CKD

SM-236262-A

INSTRUCTION MANUAL

SUPER TWIN-ROD CYLINDER

STR2 Series

- 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

For Safety Use

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

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

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

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

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

⚠ Precautions

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

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STR2 Series
Super Twin-Rod Cylinder
Manual No. SM 236262-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.

Apr.17.1998
Revision : Aug.17.2000

1. PRODUCT

1.1 Cylinder Specification

Model code & class / Item	STR2-M Sliding bearing			STR2-B Roller bearing		
Media	Compressed air					
Max.working pressure MPa	0.7					
Min.working pressure MPa	φ6 : 0.2 φ10 : 0.15 φ6 to φ32 : 0.1					
Tube bore mm	φ6, φ10, φ16, φ20, φ25, φ32					
(Connecting port dia.)	φ6 to φ25 ···· M5 , φ32 ··· Rc1/8					
Ambient temperature °C	−10 to 60 (No freezing)					
Operational piston speed mm/s	50 to 500					
Cushion	Rubber damper					
Lubrication	Not required. (Use Turbine oil 1st class, ISO VG32 if and when lubrication is preferred.)					
Adjustable range of stroke mm	0 to -5					
Type of piston rod bearing	Sliding bearing			Roller bearing		
Revolving prevention accuracy ° at 0mm no-load stroke	φ6	φ10, φ16, φ20	φ25, φ32	φ6, φ32	φ10, φ16, φ20	φ25
	±0.4	±0.3	±0.2	±0.2	±0.1	±0.3

Specifications for different model

Model	Model code	Item	
Double rod type	STR2-MD STR2-BD	Min.working pressure MPa	φ6 : 0.25 φ10 : 0.2 φ16 to φ32 : 0.15
Low speed type	STR2-MO STR2-BO	Operational piston speed mm/s	10 to 200
		Lubrication	Not allowed.
Position locking type	STR2-MQ STR2-BQ	Min.working pressure MPa	φ16 to φ32 : 0.15
		Position locking mechanism	Rod side or head side
		Holding force N	Max. thrust×0.7

Stroke

Model code	Tube bore	Stroke (mm)	Max. stroke
STR2 - M/B	φ6 φ10	10, 20, 30, 40, 50	50
	φ16 φ20 φ25 φ32	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	100

1.2 Switch Specification

Class · Model code / Items	Reed Switch	
	K0H · K0V	K5H · K5V
Application	for Relay and Programmable Controller	for Programmable Controller, Relay, IC circuit (No Lamp) : Series connection
Power Supply Voltage	——	
Load Voltage & Current	DC24V, 5 to 50mA AC100V, 7 to 20mA	DC24V, 50mA or less AC100V, 20mA or less
Current consumption	——	
Internal Voltage Drop	2.4V or less	0V
Lamp	LED is lit when Power is ON.	——
Leak Current	0	
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm²)	
Max. Shock	30G	
Insulation Resistance	20MΩ or more with DC 500Vmeggar tester	
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambience Temperature	−10 to + 60°C	
Protective Structure	IEC Standard IP67, JIS C0920 (Splash Proof), Oil resistance	

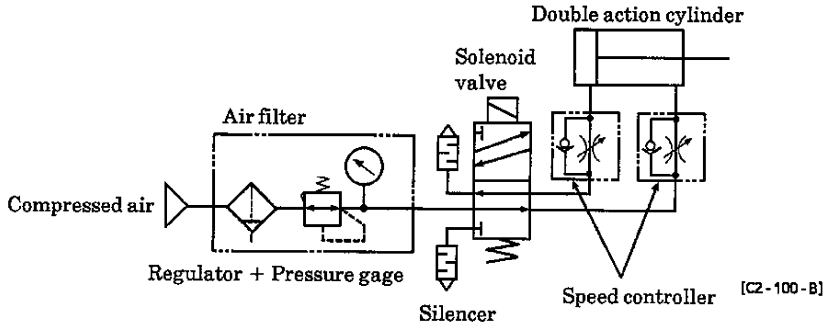
Class · Model code / Items	Proximity Switch	
	K2H · K2V	K3H · K3V
Application	Exclusively for Programmable Controller	for Programmable Controller and Relay
Power Supply Voltage	——	DC10 to 28V
Load Voltage & Current	DC10 to 30V 5 to 25mA (Note 2)	DC30V or less 100mA or less
Current consumption	——	10mA or less at DC24V (Power ON)
Internal Voltage Drop	Less than 4V	0.5V or less at 100mA
Lamp	LED is lit when Power is ON	
Leak Current	1 mA or less	10μA or less
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm²)	Standard 1m (Oil resistance Vinyl cabtyre cord, 3-core 0.2mm²)
Max. Shock	100G	
Insulation Resistance	20MΩ or more with DC 500Vmeggar tester	
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambience Temperature	−10 to +60°C	
Protective Structure	IEC Standard IP67, JIS C0920 (Splash Proof), Oil resistance	

Note 1 : 3m, 5m optional lead wire are available besides standard length.

Note 2 : Max. Load Current (25mA) is at 25°C. It may drop lower than 25mAwhen ambient temperature rises higher than 25°C.

1.3 Fundamental Circuit Diagram

1) The fundamental circuit diagram (at pre-lubricated) for the double-acting cylinder (Model STR2) is as follows.



1.4 Selection of Peripheral equipment

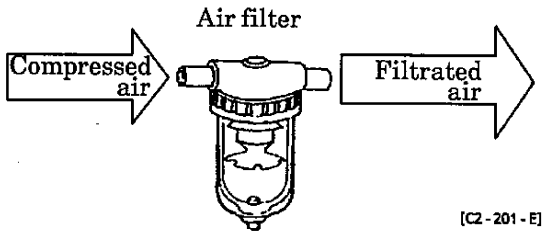
Required peripheral equipment in accordance with the fundamental circuit diagram 1-3 above varies depending on Cylinder tube bore and speed. Select appropriate models out of the following table.

Tube bore (mm)	Theoretical Basic speed (mm/s)	Required flow (ℓ/min) (at pressure = 0.5MPa)	Solenoid valve		Speed controller	Silencer	Piping (Between solenoid and cylinder)
			Single solenoid	Double solenoid			
φ6	300	7	B5142	——	SC3G-M5-4	SL-M5	φ4×φ2.5 Nylon tube
φ10	300	17	B5142	——	SC3G-M5-4	SL-M5	φ4×φ2.5 Nylon tube
φ16	300	44	4KA110 4KB110	4KA120 4KB120	SC3G-M5-6	SL-M5 SLW-6A	φ6×φ4 Nylon tube
φ20	300	68	4KA110 4KB110	4KA120 4KB120	SC1-6	SL-M5 SLW-6A	φ6×φ4 Nylon tube
φ25	300	106	4KA110 4KB110	4KA120 4KB120	SC1-6	SL-M5 SLW-6A	φ6×φ4 Nylon tube
φ32	500	289	4KA210 4KB210	4KA220 4KB220	SC1-8	SLW-6A SLW-8A	φ10×φ7.2 Nylon tube

2. CAUTION

2.1 Fluid

1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rate (5μm or lower preferred), flow rate and its mounting location (as closest to solenoid valve as possible).
2) Be sure to drain out the accumulation in filter periodically.
3) Note that the intrusion of carbide of compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of solenoid valve and cylinder. Be sure to carry out thorough inspection and maintenance of compressor.



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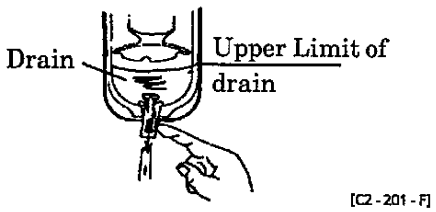


[C2-201-F]

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as lubricant if lubrication is preferred.

However, for the low-speed types (STR2-MO & STR2-BO), no lubrication is required: applying oil thereto may give rise to malfunctions or operating defective.

3. OPERATION

1) Supplying pressure to the cylinder should be as per specified in "1-1 Cylinder specification".
   Operate it within the specification.
2) Although a rubber cushion is installed to the cylinder, it is advisable to provide an external stopper device in case kinetic energy is large. Tolerable kinetic energy to cylinder with respective bore diameter is per table posted below.
3) Upon installation speed controllers as per Fundamental circuit drawing on page 3, set it to the specified piston speed by opening speed controllers gradually from closing state.
4) Prevent charging larger lateral load than tolerated to the end plate. There may be, otherwise, remarkable wear or damage of metal or bearing as well as piston rod.
5) No excessive load should be attached to the end plate.
   There may be possible damage of metal or bearing due to momentum inertia.

Remarks :
Tolerable kinetic energy.

Cylinder boar dia. (mm)	Rubber cushion Tolerable kinetic energy (J)	
	PUSH	PULL
ϕ6	0.008	0.059
ϕ10	0.061	0.083
ϕ16	0.181	0.083
ϕ20	0.303	0.127
ϕ25	0.68	0.237
ϕ32	1.3	0.311

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

(Note) Mean speed of cylinder is calculated by the following formula.

$$\nu a = \frac{L}{T}$$

νa : Mean speed (m/s)
L : Cylinder stroke (m)
T : Responce time (S)

Against this, piston speed just about rushing into cushion is calculated by the following simplified formula.

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

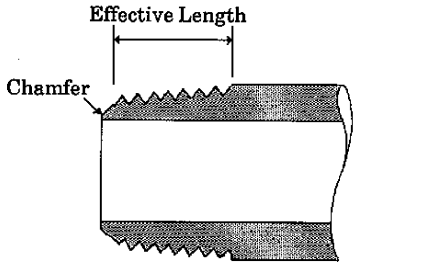
νm : Piston speed just about rushing into cushion (m/s)
ω : Cylinder load ratio (%)

To calculate kinetic energy, use the value of νm in place of speed.

4. INSTALLATION

4.1 Piping

1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc.
2) See to it that the pipe connecting cylinder and solenoid valve has effective sectional area needed for the cylinder to drive at specified speed.
3) Install filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.
5) Flush air into the pipe to blow out foreign substances and chips before piping.



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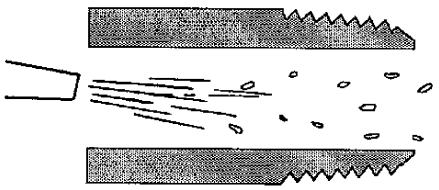
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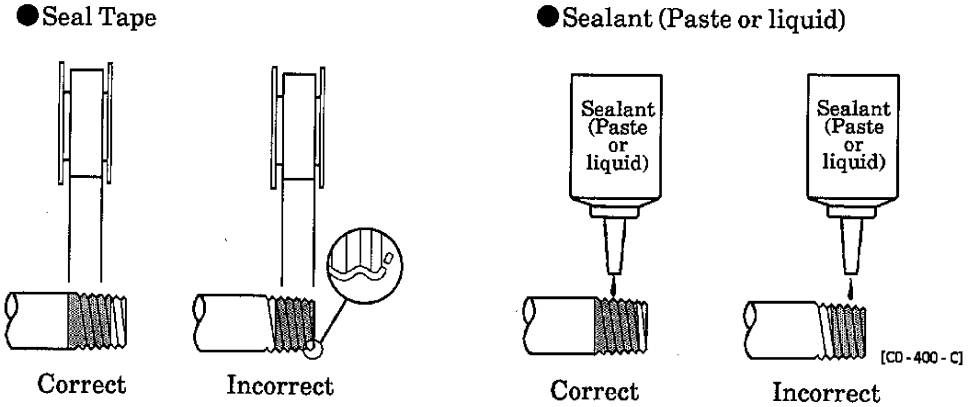
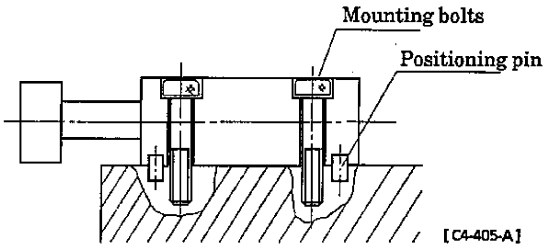
6) Refrain applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

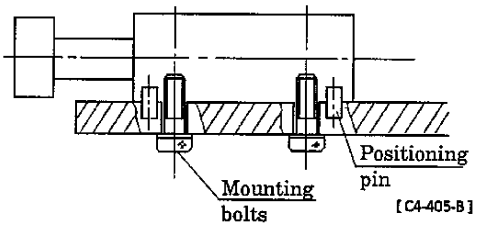


7) Super Twin Rod Cylinder has 2-ea connecting ports in each direction of stroke. Make use of appropriate ports to suit the purpose of operation and plugging other unrequired ports. Confirm, after relocating plugs, no air leakage through plugged ports.

4.2 Installation

1) Serviceable range of ambient temperature for cylinder of this type is −10℃ to +60℃.
   Use it within this range.
2) Directly mount cylinder making use of socket headed mounting bolts.
   - Installation from top having bolts go down through.
   - Installation from bottom having bolts go up.



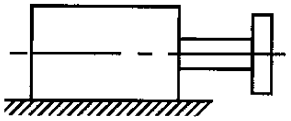


Use socket headed bolts to install cylinder from top through bottom. Refer to the table right as for sizes of bolts.

Tube bore	Size of socket headed bolts	Size of paralleling pins	Qty
ϕ6	M3×15ℓ	ϕ4×8ℓ	2
ϕ10	M4×20ℓ	ϕ4×8ℓ	2
ϕ16	M4×25ℓ	ϕ6×12ℓ	2
ϕ20	M5×32ℓ	ϕ6×12ℓ	2
ϕ25	M6×40ℓ	ϕ6×12ℓ	2
ϕ32	M6×45ℓ	ϕ6×12ℓ	2

3) Refer to the graph "Tolerable weight of load" below, to find the limit of the load fixed to the end plate.

Lateral load : F



Allowable lateral load

STR2 Allowable lateral load

● liding bearing (N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-M-6	2.4	1.9	1.5	1.3	1.1	—	—	—	—	—
STR2-M-10	5.8	4.8	4.1	3.5	3.1	—	—	—	—	—
STR2-M-16	15.9	13.3	11.5	10.1	8.9	8.1	7.3	6.7	6.2	5.8
STR2-M-20	20.3	17.3	15.1	13.4	12.1	10.9	10.0	9.2	8.5	7.9
STR2-M-25	22.1	18.9	16.5	14.7	13.1	11.9	10.9	10.1	9.3	8.7
STR2-M-32	34.9	30.2	26.7	23.9	21.6	19.7	18.1	16.8	15.7	14.7

● Roller bearing (N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-B-6	2.6	1.9	1.5	1.2	1.0	—	—	—	—	—
STR2-B-10	6.0	4.4	3.6	3.0	2.6	—	—	—	—	—
STR2-B-16	11.4	8.5	7.0	5.9	5.1	4.5	4.0	3.7	3.3	3.0
STR2-B-20	12.7	9.6	7.9	6.8	5.9	5.3	4.7	4.3	3.9	3.6
STR2-B-25	14.7	11.1	9.2	7.9	6.9	6.1	5.5	5.0	4.6	4.2
STR2-B-32	24.3	18.5	15.4	13.3	11.7	10.5	9.5	8.7	8.0	7.4

STR2-D Allowable lateral load

● liding bearing (Double rod type) (N)

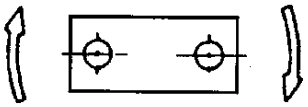
Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-MD-6	3.3	3.2	3.1	3.0	2.9	—	—	—	—	—
STR2-MD-10	8.0	7.6	7.3	7.1	7.0	—	—	—	—	—
STR2-MD-16	21.7	20.5	19.7	19.1	18.7	18.3	18.0	17.8	17.6	17.5
STR2-MD-20	26.7	25.3	24.3	23.7	23.1	22.7	22.4	22.1	21.9	21.7
STR2-MD-25	29.3	27.8	26.7	26.0	25.4	24.9	24.6	24.3	24.0	23.8
STR2-MD-32	45.2	42.9	41.3	40.1	39.1	38.3	37.7	37.2	36.7	36.3

● Roller bearing (Double rod type) (N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-BD-6	3.7	3.0	2.7	2.5	2.3	—	—	—	—	—
STR2-BD-10	8.6	6.9	6.2	5.7	5.3	—	—	—	—	—
STR2-BD-16	16.6	13.3	11.7	10.7	10.0	9.4	9.0	8.6	8.3	8.0
STR2-BD-20	17.8	14.3	12.6	11.5	10.8	10.2	9.8	9.3	9.0	8.7
STR2-BD-25	20.8	16.7	14.7	13.5	12.6	11.9	11.4	10.9	10.5	10.2
STR2-BD-32	34.5	27.6	24.2	22.1	20.6	19.5	18.5	17.8	17.1	16.6

Allowable rotary torque

Torque : T



STR2 Allowable trotary torque

● Sliding bearing

(N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-M-6	8.4	6.7	5.3	4.6	3.9	—	—	—	—	—
STR2-M-10	29.0	24.0	20.5	17.5	15.5	—	—	—	—	—
STR2-M-16	99.4	83.1	71.9	63.1	55.6	50.6	45.6	41.9	38.8	36.3
STR2-M-20	142.1	121.1	105.7	93.8	84.7	76.3	70.0	64.4	59.5	55.3
STR2-M-25	187.9	160.7	140.3	125.0	111.4	101.2	92.7	85.9	79.1	74.0
STR2-M-32	383.9	332.2	293.7	262.9	237.6	216.7	199.1	184.8	172.7	161.7

● Roller bearing

(N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-B-6	9.1	6.7	5.3	4.2	3.5	—	—	—	—	—
STR2-B-10	30.0	22.0	18.0	15.0	13.0	—	—	—	—	—
STR2-B-16	71.3	53.1	43.8	36.9	31.9	28.1	25.0	23.1	20.6	18.8
STR2-B-20	88.9	67.2	55.3	47.6	41.3	37.1	32.9	30.1	27.3	25.2
STR2-B-25	125.0	94.4	78.2	67.2	58.7	51.9	46.8	42.5	39.1	35.7
STR2-B-32	267.3	203.5	169.4	146.3	128.7	115.5	104.5	95.7	88.0	81.4

STR2-D Allowable trotary torque

● Sliding bearing (Double rod type)

(N)

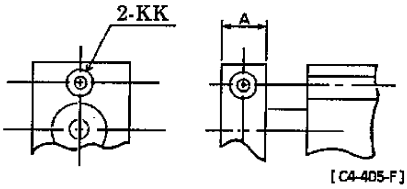
Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-MD-6	11.6	11.2	10.9	10.5	10.2	—	—	—	—	—
STR2-MD-10	40.0	38.0	36.5	35.5	35.0	—	—	—	—	—
STR2-MD-16	135.6	128.1	123.1	119.4	116.9	114.4	112.5	111.3	110.0	109.4
STR2-MD-20	186.9	177.1	170.1	165.9	161.7	158.9	156.8	154.7	153.3	151.9
STR2-MD-25	249.1	236.3	227.0	221.0	215.9	211.7	209.1	206.6	204.0	202.3
STR2-MD-32	497.2	471.9	454.3	441.1	430.1	421.3	414.7	409.2	403.7	299.3

● Roller bearing (Double rod type)

(N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-BD-6	13.0	10.5	9.5	8.8	8.1	—	—	—	—	—
STR2-BD-10	43.0	34.5	31.0	28.5	26.5	—	—	—	—	—
STR2-BD-16	103.8	83.1	73.1	66.9	62.5	58.8	56.3	53.8	51.9	50.0
STR2-BD-20	124.6	100.1	88.2	80.5	75.6	71.4	68.6	65.1	63.0	60.9
STR2-BD-25	176.8	142.0	125.0	114.8	107.1	101.2	96.9	92.7	89.3	86.7
STR2-BD-32	379.5	303.6	266.2	243.1	226.6	214.5	203.5	195.8	188.1	182.6

4) In case of utilizing bolt holes KK on the end plate, make sure to keep length of bolt within the dimension A. Otherwise, sticking bolt tip may cause damage of end plate.



5) Keep flatness of matching surface to end plate within 0.05. Otherwise, it may cause malfunction of cylinder.

6) There is a stroke adjusting bolt for 0 to −5mm at the piston retracting end of Super Twin Rod Cylinder. Always keep hexagonal lock nut tightened. Avoid operating cylinder while removing the stopper bolt.

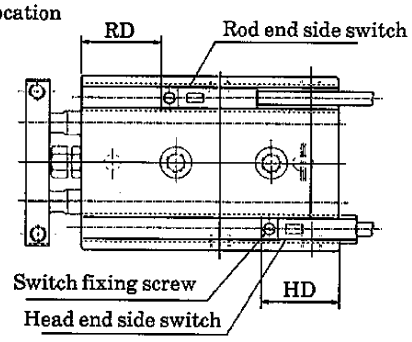
4.3 Switch mounting

1) Switch mounting location

(1) Stroke end mounting

Install one switch at the distance of RD away from rod end and the other at the distance of HD away from cylinder head, so as to have each switch function at its most sensitive location.

Switch mounting location



(2) Mounting it at an intermediate point of stroke

At first, fix the piston rod at the point where rod is made to stop. Slide a switch along the surface of cylinder longitudinally. Mark the first location where switch turns ON while keep sliding till near the stroke end. Reverse direction of sliding and mark the second location where switch turns ON. The center point of those two points is the most sensitive point of the switch and it is the switch mounting location, accordingly.

2) Scope of function

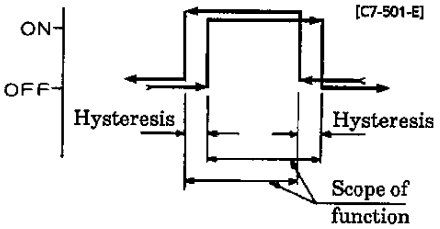
(1) It is the distance of two positions where switch turns ON, while piston continues its stroke in one directin, and where it turns OFF.

(2) The center point of scope of fundtion is the most sensitive point of switch. Selection of this point for piston stopping makes the external magnetic disturbance the least and provides the most stable function of switch.

3) Hysteresis

(1) It is the distance of two points where switch turns ON as piston travels in one direction and where switch turns OFF while piston travels reversely.

(2) Beware of that the function of switch becomes unstable when piston stops within this distance and easily affected by the disturbance.



4) Relocation of switch

Make switch slide along cylinder tube after loosening the switch mounting screw then tighten mounting screw upon selecting relocating position. (Note 1)

5) Replacement of switch

Take the switch body out of a groove upon loosening switch mounting screw. Insert a new replacement back to a groove and tighten the screw. (Note 1)

Note 1 : Apply screw tightening torque of 0.1 to 0.2N.m using prescision driver or watch driver of handle dia. 5 to 6mm, minus tip width 2.4mm or less, thickness 0.3mm or less.

The most sensitive position (HD & RD), Scope of function, and Hysteresis Unit

Item / Tube	Proximity switch (K2H, K2V, K3H, K3V)				Bicolor proximity switch (K※Y※※)			
	The most sensitive position		Scope of function	Hysteresis	The most sensitive position		Scope of function	Hysteresis
	HD	RD			HD	RD		
ϕ6	3.5	21	1 to 6	2 or less	2.5	20	4 to 7.5	1.5 or less
ϕ10	2.5	33	1 to 5.5		1	32		
ϕ16	7	39.5	1.5 to 7.5		5.5	38.5	4.5 to 9	
ϕ20	10.5	45	3 to 9		9.5	44	5.5 to 10	
ϕ25	11.5	43.5	3.5 to 10.5		10.5	42.5	6.5 to 10.5	
ϕ32	15.5	55.5			14.5	54.5	1.5 to 10.5	

Item / Tube	Reed switch (K0H, K0V, K5H, K5V)			
	The most sensitive position		Scope of function	Hysteresis
	HD	RD		
ϕ6	3.5	21	4 to 9	3 or less
ϕ10	2.5	33		
ϕ16	7	39.5	5 to 12.5	
ϕ20	10.5	45	6.5 to 14.5	
ϕ25	11.5	43.5	8 to 14.5	
ϕ32	15.5	55.5	5.5 to 14	

- Switches are mounted at the most sensitive locations (HD, RD) ex-factory.
- Reed switches (K0H, K0V, K5H, and K5V) are not available for the STR2-B-6, 10.

5. CAUTION FOR OPERATING SWITCH

5.1 Cylinder with switch

1) Avoidance placing any magnetizable item

Carefully avoid placing such magnetizable items near by the cylinder as magnetic disk, magnetic card, magnetic tape or testers because the cylinder has a bult-in magnet.

2) Unserviceable in the ambient temperature over 60°C.

Avoid using this type of cylinder in such a high temperature due to characteristics of Magnetic parts and electronic components.

3) Unserviceable where magnetic disturbance is predicted.

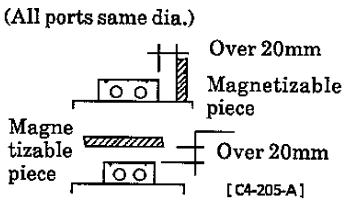
Magnetic switch for this type of cylinder will be affected for worse by such disturbance.

4) Reed switch is unserviceable with models STR2-B-6 and 10.

Also, avoid mounting STR2-B-6 with proximity switch on such a magnetizable material as iron plate. Detecting error of switch may be resulted.

5) Keep such a magnetizable material as iron away over 20mm from cylinder surface because it may cause malfunction of switch.

6) Leave space of more distance than posted in the table below to prevent possible malfunction of switches when installing prural number of cylinders.

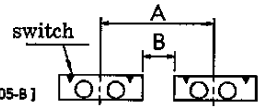
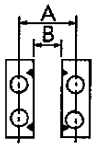
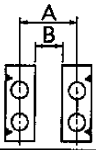
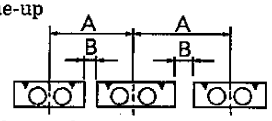
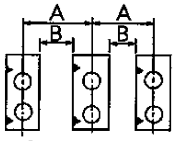


7) Pay consideration to eliminate repetitive bending stress or stretching of lead cord when installing the cord. To the moving portion, use such cord of flexibility as for building robots.

8) Beware that an excessive speed of piston may make relay unable to respond in the system to make the switch actuate in the midway of stroke.

(Example) In case that relay responce time is 20ms and switch actuating range is 6mm, set piston speed less than 300mm/s.

9) Prevent strong vibration or shock during transportation of cylinder or during installation and adjusting switch.

The adjacency condition			Type of switches	ϕ6	ϕ10	ϕ16	ϕ20	ϕ25	ϕ32
2 cylinders parallel	• Flat line-up  [C4-205-B]	A	K2, K3	43	45	56	66	75	111
			K0, K5	40*	47*	62	81	85	111
		B	K2, K3	7	1	2	4	3	15
			K0, K5	4*	3*	8	19	12	15
	• Vertical line-up, switches facing to adjacent cylinder.  [C4-205-C]	A	K2, K3	28	27	36	47	47	58
			K0, K5	27*	26*	36	53	53	58
		B	K2, K3	15	12	15	20	14	20
			K0, K5	14*	11*	15	26	20	20
	• Vertical line-up, switches on the side away from adjacent cylinder.  [C4-205-D]	A	K2, K3	19	16	22	28	34	39
			K0, K5	14*	16*	22	33	34	39
		B	K2, K3	6	1	1	1	1	1
			K0, K5	1*	1*	1	6	1	1
More than 3 cylinders parallel	• Flat line-up  [C4-205-E]	A	K2, K3	44	45	57	67	77	111
			K0, K5	41*	47*	64	83	86	111
		B	K2, K3	8	1	3	5	5	15
			K0, K5	5*	3*	10	21	14	15
	• Vertical line-up  [C4-205-F]	A	K2, K3	33	30	40	51	49	58
			K0, K5	30*	28*	42	60	97	58
		B	K2, K3	20	15	19	24	16	20
			K0, K5	17*	13*	21	33	25	20

Note*: These are dimensions of model STR2-M series.
As for models STR2-B-6 and 10, reed type switches are unserviceable.

5.2 Proximity switch - Models K2H · K2V · K3H and K3V

1) Connection of lead wire

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

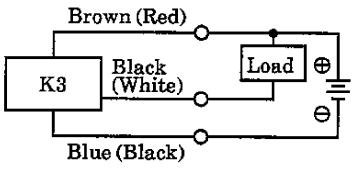


Fig. 1 An example (1) of fundamental circuit of K3 (In case the power for switch and load is the same.)

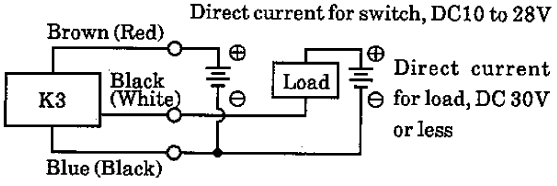


Fig. 2 An example (2) of fundamental circuit of K3 (In case the power for switch and load is independent.)

2) Protection of output circuit

- Install some protective circuit as per illustrated in Fig. 3 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current at turning switch off.
- Install some protective circuit as per illustrated in Fig. 4 when capacitor type lord (Capacitor type) are to be used because those types apt to generate dash current at turning switch on.
- Install some protective circuit as per illustrated in Fig. 5 or 6 (in case of model K2) and Fig 7 (in case of model K3) when length of lead wire is over than 10m.

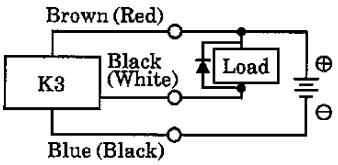


Fig. 3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)

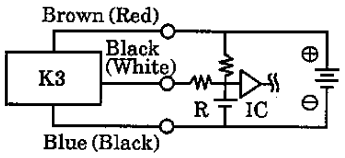


Fig. 4 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R. $\frac{V}{0.05} = R(\Omega)$

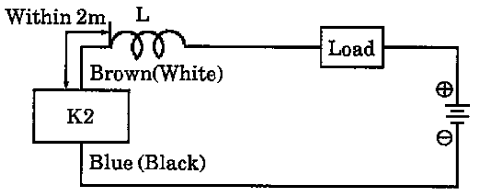


Fig. 5 • Choke coil L
L = a couple hundred μH ~ a couple mH surpassing high frequency characteristic
• Install it near by a switch (within 2 m).

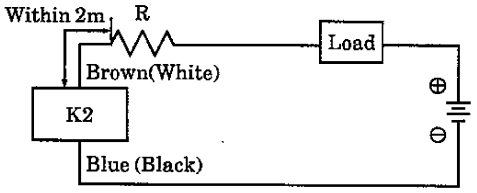


Fig. 6 • Dash current restriction resister R
R = As much large resister as the load circuit can afford.
• Install it near by a switch (within 2 m).

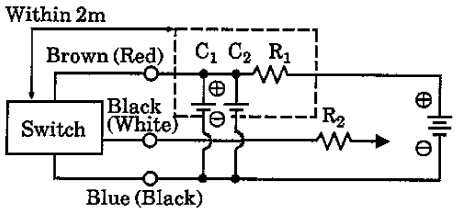


Fig. 7

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

3) Connection to a programmable controller (Sequencer)
Type of the connection varies depending upon the model of the programmable controller. Refer to the following Fig. 8 to 12 respectively.

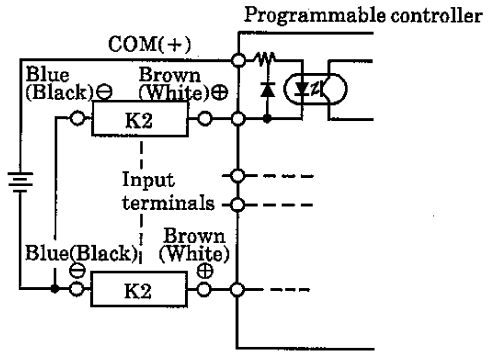


Fig. 8 K2 model connection to source load input type (an external power of source)

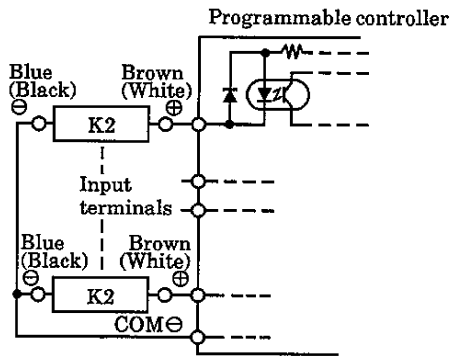


Fig. 9 An example of K2 model connection to source load input type (an internal power of source)

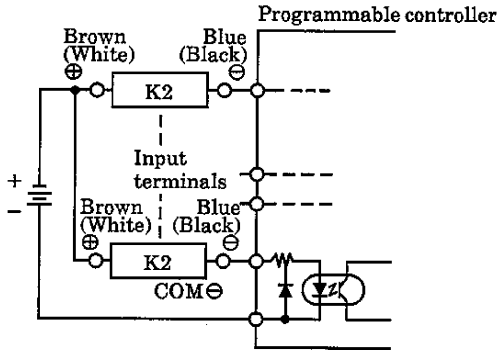


Fig. 10 An example of K2 model connection to sink load input type (an internal power of source)

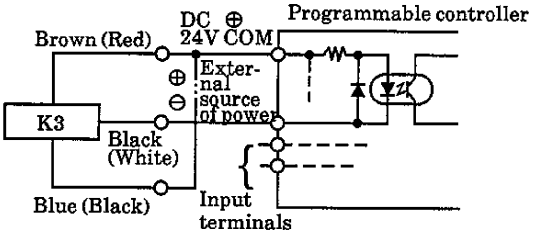


Fig. 11 An example of K3 model connection to source load input type (an external power of source)

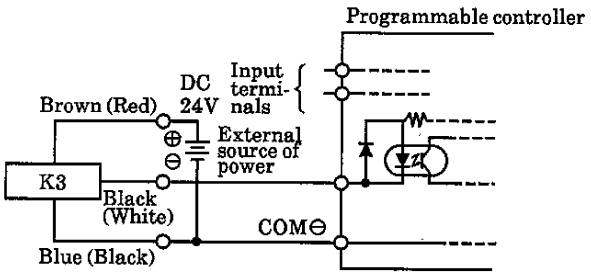


Fig. 12 An example of K3 model connection to source load input type (an internal power of source)
K3 switch is, however, unable to be connected to the source load input sequencer.

4) Series connection

The total voltage loss when series connected K2 switches equals to the sum of respective voltage loss of each switch. Load side voltage is only the residual after total voltage loss. Therefore, confirm the required voltage to the programmable controller input before deciding the number of switches connected in series. It is recommended of consulting us prior to have plural number of K3 switches connected.

5) Parallel connection

When connecting K2 switches in parallel, leak current multiplies by the number of switches connected. Therefore, confirm the required current to the programmable controller input before deciding the number of switches connected. In some occasions, either the lamps dim or distinguish at all. While one switch turns ON till turns OFF, the rest of switches do not turn ON due to internal voltage drop between both ends of switch coming lower than range of load voltage. It is, therefore, confirmation of input specification of programmable controller inlet is mandatory.

K3, on the contrary, connection of these switches creates very rare problem of multiplied leakage due to almost negligible leakage (less than 10 μA) of individual switch. There will be no visible difference of luminance of lamps.

5.3 Reed switch - Model K0H · K0V · K5H and K5V

1) Connection of lead wire

Instead of connecting a wire to the power source directly, always connect to the load in series. In case of model K0 connection, pay the following precautions.

Ⓐ For DC connection, use such polarities of wires as white ⊕ and black ⊖. The switch still functions right with reversed polarities but lamp is not lit.

Ⓑ For AC connection to either relay or input terminal to programmable controller, Switch lamp sometimes is not lit in case when half-wave rectification is being carried out. Lamp is lit, in this occasion, when polarities of cords for switch is reversed.

2) Capacity of contact points

Avoid using a load exceeding the max. capacity of contact points. On the other hand, in case of K0 model, switch lamp may not be lit sometimes when current is lower than rated current.

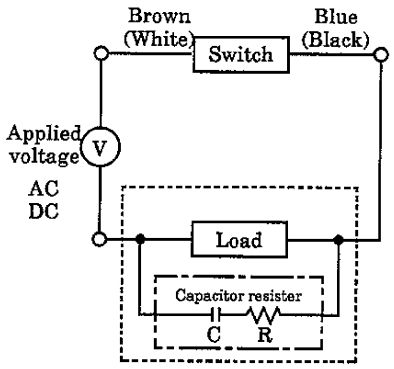
3) Protection of contact point

Install such protective circuit as illustrated in either Fig 1 or 2, on the following page, when inducing type load such as relay is to be used.

Furthermore, install such protective circuit as illustrated in either Fig. 3 or 4, o the following page, in case the cord length exceeds the length per table 1, right.

Table 1

Current	Wire length
DC	50m
AC	10m



User circuit

Protective circuit (Spark absorbing circuit)

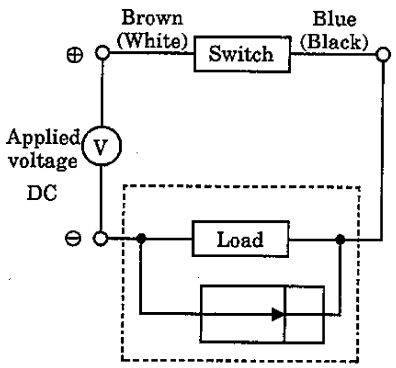
Recommended value

C (Capacitor) = 0.033 to 0.1μF

R (Resister) = 1 to 3 kΩ

Okaya Denki XFB1K1 or equiv.

Fig. 1 When capacitor resister is used.



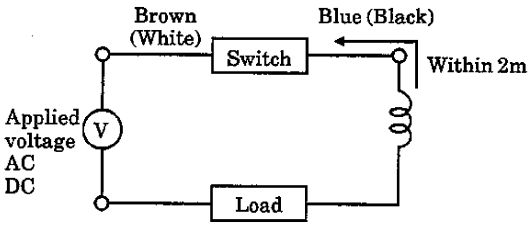
User circuit

Protective circuit

Rectifying diode, general use

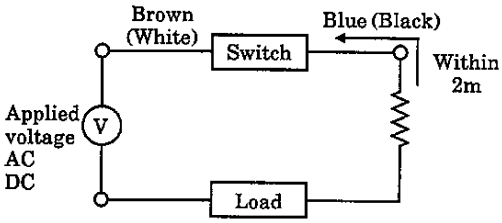
Hitachi Mfg. product V06C or equivalent

Fig. 2 When diode is used.



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

Fig. 3



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

Fig. 4

4) Relay

Use such products as specified below or equivalent.

OMRON Corporation	Model MY
FUJI ELECTRIC CORP	Model HH5
Matsushita Electric Works Ltd. ..	Model HC

5) Series connection

Total voltage loss, when connected K0 switches in series, equals to the sum of respective voltage loss of each switch. The total voltage loss becomes equivalent to one K0 switch (approx. 2.4V) when connecting the combination of one K0 switch for actuation confirming and rest of switches K5 Lamp is lit only when all switches turn on.

6) Parallel connection

There is no restriction in parallel connection number of switches of these types. Multi number connection of model K0, sometimes, cause dimmed lamp or no lamp lit.

6. MAINTENANCE

6.1 Periodic Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.

2) Inspection items

ⓐ Check the bolts and nuts slackening for end plate and cylinder body.
ⓑ Check to see that the cylinder operates smoothly.
ⓒ Check any change of the piston speed and cycle time.
ⓓ Check for internal and/or external leakage.
ⓔ Check the piston rod for flaw (scratch) and deformation.
ⓕ Check the stroke for abnormality.

See 6.2, "Trouble shooting", should there be any trouble found, also carry out additional tightening if bolts, nuts, etc.are slackened.

6.2 Trouble Shooting

1) Cylinder

Troubles	Causes	Countermeasure
Does not operate	No pressure or inadequate pressure	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve	Correct the control circuit.
	Improper or misalignment of installation	Correct the installation state and/or change the supporting system.
	Broken piston packing	Replace the packing.
Does not function smoothly	Speed is below the low speed limit	Limit the load variation and consider the adoption of low pressure cylinder.
	Improper or misalignment of installation	Correct the installation state and /or change the supporting system.
	Exertion of transverse (lateral) load	Install a guide. Revise the installation state and/or change the supporting system.
	Excessive load	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit	Change the installation direction of the speed control valve.
Breakage and/or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g. external cushion mechanism).
	Exertion of transverse load	Install a guide. Reverse the installation state and/or change the supporting system.

2) Switch

Troubles	Causes	Remedies
Lamp is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged lamp	Replace the switch
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly within the piston stroke	Adjust speed slower. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	Improper ambient temperature	Adjust the ambient temperature within the range of −10 to 60°C
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

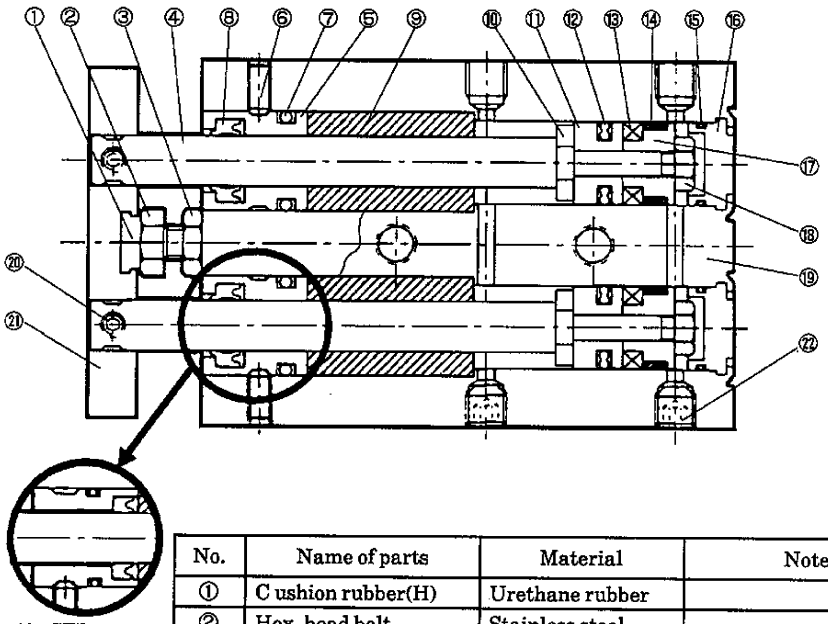
6.3 Disassembly

When air leakage take place, disassemble cylinder referring to the following "Internal structure drawing" and replace any worn out expendable parts.

1) At frst remove Hex. soc. hd.cap screw ⑳. Secondly remove End plate ㉑. Thirdly remove Hex. soc. hed. cap screw (ϕ6, ϕ10) or C ring for hole (ϕ16 to ϕ32) ⑥. Lastly pull out Housing ass'y ⑤ and Metal or Bearing ⑨ together with Piston rod assy ④.

2) Internal structure drawing

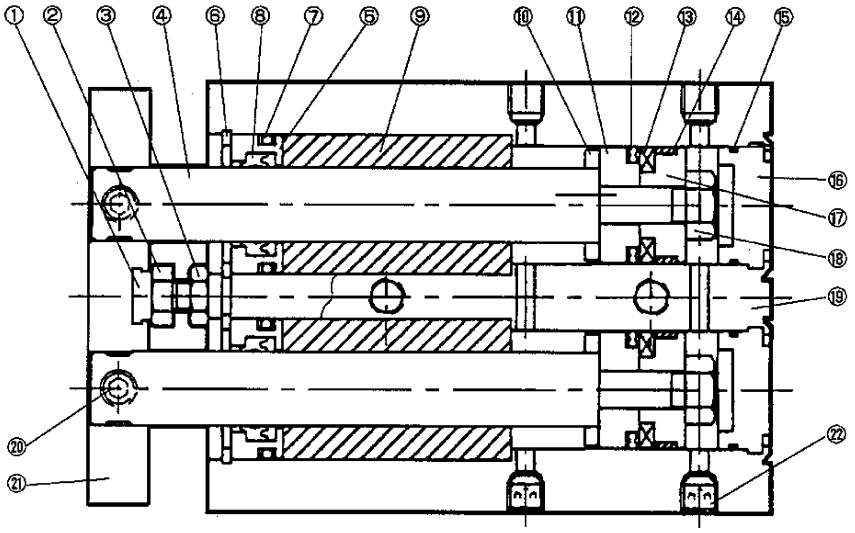
- STR2-M-6·10



(At STR2-M-6)

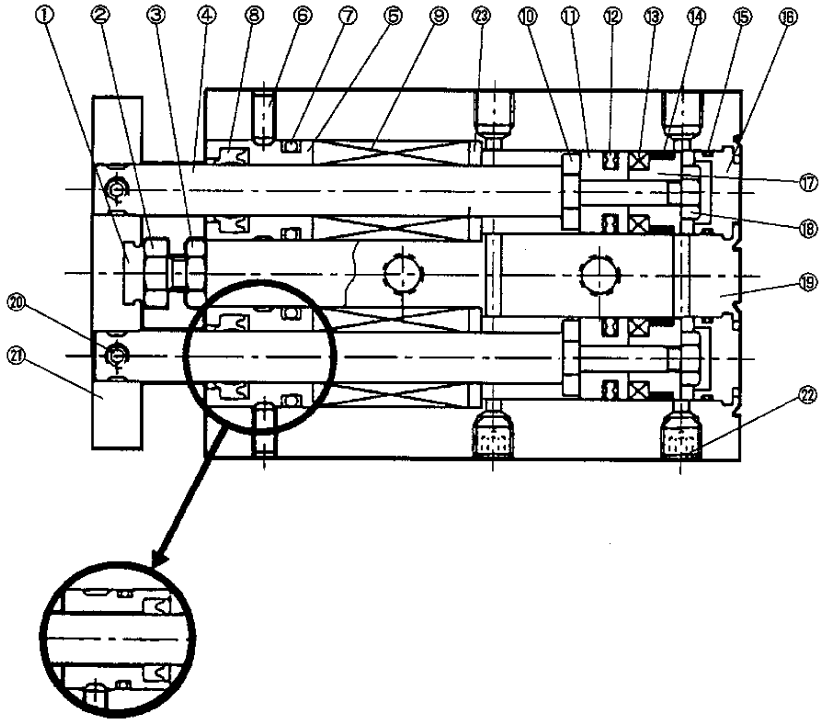
No.	Name of parts	Material	Note
①	C ushion rubber(H)	Urethane rubber	
②	Hex. head bolt	Stainless steel	
③	Hex. nut	Stainless steel	
④	Piston rod	Stainless steel	
⑤	Housing	Stainless steel	
⑥	Hex. soc. hd. cap screw	Stainless steel	
⑦	O ring	Nitrile rubber	
⑧	Rod packing	Nitrile rubber	
⑨	Bushing	Copper alloy	
⑩	Cushion rubber(R)	Urethane rubber	
⑪	Piston	Aluminium alloy	Berrymate
⑫	Piston packing	Nitrile rubber	
⑬	Piston magnet	Platic magnet	
⑭	Wear ring	Acetar resin	
⑮	O ring	Nitrile rubber	
⑯	Cap	Aluminium alloy	Berrymate
⑰	Magnet spacer	Aluminium alloy	Berrymate
⑱	Hex. nut	Steel	Galvanizing
⑲	Tube body	Aluminium alloy	Hard alumite disposal
⑳	Hex. soc. hd. cap screw	Stainless steel	
㉑	End plate	Aluminium alloy	Alumite
㉒	Hex. soc. hd. cap screw	Stainless steel	

- STR2-M-16 to 32



No.	Name of parts	Material	Note
①	C ushion rubber (H)	Urethane rubber	
②	Hex. head bolt	Stainless steel	
③	Hex. nut	Stainless steel	
④	Piston rod	Stainless steel(ϕ16, ϕ20) Steel(ϕ25, ϕ32)	Industrial chromium plating
⑤	Housing	Aluminium alloy	Berrymate
⑥	C riing for hole	Stainless steel	
⑦	O ring	Nitrile rubber	
⑧	Rod packing	Nitrile rubber	
⑨	Bushing	Copper alloy	
⑩	Cushion rubber((R)	Urethane rubber	
⑪	Piston	Aluminium alloy	Berrymate
⑫	Piston packing	Nitrile rubber	
⑬	Piston magnet	Platic magnet	
⑭	Wear ring	Acetar resin	
⑮	O ring	Nitrile rubber	
⑯	Cap	Aluminium alloy	Berrymate
⑰	Magnet spacer	Aluminium alloy	Berrymate
⑱	Hex. nut	Steel	Galvanizing
⑲	Tube body	Aluminium alloy	Hard alumite disposal
⑳	Hex. soc. hd. cap screw	Stainless steel	
㉑	End plate	Aluminium alloy	Alumite
㉒	Hex. soc. hd. cap screw	Stainless steel	

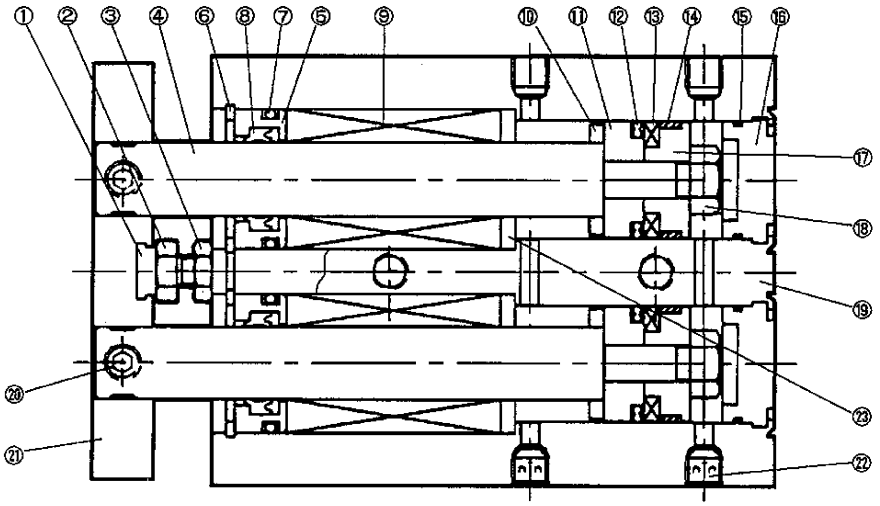
- STR2-B-6 · 10



(At STR2-B-6)

No.	Name of parts	Material	Note
①	C ushion rubber (H)	Urethane rubber	
②	Hex. head bolt	Stainless steel	
③	Hex. nut	Stainless steel	
④	Piston rod	Steel	
⑤	Housing	Stainless steel	
⑥	Hex. soc. hd. cap screw	Stainless steel	
⑦	O ring	Nitrile rubber	
⑧	Rod packing	Nitrile rubber	
⑨	Bearing		
⑩	C ushion rubber (R)	Urethane rubber	
⑪	Piston	Aluminium alloy	Berrymate
⑫	Piston packing	Nitrile rubber	
⑬	Piston magnet	Platic magnet	
⑭	Wear ring	Acetar resin	
⑮	O ring	Nitrile rubber	
⑯	Cap	Aluminium alloy	Berrymate
⑰	Magnet spacer	Aluminium alloy	Berrymate
⑱	Hex. nut	Steel	Galvanizing
⑲	Tube body	Aluminium alloy	Hard alumite disposal
⑳	Hex. soc. hd. cap screw	Stainless steel	
㉑	End plate	Aluminium alloy	Alumite
㉒	Hex. soc. hd. cap screw	Stainless steel	
㉓	Spacer	Aluminium alloy	Berrymate

- STR2-B-16 to 32



No.	Name of parts	Material	Note
①	C ushion rubber (H)	Urethane rubber	
②	Hex. head bolt	Stainless steel	
③	Hex. nut	Stainless steel	
④	Piston rod	Steel	Industrial chromium plating
⑤	Housing	Aluminium alloy	Berrymate
⑥	C ring for hole	Stainless steel	
⑦	O ring	Nitrile rubber	
⑧	Rod packing	Nitrile rubber	
⑨	Bearing		
⑩	C ushion rubber (R)	Urethane rubber	
⑪	Piston	Aluminium alloy	Berrymate
⑫	Piston packing	Nitrile rubber	
⑬	Piston magnet	Plastic magnet	
⑭	Wear ring	Acetar resin	
⑮	O ring	Nitrile rubber	
⑯	Cap	Aluminium alloy	Berrymate
⑰	Magnet spacer	Aluminium alloy	Berrymate
⑱	Hex. nut	Steel	Galvanizing
⑲	Tube body	Aluminium alloy	Hard alumite disposal
⑳	Hex. soc. hd. cap screw	Stainless steel	
㉑	End plate	Aluminium alloy	Alumite
㉒	Hex. soc. hd. cap screw	Stainless steel	
㉓	Spacer	Aluminium alloy	Berrymate

3) Repair kits list

No. / Name of parts / Tube bore (mm) / Kit No.	① C ushion rubber (H)	⑦ O ring	⑧ Rod packing	⑩ C ushion rubber (R)	⑫ Piston packing	⑭ Wear ring
ϕ6 STR2-6K	F4-659142	P12115-0600100	P12246-004	F4-662938	F4-669778	F4-175172
ϕ10 STR2-10K	F4-659142	P12056-011	P12219-006	F4-662980	F4-669779	F4-174964
ϕ16 STR2-16K	F4-659142	P12560-016	P12219-010	F4-175133	F4-669780	F4-162726
ϕ20 STR2-20K	F4-659142	P12056-017	P12219-012	F4-116102	P12230-020	F4-125610
ϕ25 STR2-25K	F4-659112	P12056-020	P12219-014	F4-116103	P12230-025	F4-654958
ϕ32 STR2-32K	F4-659112	P12056-026	P12219-016	F4-116104	P12230-032	F4-654960

4) Assembling procedure

(1) Apply a film of grease over Rod packing ⑧, Piston packing ⑫, Metal ⑨ or Ball bushing ⑨ and internal surface of cylinder. Use Litium list, saponaceous grease.
(Recommended grease: Duphne eponex No.1 - product of Idemitsu Kosan Co. or Duplex SP No.1 - product of Kyodo Oil Co.)

(2) Assemble Rod packing ⑧ into Housing ⑤ and set it aside. Slide Piston packing ⑫ and Wear ring ⑪ over piston.

(3) Build up Piston ass'y ④ by sliding Cushion rubber ⑩, Metal ⑨ or Ball bushing ⑨ and assembled housing ⑤ over piston rod. (Refer to the internal structure drawing.)

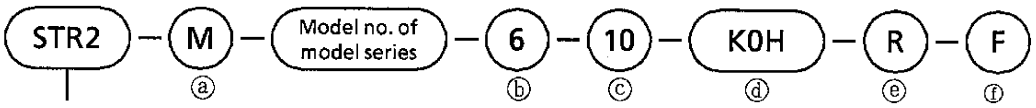
(4) Slide the total ass'y, built in paragraph (3) above, then ϕ6 and ϕ10 fix by hex. cap set screw ⑥, and ϕ16 to ϕ32 fix by C ring for hole ⑥.

(5) Mount End plate ㉑ at Rod end and tighten Hex. cap set screw ⑳. Use adhesive glue. Tighten it while piston is in the state of PULLing.

Tightening torque for hex. cap set screw ⑥ & ⑳.

Tube bore (mm)	Tightening torque (N·cm)	
	⑥	⑳
ϕ6	49	49
ϕ10	49	49
ϕ16	—	284
ϕ20	—	284
ϕ25	—	1107
ϕ32	—	1107

7. HOW TO ORDER



Model no.

Symbol		Description			Model no. of model series: Standard	Low speed O	Double rod D	Position locking Q
ⓐ Type of bearing	M	Sliding bearing			●	●	●	●
	B	Roller bearing			●	●	●	●
ⓑ Tube bore	6	ϕ6			●	●	●	—
	10	ϕ10			●	●	●	—
	16	ϕ16			●	●	●	●
	20	ϕ20			●	●	●	●
	25	ϕ25			●	●	●	●
	32	ϕ32			●	●	●	●
ⓒ Stroke (mm)	10	10			ϕ6 to ϕ32			
	20	20						
	30	30						
	40	40						
	50	50						
	60	60			ϕ16 to ϕ32			
	70	70						
	80	80						
	90	90						
	100	100						
Position locking unit	H	With position locking unit on head end			—	—	—	●
	R	With position locking unit on rod end			—	—	—	●
ⓓ Switch model no.	K0H※	Reed	2 wire	Axial lead wire	●	●	●	●
	K5H※				●	●	●	●
	K2H※	Proximity			●	●	●	●
	K3H※		3 wire		●	●	●	●
	K2YH※	Bicolor proximity	2 wire		●	●	●	●
	K3YH※				●	●	●	●
	K2YFH※	Preventive maintenance proximity	3 wire		●	●	●	●
	K3YFH※		4 wire		●	●	●	●
	K2YMH※		3 wire		●	●	●	●
	K3YMH※		4 wire		●	●	●	●
	K0V※	Reed	2 wire	Radial lead wire	●	●	●	●
	K5V※				●	●	●	●
	K2V※	Proximity			●	●	●	●
	K3V※		3wire		●	●	●	●
	K2YV※	Bicolor proximity	2 wire		●	●	●	●
	K3YV※				●	●	●	●
	K2YFV※	Preventive maintenance proximity	3 wire		●	●	●	●
	K3YFV※		4 wire		●	●	●	●
	K2YMV※		3 wire		●	●	●	●
	K3YMV※		4 wire		●	●	●	●
Length of lead wire	No code	1m (Standard)			●	●	●	●
	3	3m (Option)			●	●	●	●
	5	5m (Option)			●	●	●	●

※ : In case of the position locking type Q, select the position locking unit "H" or "R" after the stroke ⓒ.

Symbol		Description	Model no. of model series			
			Standard	Low speed O	Double rod D	Position locking Q
ⓔ Q'ty of switches	R	One on rod side	●	●	●	●
	H	One on head side	●	●	●	●
	D	2 installed	●	●	●	●
ⓕ Option	F	Material of end plate ; Steel	●	—	—	—
	R	Backward piping type	●	—	—	—
	P6	Note : Nonpurple specification	●	—	—	—
	P7	Exhaust treatment type(Released to air)	●	—	—	—
	P71	Exhaust treatment type (Draw vacuum)	●	—	—	—

Note) Nonpurple : Neither copper series nor Teflon series are used for prevention against generating copper ion.
The standard type for the roller bearing is "P6" specification.

⚠ CAUTION

When Super twin-rod cylinder STR2-B-6 with proximity switch (K2H and K3H) are to be installed, avoid mounting it on a magnetizable material (such as iron plate). It causes switch detecting inaccurate. Also, Reed switches are impracticable to be combined with Super twin-rod cylinder STR2-B-6 & 10.

HOW TO ORDER THE SWITCHES

- Switch only

SW — K0H

ⓓ

Switch model no.
(ⓓ on page 28)