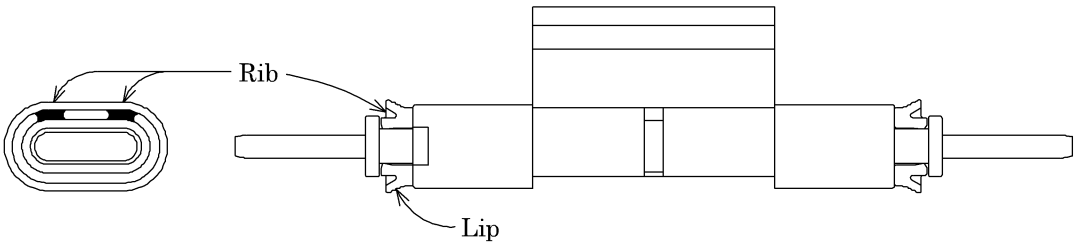
Recommended grease: Daphne Eponex No.1 Idemitsu Kosan
Duplex No.1 Kyodo Resin

(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.

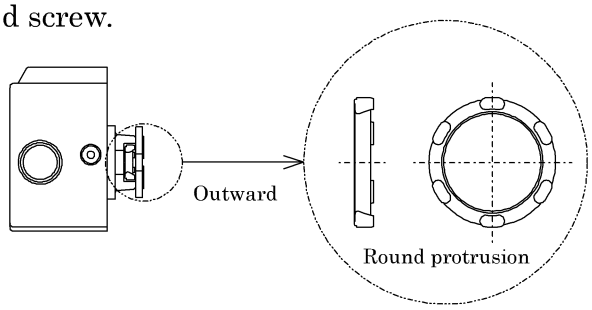



Note: Fitting the piston packing ㉗ to the single piston yoke Ass' y unit will make it difficult to mount the piston yoke Ass' y and the seal belt ㉙ on the cylinder ㉓. To avoid this inconvenience, follow 3) Assembly procedures of the standard SRL2 described the next page.

(2) Cushion packing replacement

● SRM-25 to 40

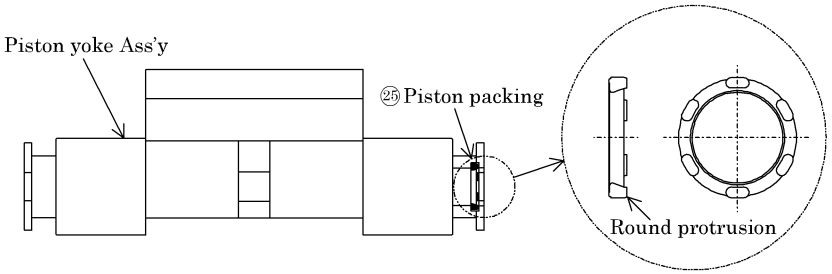
The cushion packing ㉕ should be set in the proper direction. Be sure that the round protrusion faces outward (the protrusion is visible), and, with the cover ⑬ in place, fit the cushion adaptor to the cover and fasten the cross-recessed screw.




● SRM-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).

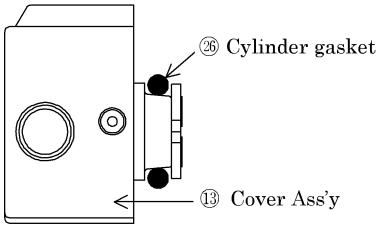
Next, fit a new cushion packing into the groove. The round protrusion should be on the out side.




(3) Cylinder gasket replacement

● SRM-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).



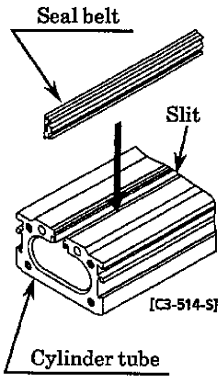
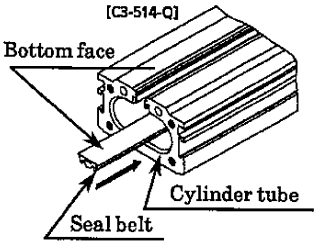
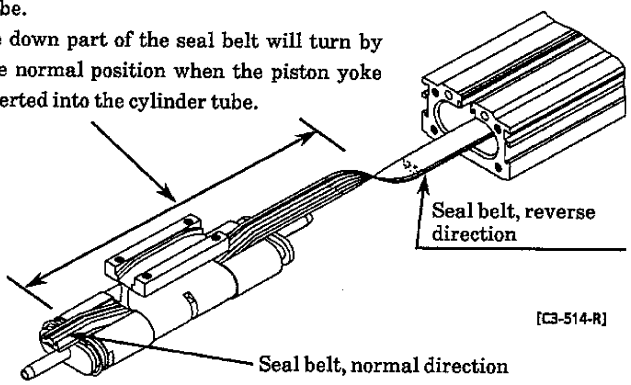

● SRM-63

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.

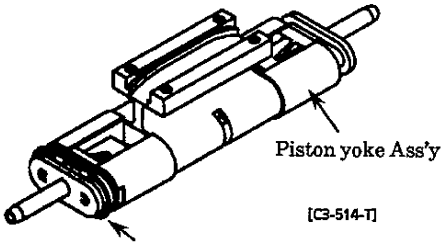
Fit the cushion ring ㊶ and fasten the cross-recessed screw.

### 3) Assembly procedures

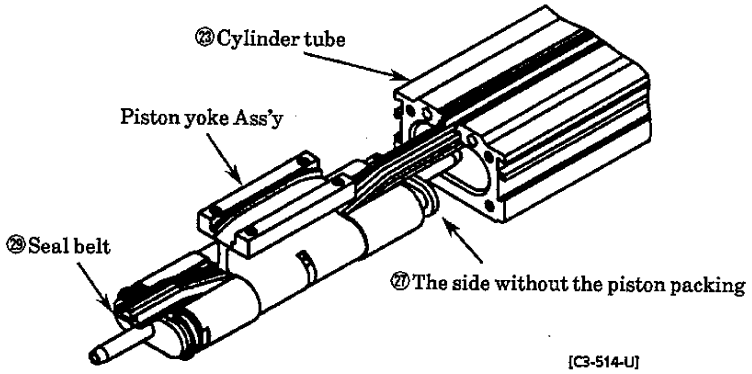
#### (1) Insert the seal belt into the cylinder tube.

| Cylinder stroke | Assembly procedures |
|---|---|
| 2 m or less |  Insert the seal belt through the slit of the cylinder tube. |
| Over 2 m |  Turn the seal belt upside down and insert it.<br>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.<br>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.<br>  |

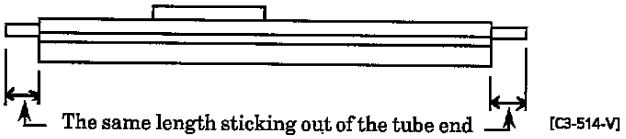
(2) Mount one piston packing ㉗ onto the piston yoke Ass'y . (Fit the packing in the proper direction. Refer to 2) Repair kits replacement procedures, (1) Piston packing replacement.)



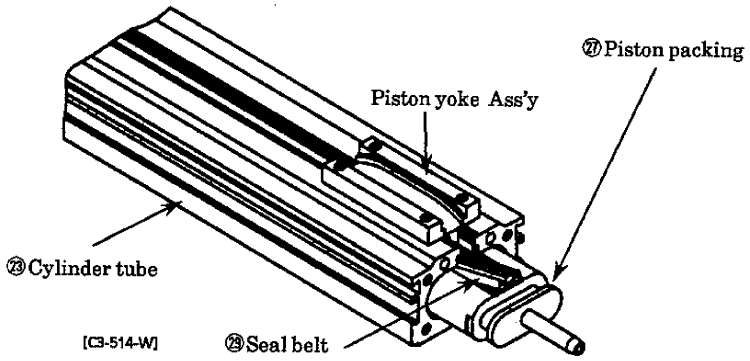

(3) Insert the seal belt ㉙ into the piston yoke Ass'y ㉗. Be sure that the side of the piston yoke Ass'y without the piston packing faces the cylinder tube ㉓, and that the flat side of the seal belt faces downward.



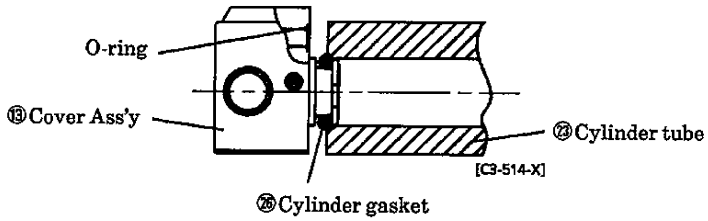

(4) Insert the piston yoke Ass'y together with the seal belt ㉙ into the cylinder tube ㉓. Adjust the seal belt position so that the same length of the belt sticks out of the either end of the cylinder tube.




(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 ㉗ into the groove, as illustrated below.

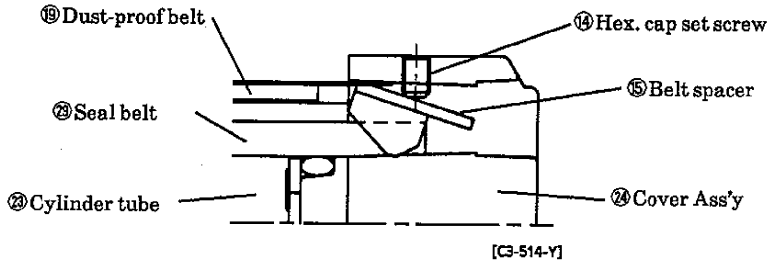


(6) Push the piston yoke Ass'y back into the center of the cylinder tube. Next, attach the cover Ass'y ⑬ to the cylinder tube and secure it by the hex. head bolt ㉝. Be careful not to pinch the cylinder gasket ㉖ between the cover Ass'y and the cylinder tube. Do not lose the O-ring.




(7) Set the dust-proof belt ⑲ in the cylinder ㉓ 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 ⑮ through the window of the cover Ass'y ㉔ (the side onto which one end of the dust-proof belt ⑲ has been inserted), push it until its end hits the end face of the cylinder tube ㉓. Fasten it by the hex. cap set screw.




(9) Push the dust-proof belt ⑲ through the slit of the cylinder tube ㉓ from the side fastened by the belt spacer ⑮, and insert the opposite end into the gap between the cylinder tube and the cover Ass'y ㉔. 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 ⑮ through the cover Ass'y ㉔ window and secure the dust-proof belt ⑲ in the same manner as (9) above.

(12) Fit the belt cover ⑫ into the cover Ass'y ㉔.

Discontinue



# 6. HOW TO ORDER

•No switch

SRM – 25 B – 500 ——————— A

•With switch

SRM – 25 B – 500 – TOH※ – R – A

ⓐ ⓑ ⓒ ⓓ ⓔ ⓕ

| Basic models | | ⓐ Tube bore (mm) | | ⓑ Cushion | | ⓒ Stroke (mm) | | |
|---|---|---|---|---|---|---|---|---|
| SRM | Standard | 25 | φ 25 | B | Both side cushion | Standard stroke | | Max. stroke |
| SRM-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 | |
| | | | | | | 300 | 300 1200 | |
| | | | | | | 400 | 400 1300 | φ25, φ32 : 1000 |
| | | | | | | 500 | 500 1400 | |
| | | | | | | 600 | 600 1500 | |
| | | | | | | 700 | 700 1600 | φ40, φ63 : 2000 |
| | | | | | | 800 | 800 1700 | |
| | | | | | | 900 | 900 1800 | |
| | | | | | | 1000 | 1000 1900 | |
| | | | | | | | 2000 | |

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

| ⓓ 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 | | 2-color display |
| T3YH | TY3V | Relay, PC, IC circuit, small electromagnetic valve | | 3-wire | 3-color display |
| T2YD | | PC | | 2-wire | 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) |

| ⓔ No. of switches | |
|---|---|
| R | R side 1 SW |
| L | L side 1 SW |
| D | 2 SW |
| T | 3 SW |
| 4 | 4 SW |
| 5 | 5 SW |

For four or more switches, indicate the number by numeral.

| ⓕ Option, accessory | |
|---|---|
| A | All stroke adjustment both sides, with shock killer |
| A1 | All stroke adjustment R side only, with shock killer |
| A2 | All stroke adjustment L side only, with shock killer |
| A3 | All stroke adjustment to be fitted later (φ12 to φ25, note 5) |
| E | All stroke adjustment on both sides, with light load shock absorber |
| 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 |
| 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) |



[SM-220291-A]

Discontinue

6
HOW TO ORDER

- Shock killer unit marking

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

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

SRM — Tube bore — ※

(Specify A1 or E1 in the section indicated by ※)

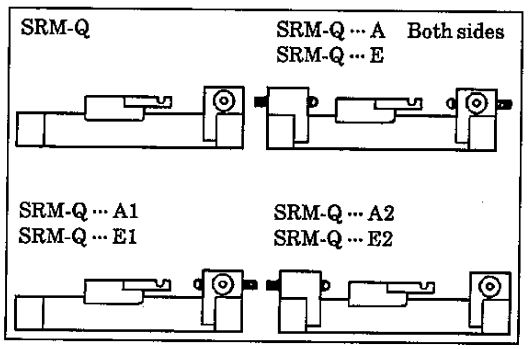
- Repair kits marking

SRM — 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. When the cylinder switch is not specified (no mark), a cylinder equipped with a reed switch will be delivered.

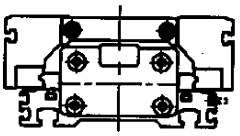
Note 5 : Port R (common port) is available only in 25 mm, 32 mm and 40 mm diameter sizes. The cylinder with a 63-mm-diameter common port will be out soon.

# 7. CAUTION FOR OPERATING CYLINDER SW

## 7.1 Common Characteristics of Contact and Non-contact Cylinder Switches

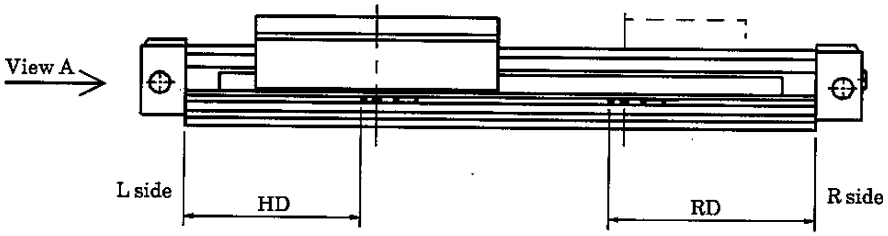
1) The cylinder switches were set at the position (for max. sensitivity) as indicated in the table below at the time of their shipment. Before operation, however, it is recommended to check the position of each switch. If the switch and the cylinder have been purchased separately, or if another switch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

View A

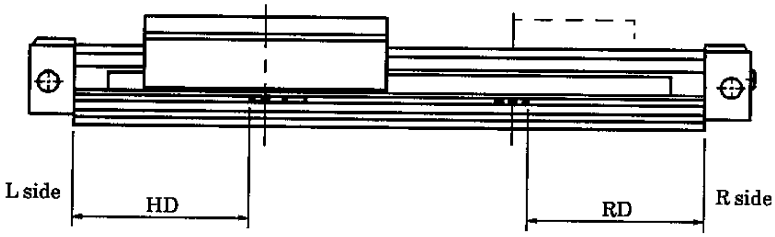


| Marking / Model | HD | RD |
|---|---|---|
| SRM-25 | 87.5 | 108.5 |
| SRM-32 | 95.5 | 116.5 |
| SRM-40 | 120.5 | 141.5 |
| SRM-63 | 176.5 | 197.5 |

● 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

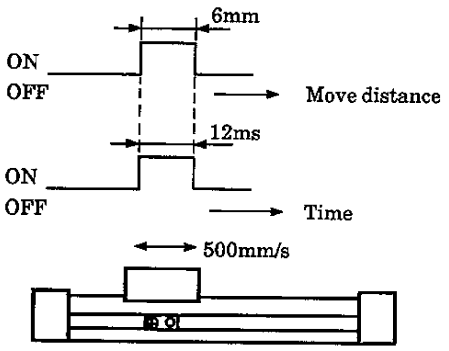
Move the switch and fasten it where the green light comes on (max. sensitivity point).

- 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)?



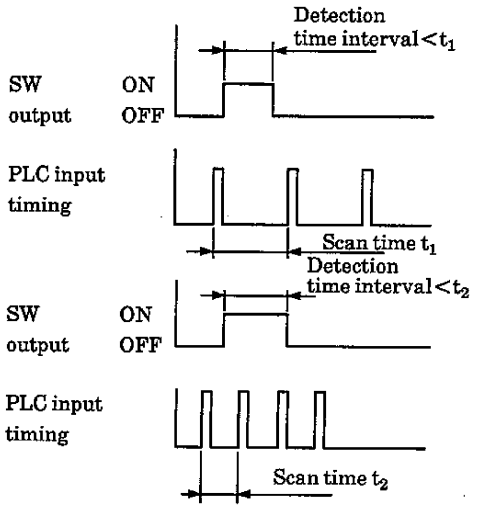

[C3-701-C]

◦ The cylinder switch has the response speed of faster than 1ms, but the detection t 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).



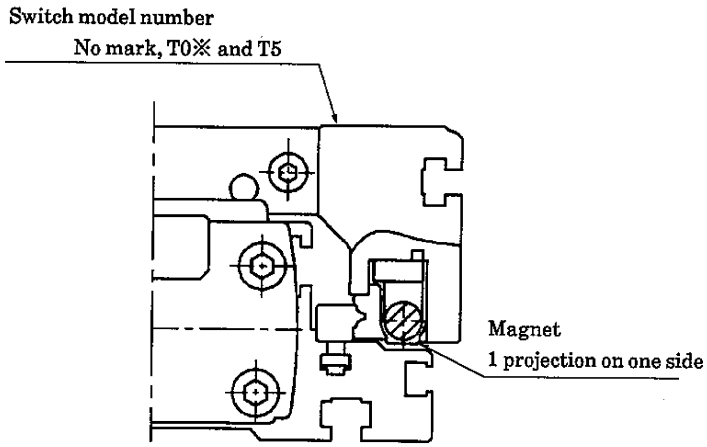

[C3-701-D]

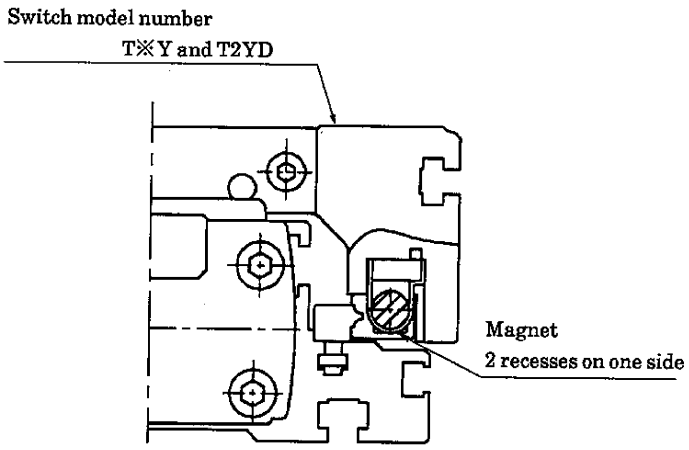
- The table below shows the operation ranges of the switches.

| 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.

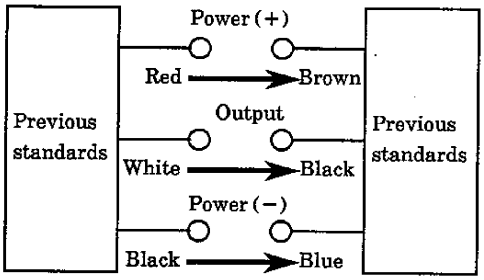


## 7.2 Caution for Operation (cylinder switch)

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.

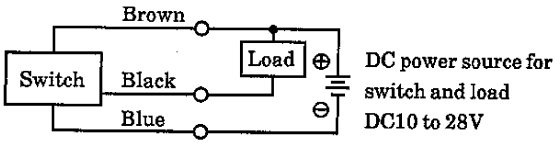



Fig.1 T3Y basic circuit 1 (same power for SW and load)

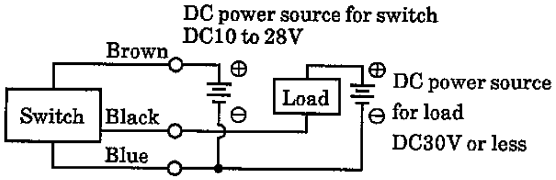



Fig.2 T3Y basic circuit 2 (separate power for SW and load)

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※).

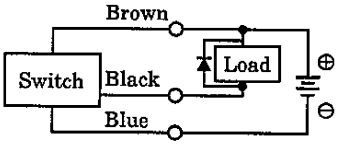



Fig.3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)

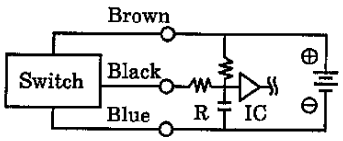



Fig.4 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R. $\frac{V}{0.10} = R\,(\Omega)$

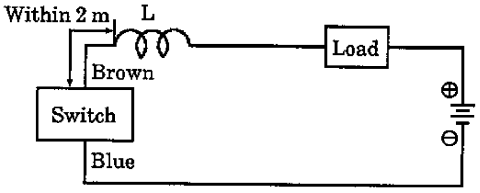



Fig.5 • Choke coil
L= a couple hundred μH to a couple mH surpassing high frequency characteristic
• Install it nearby the switch (within 2 m).

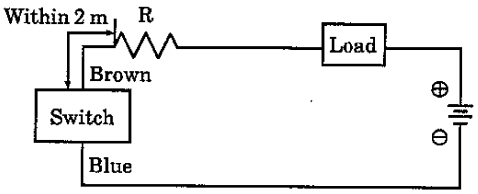



Fig.6 • Dash current restriction resister
R= As much large resister as the load circuit can afford.
• Install it nearby the switch (within 2 m).

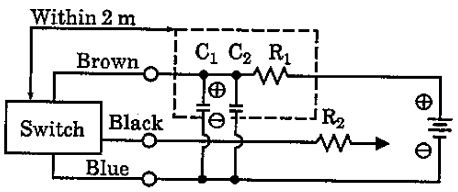



Fig.7

- Electric power noise absorptive circuit
$C_1$=20 to 50μF electrolytic capacitor (withstanding 50V or more)
$C_2$=0.01 to 0.1μF ceramic capacitor
- Dash current restriction resister
$R_1$=20 to 30Ω
$R_2$=As much large resister 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.

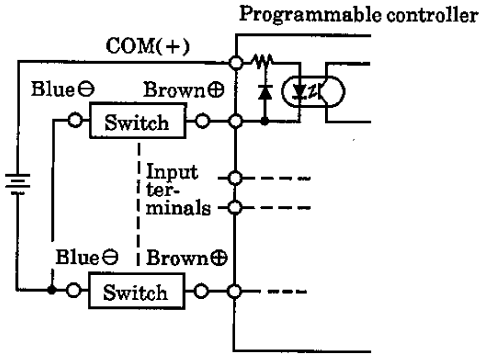



Fig.8 An example of T2Y※ connection to source input type (an external power source)

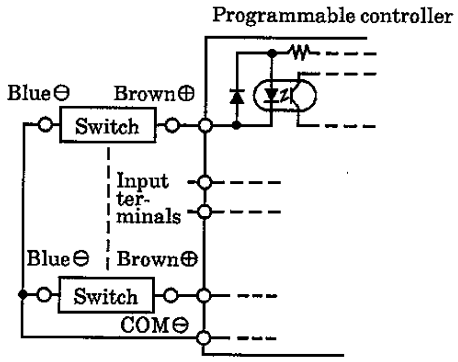



Fig.9 An example of T2Y※ connection to source input type (an internal power source)

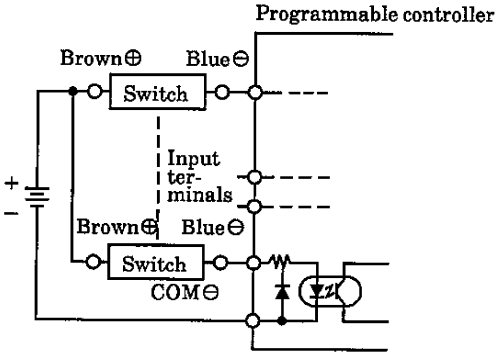



Fig.10An example of T2Y※ connection to sink input type

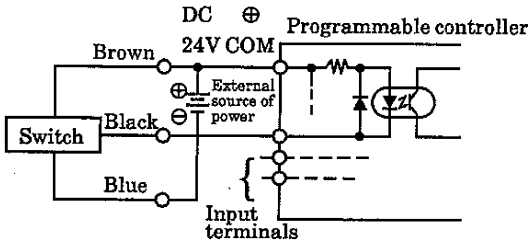



Fig.11An example of T3Y※ connection to source input type (an external power source)

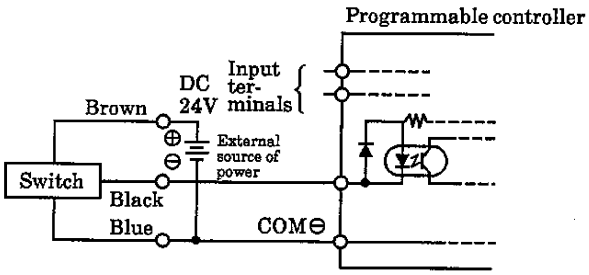


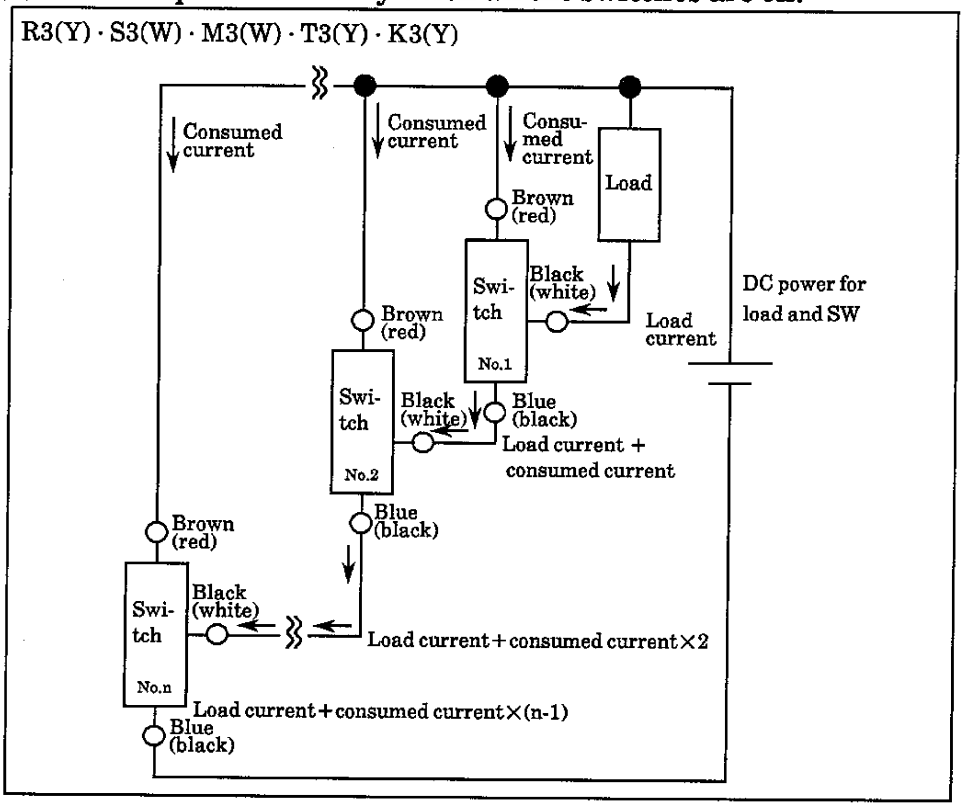

Fig.14An example of T3Y※ connection to source input type (an internal power source)
The T3Y※ switch cannot be connected to the sync. input sequencer.

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 determing the number or switches.

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

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



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.

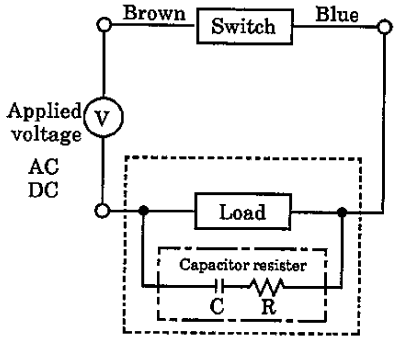
3) Contact protection

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 |

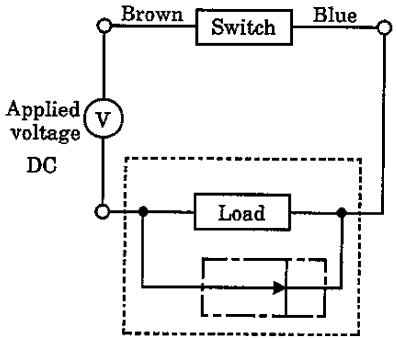



User circuit

Protective circuit (Spark absorbing circuit)

Recommended value C (Capacitor) = 0.033 to 0.1μF
R (Resister) = 1 to 3kΩ
XEB1K1 Okaya Denki Mfg. or equivalent

Fig. 1 When capacitor resister is used.




User circuit

Protective circuit

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

Fig.2 When diode is used.