CKD

Twin Rod Cylinder
STR2-HP1 Series

INSTRUCTION MANUAL

SM-A42815-A/2

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **"STR2-HP1 Series" Twin Rod Cylinder**.
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the fluid control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest edition of each standard), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Product Disposal

⚠CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

CONTENTS

1. PRODUCT OVERVIEW

1.1 Model Number Indication

1.1.1 Product model number

■ **Example of model number indication : STR2-HP1 series**

Without switch (built-in magnet for switch)

STR2 - M - 16 ○ - 30 ——— F - HP1

With switch (built-in magnet for switch)

STR2 - M - 16 ○ - 30 - K0H - R - F - HP1

Model No.

Ⓐ Bearing

Code	Description
Ⓐ Bearing	
M	Metal bush bearing
B	Ball bearing

Ⓑ Bore size

Ⓑ Bore size (mm)	
6	ø6
10	ø10
16	ø16
20	ø20
25	ø25
32	ø32

Ⓒ Port thread

Ⓒ Port thread	
Blank	Rc thread
NN	NPT thread (ø32 only) (made-to-order product)
GN	G thread (ø32 only) (made-to-order product) *5

Ⓓ Stroke length *1

■ Custom stroke length
Available in 1 mm increments.

Ⓓ Stroke length (mm)			
Bore size	Stroke length	Available stroke length	Custom stroke length
ø6	5 to 50	100	In 1 mm increments
ø10	5 to 50		
ø16	5 to 100	150	
ø20	5 to 100		
ø25	5 to 100		
ø32	5 to 100		

Ⓔ Switch model No. *2

Ⓔ Switch model No.						
Lead wire Straight	Lead wire Radial	Contact	Voltage AC	Voltage DC	Indicator	Lead wire
K0H*	K0V*	Reed	●	●	1-color display	2-wire
K5H*	K5V*		●	●	Without indicator lamp	
K2H*	K2V*	Proximity		●	1-color display	2-wire
K3H*	K3V*			●		3-wire
K3PH*	K3PV*			●	Water-resistant 2-color display	3-wire
K2YH*	K2YV*			●	2-color display	2-wire
K3YH*	K3YV*			●		3-wire

* Lead wire length	
Blank	1 m (standard)
3	3 m (option)
5	5 m (option)

Ⓕ Switch quantity

Ⓕ Switch quantity	
R	1 on rod side
H	1 on head side
D	2

Ⓖ Option *4

Ⓖ Option	
F	End plate material: steel
O	Change piping port position by 180°
R	Rear piping

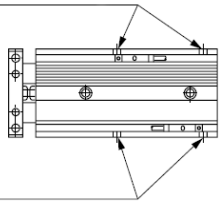
Note1: The max stroke length of rear piping "R" is:
- φ6,10 : 50 stroke
- φ16 : 70 stroke
- φ20,25 : 60 stroke
- φ32 : 50 stroke.

Note2: STR2-B-6 and 10 are not compatible with reed switches.

Note3: The ball bearing is copper and PTFE free "P6" as standard.

Note4: The piping port positions for "O" are as shown in the figure below.

Piping port positions for standard (blank)



Change piping port position by 180°
(Code: 0) piping port

Note5: For G thread, ports on the opposite side (option "O") are not available. Rather than plug sealing, they are simply not provided. (The standard ports are not provided for option "O".)

■ Example of model number indication：STR2-P4※-HP1 series

Without switch (built-in magnet for switch)

STR2 - M - 16 - 30 — R P4/P40 - HP1

With switch (built-in magnet for switch)

STR2 - M - 16 - 30 - SW51 - R - R P4/P40 - HP1

Model No.

Ⓐ Bearing

Ⓑ Bore size

Ⓒ Stroke *2

■ The custom Stroke is available in 1 mm increments.

Ⓓ Switch model No. *3

Ⓔ Switch quantity

Ⓕ Option *4

Code	Description
Ⓐ Bearing	
M	Metal bush bearing *1
B	Ball bearing

Ⓑ Bore size(mm)	
6	ø6
10	ø10
16	ø16
20	ø20
25	ø25
32	ø32

Ⓒ Stroke(mm)

Bore size	Stroke	Available Stroke	Intermediate Stroke
ø6	5 to 50	100	In 1 mm increments
ø10	5 to 50		
ø16	5 to 100	150	
ø20	5 to 100		
ø25	5 to 100		
ø32	5 to 100		

Ⓓ Switch model No.

For switch model number, refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A) .

Ⓔ Switch quantity	
R	1 on rod side
H	1 on head side
D	2

Ⓕ Option	
O	Change piping port position by 180°
R	Rear piping

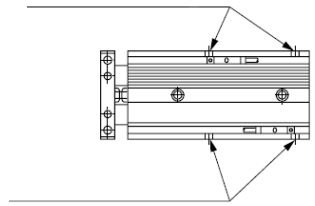
Note1: Bearing type M of HP1 is P4 specification.

Note2: The max stroke length of rear piping "R" is:
- φ6、10 : 50 stroke
- φ16 : 70 stroke
- φ20、25 : 60 stroke
- φ32 : 50 stroke

Note3: STR2-B-6 and 10 are not compatible with a reed switch.

Note4: The piping port positions for "O" are as shown in the figure below.

Piping port positions for standard (blank)



Piping port position on the 180° opposite side (code: 0)

■ Stroke length

Bore size	Stroke length (mm)	Max. stroke length (mm)	Min. stroke length (mm)	Manufacturable stroke (mm)	Min. stroke with switch (mm)
φ6	10,20,30,40,50	50	5	100	10
φ10					
φ16	10,20,30,40,50 60,70,80,90,100	100 Note1		150	
φ20					
φ25					
φ32					

Note1: In the case of rear piping:
- φ16 : 70
- φ20, 25 : 60
- φ32 : 50

※ Custom stroke length
Available in 1mm increments.However, the total length is the same as that of the next longer standard stroke length.

1.2 Specifications

1.2.1 Product specifications

Descriptions \ Model		STR2-M-HP1 (metal bush bearing) STR2-B-HP1 (ball bearing) STR2-M-P4※-HP1(metal bush bearing) STR2-B-P4※-HP1(ball bearing)					
Bore size	mm	φ6	φ10	φ16	φ20	φ25	φ32
Actuation		Double acting					
Working fluid		Compressed air					
Max. working pressure	MPa	0.7					
Min. working pressure	MPa	0.2	0.15	0.1			
Proof pressure	MPa	1.05					
Ambient temperature	°C	-10 to 60 (no freezing)					
Port size		M5					Rc1/8
Stroke tolerance	mm	$^{+2.0}_{0}$					
Adjustable stroke range	mm	0 to -5					
Working piston speed	mm/s	50 to 500					
Non-rotating accuracy (reference value)	STR2-M	±0.4°	±0.3°			±0.2°	
	STR2-B	±0.2°	±0.1°			±0.3°	
Piston rod Bearing	STR2-M	Metal bush bearing					
	STR2-B	Ball bearing					
Cushion		Rubber cushion					
Lubrication		Not required					
Max absorbed energy J	PUSH	0.008	0.061	0.181	0.303	0.68	1.3
	PULL	0.059	0.083	0.083	0.127	0.237	0.311

1.2.2 Switch specifications

Descriptions	Reed 2-wire type			
	K0H/V		K5H/V	
Applications	For programmable controller, relay		For programmable controller, relay, IC circuit(without indicator), serial connection	
Power supply voltage	—			
Load voltage	12/24 VDC	110 VAC	5/12/24 VDC	110 VAC
Load current	5 mA to 50 mA	7 mA to 20 mA	50 mA or less	20 mA or less
Current consumption	—			
Internal voltage drop	3V or less (For DC, when the load current is 30mA)		0.1V or less (Internal resistance 0.5Ω or less)	
Indicator	Red LED (Lights up when turned on)		No indicator	
Leakage current	—			
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.2 mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20 MΩ or more with 500 VDC megger			
Withstand voltage	No abnormality after applying 1000 VAC for one minute			
Ambient temperature	−10°C to 60°C			
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant			

Descriptions	Proximity 2-wire type	
	K2H/V	K2YH/V
Applications	Only for programmable controller	
Power supply voltage	—	
Load voltage	10 to 30VDC	
Load current	5 to 20mA Note 2	
Current consumption	—	
Internal voltage drop	4V or less	
Indicator	Red LED (Lights up when turned on)	Red/green LED(Lights up when turned on)
Leakage current	1 mA or less	
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.2mm^2)	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.3mm^2)
Shock resistance	980m/s^2	
Insulation resistance	20 MΩ or more with 500 VDC megger	100 MΩ or more with 500 VDC megger
Withstand voltage	No abnormality after applying 1000 VAC for one minute	
Ambient temperature	−10°C to 60°C	
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant	

Descriptions	Proximity 3-wire type		
	K3H/V(NPN output)	K3PH/V(PNP output)	K3YH/V(NPN output) (2-color display)
Applications	For programmable controller, relay		
Power supply voltage	10 to 28VDC		
Load voltage	30VDC or less		
Load current	50 mA or less		
Current consumption	10 mA or less at 24 VDC	10 mA or less at 24 VDC	10 mA or less at 24 VDC
Internal voltage drop	0.5V or less		
Indicator	Red LED (Lights up when turned on)	Yellow LED (Lights up when turned on)	Red/green LED (Lights up when turned on)
Leakage current	10μA or less		
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 3 core cord, 0.2 mm^2)		
Shock resistance	980m/s^2		
Insulation resistance	20 MΩ or more with 500 VDC megger		100 MΩ or more with 500 VDC megger
Withstand voltage	No abnormality after applying 1000 VAC for one minute		
Ambient temperature	−10°C to 60°C		
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant		

Note 1: 3 m and 5 m lead wires are available as options. (Except 5m of F type switch)
Note 2: The maximum load current of 20 mA is the value when the ambient temperature is 25°C.
Note 3: Switches for P4 * series have different order model numbers from the standard ones.
Please refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A).

※ K3PH and K3PV are available as made-to-order products.

※ "K□H" show Lead wire straight type, as well as "K□V" show Lead wire angled type.

2. INSTALLATION

2.1 Environment

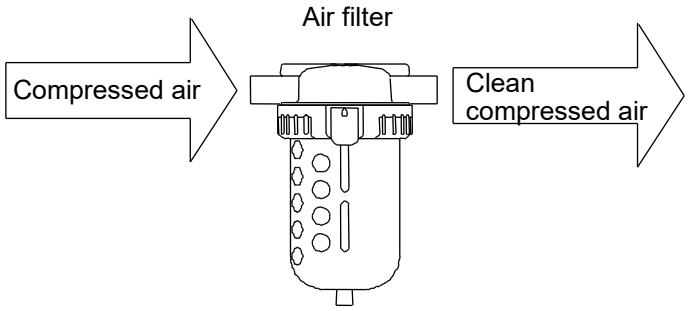
⚠CAUTION

When using the product in a cutting, casting, or welding plant, install a cover to prevent foreign matters such as cutting fluid, chips, powder, and dust from entering.

Do not use the equipment in the following environments.

- Where cutting oil can splash onto the product (abrasives and polishing powder in the oil can abrade the sliding section)
- Where organic solvents, chemicals, acids, alkalis, and kerosene are present
- Where water can splash onto the product

- Use the product within the following ambient temperature range.
  −10°C to 60°C (no freezing)
- For compressed air, use clean and dry air that has been passed through an air filter.
  Use an air filter in the circuit and be careful with the filtration rate (a filter that removes particles exceeding 5 μm is desirable), flow rate, and mounting position (install the filter near the directional control valve).



- Since the STR2-M uses oil-impregnated bearings, oil may be discharged to the outside of the cylinder.
  Be careful when using it in a place where you do not want to drain oil.

2.2 Unpacking

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.
- When storing the product, take proper measures to prevent foreign matters from entering the cylinder.

2.3 Mounting

⚠CAUTION

The twin rod cylinder has two piping ports each on both sides in the operating direction. Change the plugged ports according to your application.
After the change, confirm that there is no air leakage from the plugged ports.

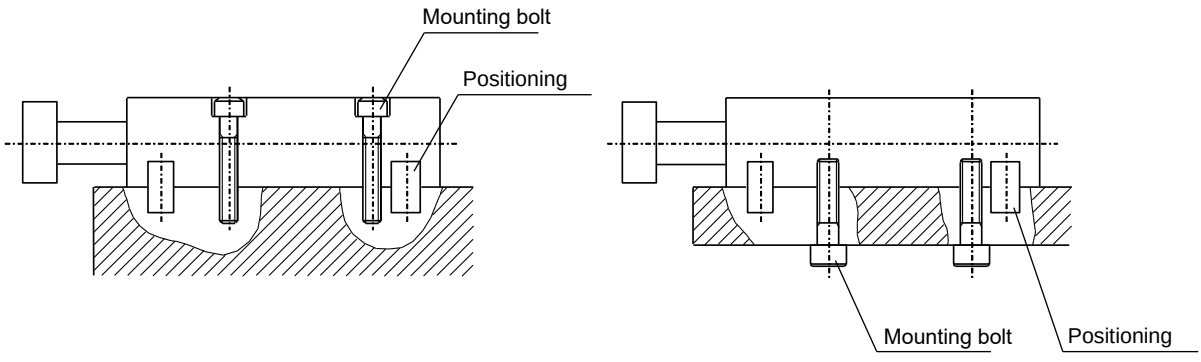
Do not damage surface flatness by denting or scratching the body (tube) mounting surface or the end plate surface.

Make sure that the flatness of the mating surface where the end plate will be attached is 0.05 mm or below.

2.3.1 Mounting the body

- Install cylinder body with a hexagon socket head cap screw directly.

<Top mounting> <Bottom mounting>



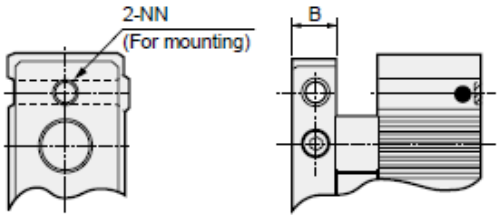
- Use hexagon socket head cap bolts for mounting bolts from the top.
Refer to the table below for the hexagon socket head cap screw to be used.

Bore size (mm)	Hexagon socket head bolt	Parallel pins	Quantity
φ6	M3 × 15	φ4×8	2
φ10	M4 × 20		
φ16	M4 × 25	φ6×12	
φ20	M5 × 32		
φ25	M6 × 40		
φ32	M6 × 45		

- When installing with bolts through the main body, tighten with the tightening torque shown in the table below.

Bore size (mm)	Tightening torque (N·m)
φ6	0.6 to 1.0
φ10	1.4 to 2.4
φ16	
φ20	2.9 to 5.1
φ25	4.8 to 8.6
φ32	

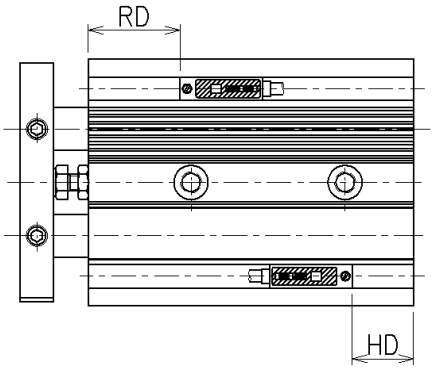
- When using screw hole NN of the end plate, make sure that the bolt length is equivalent to the B dimension.
  Not doing so could cause malfunction or damage of the end plate.



Bore size (mm)	B dimension
φ6	6
φ10	6
φ16	8
φ20	10
φ25	12
φ32	12

2.3.2 Mounting the switch

■ Location of mounting switch



< Mounting the switch at the stroke end >
Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.

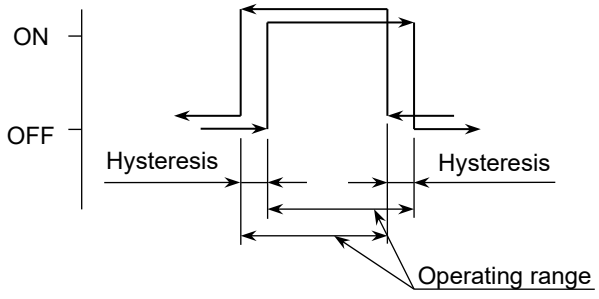
< Mounting the switch at the intermediate position of the stroke >
For the switch to function at an intermediate position of the stroke, secure the piston at the position where the switch needs to function and then slide the switch on the piston back and forth to find the positions where the switch turns on when slid forward and when slid backward. The intermediate point between these two positions is where the switch functions at maximum sensitivity for that piston position and where the switch is to be mounted.

■ Operating range

This is the range from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves farther in the same direction.

■ Hysteresis

This is the distance from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves in the opposite direction.



■ The maximum sensitivity position (HD,RD),Operating range, Hysteresis (unit：mm)

Proximity switch (K2H/V,K3H/V)				
Bore size (mm)	The maximum sensitivity position		Operating range	Hysteresis
	HD(mm)	RD(mm)		
φ6	3.5 (13.5) Note1	21 Note1	1 to 6	2 or less
φ10	2.5 (12.5) Note1	33 Note1	1 to 5.5	
φ16	7 (17)	39.5	1.5 to 7.5	
φ20	10.5 (20.5)	45	3 to 9	
φ25	11.5 (21.5)	43.5	3.5 to 10.5	
φ32	15.5 (25.5)	55.5	—	

Proximity switch (K※Y※)				
Bore size (mm)	The maximum sensitivity position		Operating range	Hysteresis
	HD(mm)	RD(mm)		
φ6	2.5 (12.5)	20	4 to 7.5	1.5 or less
φ10	1 (11)	32		
φ16	5.5 (15.5)	38.5	4.5 to 9	
φ20	9.5 (19.5)	44	5.5 to 10	
φ25	10.5 (20.5)	42.5	6.5 to 10.5	
φ32	14.5 (24.5)	54.5	—	

Reed switch (K0H/V,K5H/V)				
Bore size (mm)	The maximum sensitivity position		Operating range	Hysteresis
	HD(mm)	RD(mm)		
φ6	3.5 (13.5) Note1	21 Note1	4 to 9 (STR2-M)	3 or less
φ10	2.5 (12.5) Note1	33 Note1	4 to 9 (STR2-M)	
φ16	7 (17)	39.5	5 to 12.5	
φ20	10.5 (20.5)	45	6.5 to 14.5	
φ25	11.5 (21.5)	43.5	8 to 14.5	
φ32	15.5 (25.5)	55.5	—	

Note1：HD and RD dimensions for 10 mm stroke length differ from these dimensions according to the setting.
Note2：When using a custom stroke length, the total length is the same as that of the next longer standard stroke length.
Note3：STR2-B-6 and 10 are not compatible with K0 and K5 reed switches.
Note4：The cylinder may tilt due to the uneven surface if it is installed with the spot face side (JJ) contacted. In this case, change the port position or use the option of piping port position on the 180° opposite side (O) to keep the spot face side from being the contacting surface.
Note5：Figures in parentheses are the dimensions for the rear piping type (R).
Note6：Switches for P4 * series have different order model numbers from the standard ones.
Please refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A).

2.3.3 Changing the position of the switch

1. Loosen the fastening screw (set screw).
2. Move the switch body along the groove on the side of the body and then tighten the screw at the predetermined position.

2.3.4 Replacing the switch

1. Loosen the fastening screw (set screw) and remove the switch body from the groove.
2. Put the replacement switch into the groove.
3. Determine where to position the switch and tighten the screw.
   (Tightening torque is 0.1 to 0.2N·m for K2、K3、K0、K5, 0.5 to 0.7N·m for K2Y、K3Y.)

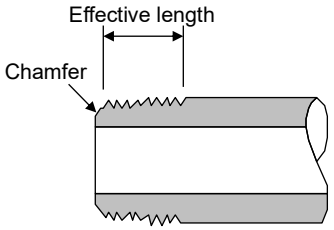
To tight switch,use minus tip screw driver of less than 0.3mm thick,less than 2.4mm wide with grip handle diam.of 5 mm.

2.4 Piping

⚠ WARNING

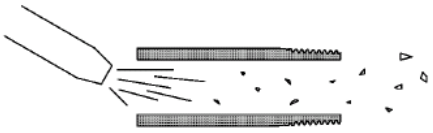
Insert the tube into the fitting until it firmly rests on the tube end and make sure that the tube does not come off before use.

- Use pipes that are made of corrosion-resistant materials after the filter such as zinc-plated pipes, nylon tubes, and rubber tubes.
- Use pipes with an effective cross-sectional area that allows the cylinder to achieve the predetermined piston speed.
- Install the filter for removing rust, foreign matters, and drainage from the piping as close as possible to the solenoid valve.
- Observe the effective thread length for the gas pipes.
- In addition, chamfer the threaded end of the pipes by about a 1/2 pitch.



■ Pipe cleaning

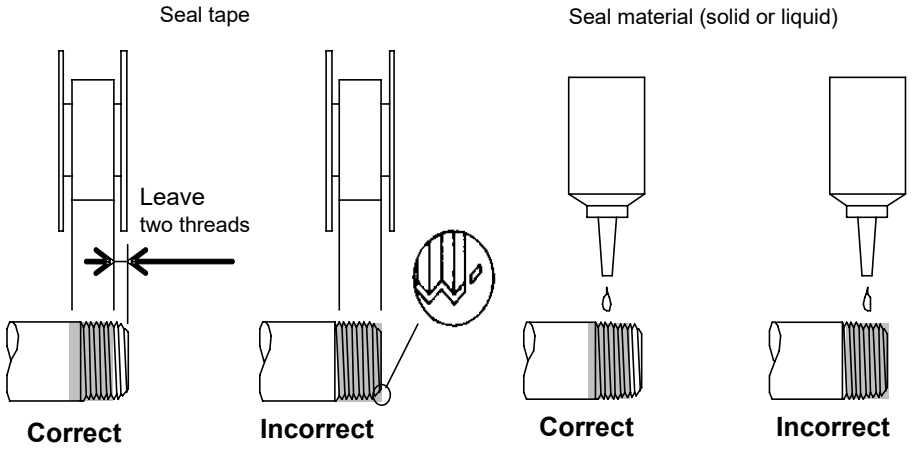
Before piping, blow air into the pipes to clean the interior and to remove cutting chips and foreign matters.



■ Seal material

Use a seal tape or a seal material to stop leakage from piping.
Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the pipes or device and cause a failure.

When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.
When using a liquid seal material, be careful not to apply it to resin parts. The resin parts can become damaged and this may lead to a failure or malfunction.
Also, do not apply seal material to the internal threads.

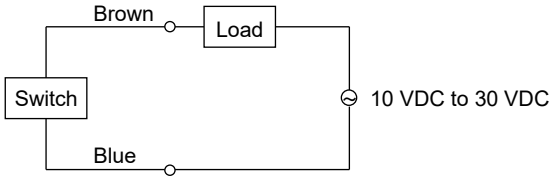


2.5 Wiring

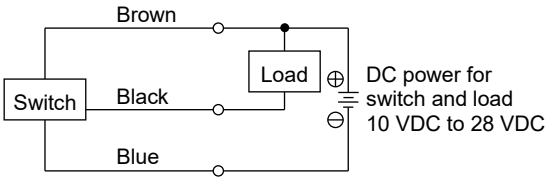
2.5.1 Proximity switch

■ Connection of lead wires

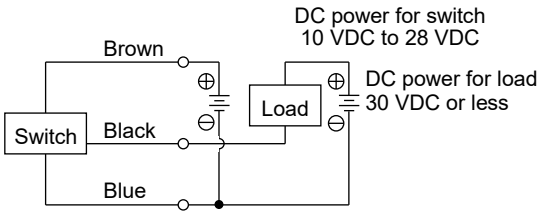
Turn off the power to the device in the electric circuit to which the switch is to be connected and connect the lead wires according to their color. Not turning off the power may cause damage to the electric circuit of the switch load.
If the switch is not wired correctly or the load is short-circuited, it may cause damage not only to the switch but also to the electric circuit on the load side.



Example of 2-wire basic circuit



Example of 3-wire basic circuit (1)
(When same power is used for switch and load)

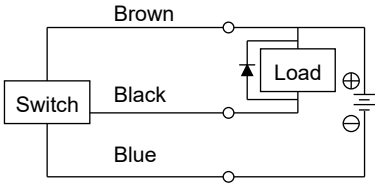


Example of 3-wire basic circuit (2)
(When separate power is used for switch and load)

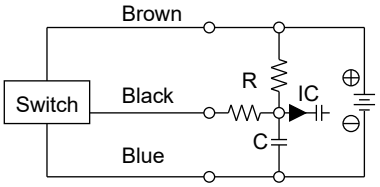
■ Protection of the output circuit

For the following cases, refer to the figures below and install a protection circuit:

- When an inductive load (relay or solenoid valve) is connected and used: See Ex. 1
  Use a surge absorption element since a surge voltage is generated when the switch is turned off.
- When a capacious load (capacitor) is connected and used: See Ex. 2
  Use a current regulating resistor since a starting current is generated when the switch is turned on.
- When the lead wire length exceeds 10 m: See Ex. 3 and 4 (2-wire type), Ex. 5 (3-wire type)

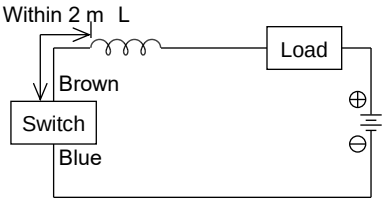


Ex. 1 Using inductive load with surge absorption element (diode). (For diode, use V06C manufactured by Hitachi or equivalent.)



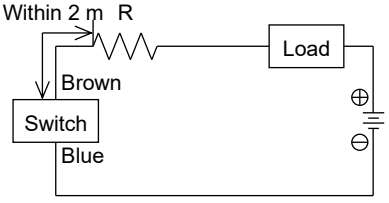
Ex. 2 Using capacious load with current regulating resistor R.
Use the following formula to figure out resistance R (Ω).

$$\frac{V}{0.05} = R\ (\Omega)$$



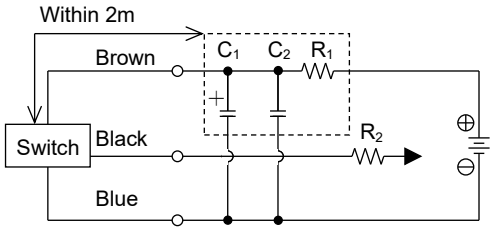
Ex. 3 - Choke coil
L = Several hundred μH to several mH
Excellent high frequency characteristic

- Wire near the switch (within 2 m).



Ex. 4 - Starting current restriction resistor
R = Highest possible resistance for the load circuit.

- Wire near the switch (within 2 m).



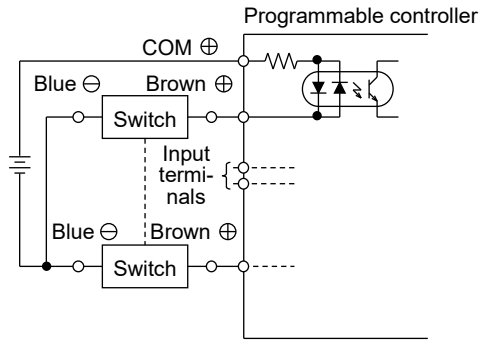
Ex. 5 - Power supply noise absorption circuit
C_1=20 μF to 50 μF electrolytic capacitor
(withstand voltage 50V or more)
C_2=0.01 μF to 0.1 μF ceramic capacitor
R_1=20 Ω to 30 Ω

- Starting current restriction resistor
R_2= Highest possible resistance for the load circuit.

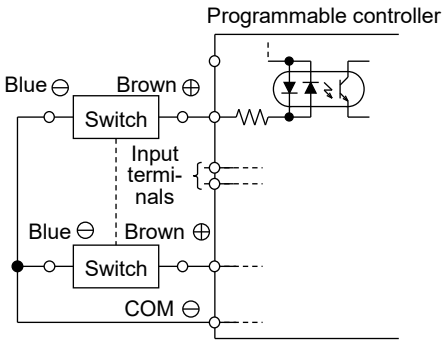
- Wire near the switch (within 2 m)

■ Connection to the programmable controller

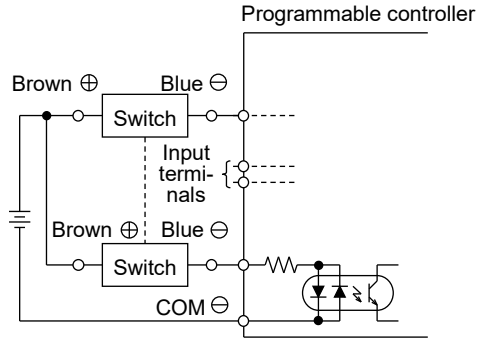
The connection method depends on the type of the programmable controller. Connect as shown below.



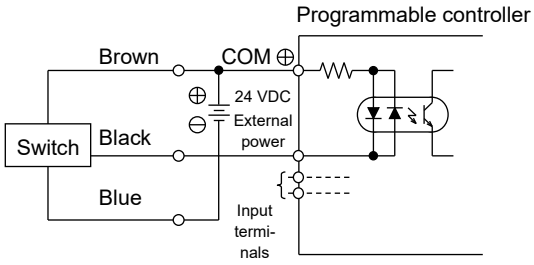
2-wire connection to source input
(external power)



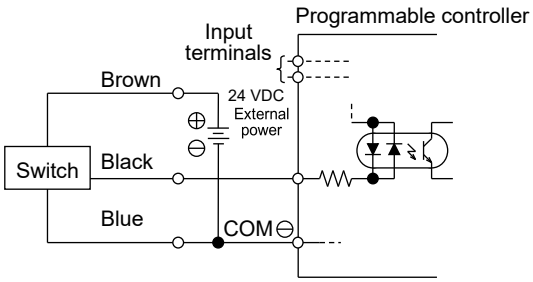
2-wire connection to source input
(internal power)



2-wire connection to sink input
(external power)



3-wire connection to source input
(external power)



3-wire connection to source input
(internal power)

■ Parallel connection

Since the leakage current of a 2-wire type switch increases according to the number of connected units, check the input specifications of the programmable controller, which is a connected load, to determine the number of switches to connect. For the 2-wire type switch, the indicator may become dim or not light up.

Although the leakage current of a 3-wire type switch increases according to the number of connected units, the leakage current is very small (10 μA or less) and can generally be ignored. For the 3-wire type switch, the indicator will light up without dimming.

2.5.2 Reed switch

■ Connection of lead wires

Do not connect the lead wire of the switch to the power directly. Make sure that the lead wire and the load are connected in serial.
For K0 switches, observe the following instructions as well:

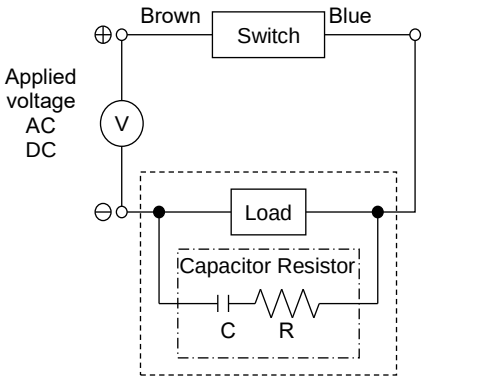
- When the switch is used with DC power, connect the brown wire to the positive side and the blue wire to the negative side. If the polarity of the connection of wires is reversed, the switch will turn on but the indicator will not light up.
- When the switch is connected to the input of a relay or a programmable controller for AC power and the half-wave rectification is performed in those circuits, the indicator on the switch may not light up. In that case, reversing the polarity of the connection of the lead wires of the switch will light up the indicator.

■ Contact protection measures

When the switch is used with an inductive load such as a relay or when the wiring length exceeds the value shown in the table to the right, install a contact protection circuit.

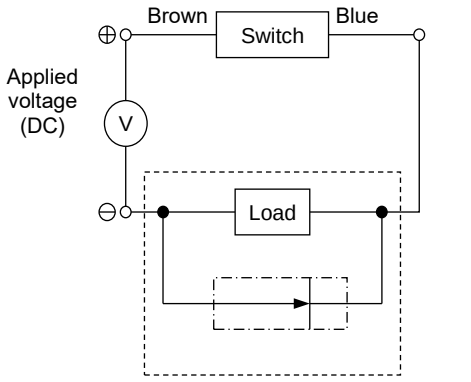
Power	Wiring length
DC	50 m
AC	10 m

<Protection when connecting an inductive load>



Recommended value
C (Capacitor) 0.033 μF to 0.1 μF
R (Resistor)1 kΩ to 3 kΩ
XEB1K1 manufactured by Okaya Electric Industries or equivalent

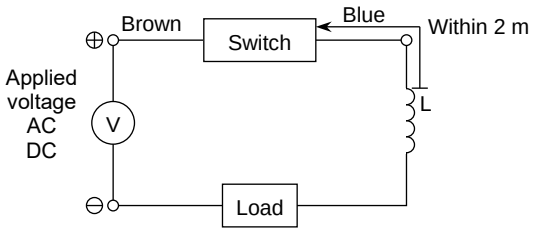
When capacitor and resistor are used



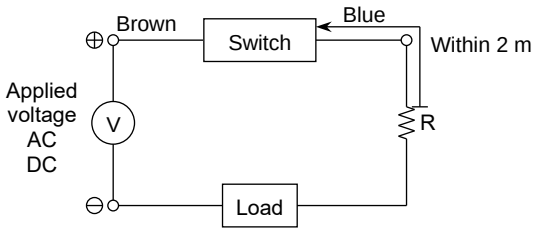
Rectifying diode for general use
V06C manufactured by Hitachi or equivalent

When diode is used

<Protection when the wiring length exceeds the value shown in the table above>



- Choke coil
  L = Several hundred μH to several mH
  Excellent high frequency characteristic
- Wire near the switch (within 2 m).



- Starting current restriction resistor
  R = Highest possible resistance for the load circuit
- Wire near the switch (within 2 m).

■ Contact capacity

Do not use a load that exceeds the maximum contact capacity of the switch. If the current falls below the rated current value, the indicator may not light up.

■ Relay

Use one of the following or equivalent relays:
- Omron Corporation ·····MY type
- Fuji Electric Co., Ltd. ·····HH5 type
- Panasonic Corporation ·····HC type

■ Serial connection

The voltage drop of multiple K0 switches connected in serial is the sum of the voltage drop of all switches.
The indicator will light up only when all the switches turn on.

■ Parallel connection

There is no limitation on the number of units that can be connected in parallel. However, the indicator may become dim or not light up for K0 switches.

3. USAGE

3.1 Using the Cylinder

■ Working pressure range

Use the cylinder within the following pressure range:

Model	Bore size(mm)	Pressure range (MPa)
STR2-HP1	φ6	0.2 to 0.7MPa
	φ10	0.15 to 0.7MPa
	φ16 to 32	0.1 to 0.7MPa

■ How to adjust the cushion

Although a rubber cushion is internally provided for this type of cylinder, it is advisable to install an additional external stopper when the kinetic energy is excessive. Tolerable kinetic energy is as the graphs below indicate.

Bore size(mm)		φ6	φ10	φ16	φ20	φ25	φ32
Allowable energy absorption (J)	PUSH	0.008	0.061	0.181	0.303	0.68	1.3
	PULL	0.059	0.083	0.083	0.127	0.237	0.311

■ Adjustment of the piston speed

Mount a speed controller to adjust the piston speed.

3.2 Using the Switch

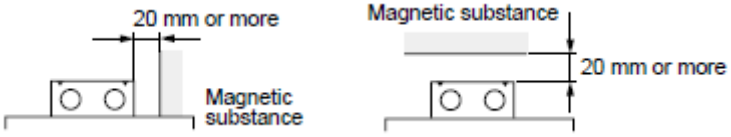
⚠CAUTION

When using a proximity switch for STR2-B-6, avoid mounting the cylinder on a magnetic substance such as a metal plate.
This could lead to switch detection malfunction.
STR2-B-6 and 10 are not compatible with reed switch.

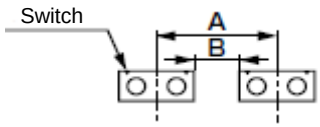
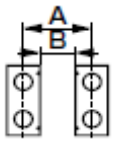
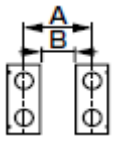
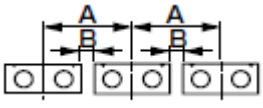
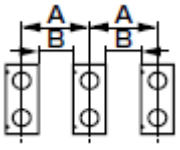
■ Magnetic environment

Do not use the switch in a place where there is a strong magnetic field or large current (such as a large magnet or welding machine). If switch mounted cylinders are installed close to each other and in parallel or if magnetic substances are moving close to the cylinder, the magnetic forces may interfere with each other and affect the detection accuracy.

- The cylinder switch may malfunction if there is a magnetic substance such as a metal plate installed adjacently. Check that a distance of 20 mm is provided from the surface of the cylinders. (Same clearance for all bore sizes)



- The cylinder switch may malfunction if cylinders are installed adjacently. Check that the following distances are allocated between cylinders.

Adjacent conditions			Switch	φ6	φ10	φ16	φ20	φ25	φ32
Two cylinders in parallel	Horizontal mounting 	A	K2,K3	43	45	56	66	75	111
			K0,K5	40*1	47*1	62	81	85	111
		B	K2,K3	7	1	2	4	3	15
			K0,K5	4*1	3*1	8	19	12	15
	Vertical mounting switches are attached on the side of adjacent cylinders 	A	K2,K3	28	27	36	47	47	58
			K0,K5	27*1	26*1	36	53	53	58
		B	K2,K3	15	12	15	20	14	20
			K0,K5	14*1	11*1	15	26	20	20
	Vertical mounting switches are attached on the opposite side of the adjacent cylinders 	A	K2,K3	19	16	22	28	34	39
			K0,K5	14*1	16*1	22	33	34	39
		B	K2,K3	6	1	1	1	1	1
			K0,K5	1*1	1*1	1	6	1	1
Three or more cylinders in parallel	Horizontal mounting 	A	K2,K3	44	45	57	67	77	111
			K0,K5	41*1	47*1	64	83	86	111
		B	K2,K3	8	1	3	5	5	15
			K0,K5	5*1	3*1	10	21	14	15
	Vertical mounting 	A	K2,K3	33	30	40	51	49	58
			K0,K5	30*1	28*1	42	60	97	58
		B	K2,K3	20	15	19	24	16	20
			K0,K5	17*1	13*1	21	33	25	20

*1: Dimensions for STR2-M. STR2-B-6 and 10 are not compatible with reed switch.

■ Wiring of lead wires

When wiring, be careful not to apply bending stress and tension repeatedly to lead wires.
For movable sections, use wiring material with the same level of bending resistance as the robot wire.

■ Ambient temperature

Do not use the switch in a high temperature environment (60°C or more).
Using the switch in a high temperature environment may affect its performance due to the temperature characteristics of magnetic parts and electronic parts.

■ Intermediate position detection

When the switch is operated at an intermediate position in the length of the stroke, the relay will not respond if the piston speed is too high.

■ Shock

Do not subject the product to strong vibrations and shocks when transporting the cylinder and mounting and adjusting the switch.

4. MAINTENANCE AND INSPECTION

⚠WARNING

Do not touch electrical wiring connections (bare live parts) of actuators equipped with switches, and other such actuators.

Do not touch live parts with bare hands.

An electric shock may occur.

Turn off the power, release the residual pressure and make sure that there is no residual pressure before disassembling or inspecting the actuator.

⚠CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.

If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.

4.1 Periodic Inspection

In order to use the product under optimum conditions, perform a periodic inspection once or twice a year.

4.1.1 Inspection item

- Actuation state
- Change in the piston speed and cycle time
- External and internal leakages
- Damage and deformation of the piston rod
- Stroke abnormality

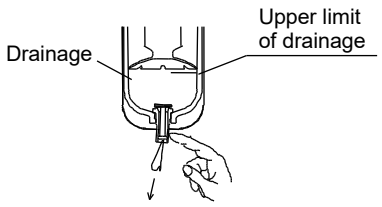
Check the items above and refer to "5. TROUBLESHOOTING" to correct any abnormality found. If there are loose threaded connections, tighten them.

4.1.2 Maintenance of the product

- This cylinder does not require lubrication.

4.1.3 Maintenance of the circuit

- Discharge the drainage accumulated in the air filter periodically before it exceeds the specified line.
- Since foreign matters such as carbide (carbon or tar substance) from the compressor oil may contaminate the circuit and cause an operation fault of the solenoid valve or the cylinder, be careful when performing maintenance or inspection of the compressor.



4.2 Disassembly method,Assembly method

4.2.1 Disassembly method

If any failure occurs such as air leakage, disassemble the product, referring to the internal structural diagram, and exchange the parts in the consumable parts list.

- When disassembling, remove the (20) hexagon socket set screw and remove the end plate.
- (6) Remove the hexagon socket set screw (φ6, 10) or the hole C ring (φ16 to 32).
- Remove the housing and metal or bearing together with the piston rod.

4.2.2 Assembly method

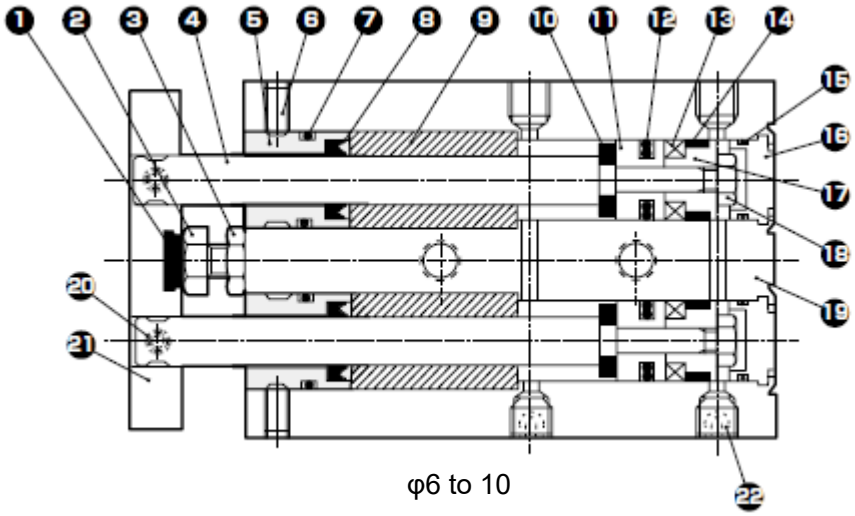
1. Apply grease to the rod packing, piston packing, metal or ball bush, and the inner surface of the cylinder body.
2. Attach the rod packing to the housing, and attach the piston packing and wear ring to the piston.
3. Refer to the internal structure diagram, attach the cushion rubber, and install it in the piston rod in the order of metal or ball bush and housing.
4. Insert the one assembled in step 3 into the cylinder body, and fix φ6 and 10 with hexagon socket set screws (6) and φ16 to 32 with C-rings for holes.
5. Install the end plate and tighten it with the hexagon socket set screw (20). Please use grease. Tighten in the PULL state.

Refer to the table below for the tightening torque of hexagon socket set screws (6) and (20).

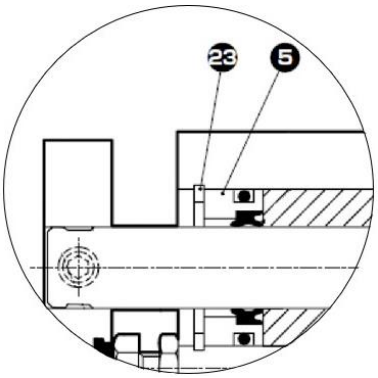
Bore size(mm)	Tightening torque (N･m)	
	Hexagon socket set screw (6)	Hexagon socket set screw (20)
φ6	49	49
φ10	49	49
φ16	-	284
φ20	-	284
φ25	-	1107
φ32	-	1107

4.2.3 Internal structural diagram

STR2-M-HP1 metal bush bearing



φ6 to 10



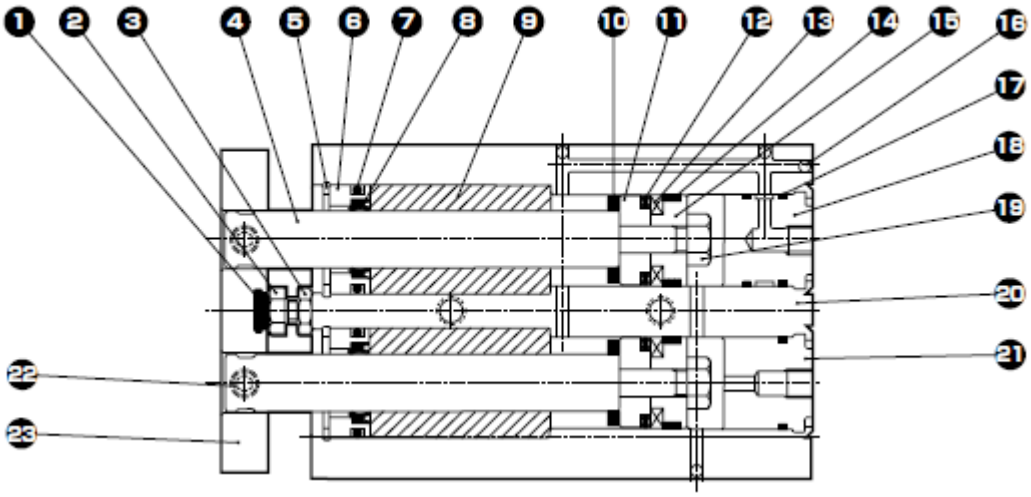
φ16 to 32

Parts list

No.	Part name	Material	Remarks
1	Cushion rubber (H)	Urethane rubber	
2	Hexagon head bolt	Stainless steel	
3	Hexagon nut	Stainless steel	
4	Piston rod	Stainless steel (φ6 to 20) Steel (φ25,32)	Industrial chrome plating
5	Housing	Stainless steel (φ6 to 10) Aluminum alloy(φ16 to 32)	Chromate (φ16 to 32)
6	Hexagon socket set screw	Stainless steel	φ6,10 only
7	O-ring	NBR	
8	Rod packing	NBR	
9	Bush	Oil-impregnated bearing alloy	
10	Cushion rubber (R)	Urethane rubber	
11	Piston	Aluminum alloy	Chromate
12	Piston packing	NBR	
13	Magnet	Plastic	
14	Wear ring	Acetal resin	
15	O-ring	NBR	
16	Cap	Aluminum alloy	Chromate
17	Spacer	Aluminum alloy	Chromate
18	Hexagon nut	Steel	Zinc chromate
19	Cylinder body	Aluminum alloy	Hard alumite
20	Hexagon socket set screw	Stainless steel	
21	End plate Note1	Aluminum alloy	Alumite
22	Hexagon socket set screw	Stainless steel	
23	Snap ring for hole	Stainless steel	φ16 to 32 only

Note1 : The steel end plate is zinc chromate.
Note 2: The above is the parts list of HP1 series.
For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.
For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

STR2-M-R-HP1 metal bush bearing Rear piping

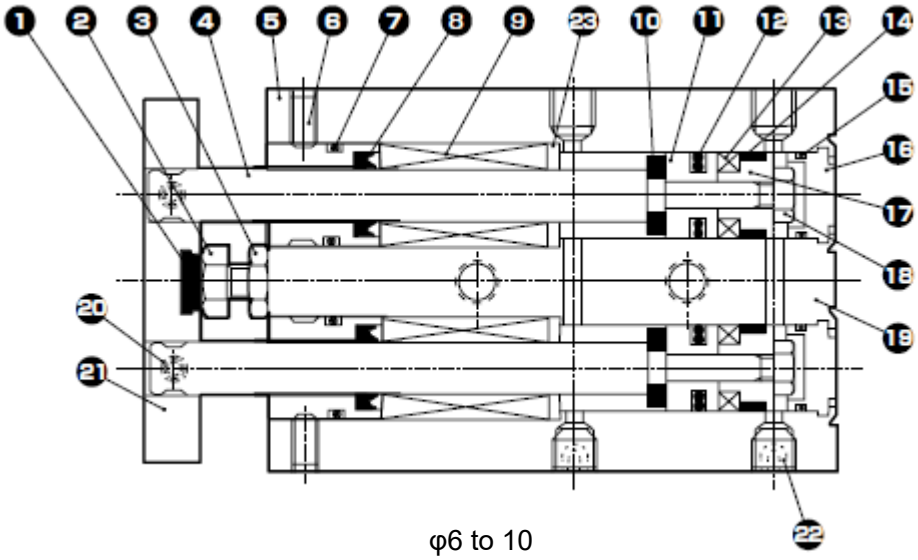


Parts list

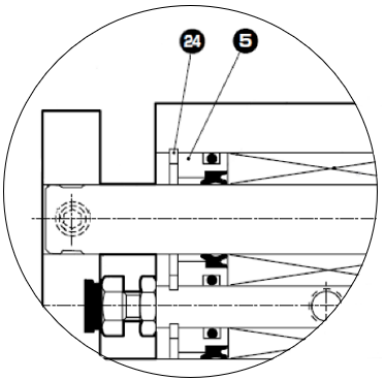
No.	Part name	Material	Remarks
1	Cushion rubber (H)	Urethane rubber	
2	Hexagon head bolt	Stainless steel	
3	Hexagon nut	Stainless steel	
4	Piston rod	Stainless steel (φ6 to 20) Steel (φ25,32)	Industrial chrome plating (φ16 to 32)
5	Snap ring for hole	Stainless steel	
6	Housing	Stainless steel (φ6,10) Aluminum alloy (φ16 to 32)	Chromate
7	O-ring	NBR	
8	Rod packing	NBR	
9	Bush	Oil-impregnated bearing alloy	
10	Cushion rubber (R)	Urethane rubber	
11	Piston	Aluminum alloy	Chromate
12	Piston packing	NBR	
13	Magnet	Plastic	
14	Wear ring	Acetal resin	
15	Spacer	Aluminum alloy	Chromate
16	Steel ball	Steel	
17	O-ring	NBR	
18	Cap (A)	Aluminum alloy	Chromate
19	Hexagon nut	Steel	Zinc chromate
20	Cylinder body	Aluminum alloy	Hard alumite
21	Cap (B)	Aluminum alloy	Chromate
22	Hexagon socket set screw	Stainless steel	
23	End plate	Aluminum alloy	Alumite

Note1 : The steel end plate is zinc chromate.
Note 2: The above is the parts list of HP1 series.
For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.
For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

STR2-B-HP1 ball bearing



φ6 to 10



φ16 to 32

Parts list

No.	Part name	Material	Remarks
1	Cushion rubber (H)	Urethane rubber	
2	Hexagon head bolt	Stainless steel	
3	Hexagon nut	Stainless steel	
4	Piston rod	Steel	Industrial chrome plating
5	Housing	Stainless steel (φ6 to 10) Aluminum alloy (φ16 to 32)	Chromate (φ16 to 32)
6	Hexagon socket set screw	Stainless steel	φ6,10 only
7	O-ring	NBR	
8	Rod packing	NBR	
9	Bearing		
10	Cushion rubber (R)	Urethane rubber	
11	Piston	Aluminum alloy	Chromate
12	Piston packing	NBR	
13	Magnet	Plastic	
14	Wear ring	Acetal resin	
15	O-ring	NBR	
16	Cap	Aluminum alloy	Chromate
17	Spacer	Aluminum alloy	Chromate
18	Hexagon nut	Steel	Zinc chromate
19	Cylinder body	Aluminum alloy	Hard alumite
20	Hexagon socket set screw	Stainless steel	
21	End plate Note1	Aluminum alloy	Alumite
22	Hexagon socket set screw	Stainless steel	
23	Spacer	Aluminum alloy	Chromate
24	Snap ring for hole	Stainless steel	φ16 to 32 only

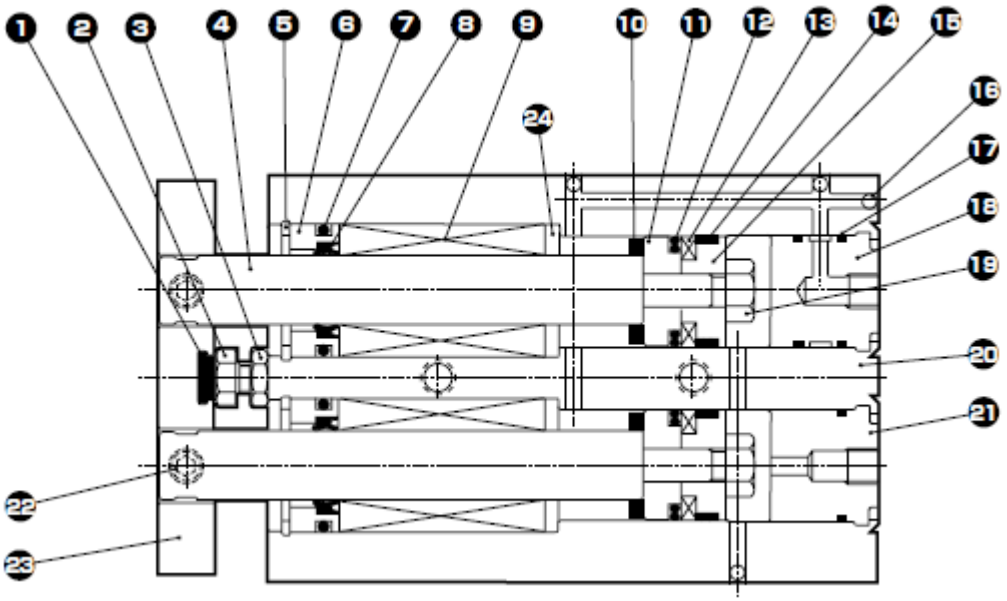
Note1 : The steel end plate is zinc chromate.

Note 2: The above is the parts list of HP1 series.

For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.

For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

STR2-B-R-HP1 ball bearing Rear piping



Parts list

No.	Part name	Material	Remarks
1	Cushion rubber (H)	Urethane rubber	
2	Hexagon head bolt	Stainless steel	
3	Hexagon nut	Stainless steel	
4	Piston rod	Steel	Industrial chrome plating
5	Snap ring for hole	Stainless steel	
6	Housing	Stainless steel (φ6,10) Aluminum alloy (φ16 to 32)	Chromate
7	O-ring	NBR	
8	Rod packing	NBR	
9	Bearing		
10	Cushion rubber (R)	Urethane rubber	
11	Piston	Aluminum alloy	Chromate
12	Piston packing	NBR	
13	Magnet	Plastic	
14	Wear ring	Acetal resin	
15	Spacer	Aluminum alloy	Chromate
16	Steel ball	Steel	
17	O-ring	NBR	
18	Cap (A)	Aluminum alloy	Chromate
19	Hexagon nut	Steel	Zinc chromate
20	Cylinder body	Aluminum alloy	Hard alumite
21	Cap (B)	Aluminum alloy	Chromate
22	Hexagon socket set screw	Stainless steel	
23	End plate	Aluminum alloy	Alumite
24	Spacer	Aluminum alloy	Chromate

Note1：The steel end plate is zinc chromate.
Note 2:The above is the parts list of HP1 series.
For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.
For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

Consumable parts list

Model	Bore size (mm)	Kit no.	Remarks
STR2-M/B-HP1	φ6	STR2-6K-HP1	Part no.1,7,8,10,12,14
	φ10	STR2-10K-HP1	
	φ16	STR2-16K-HP1	
	φ20	STR2-20K-HP1	
	φ25	STR2-25K-HP1	
	φ32	STR2-32K-HP1	

※Specify the kit No. when placing an order.

5. TROUBLESHOOTING

5.1 Problems, Causes, and Solutions

If the product does not operate properly, check the table below for a possible solution.

5.1.1 Cylinder

Problem	Cause	Solution
Does not operate.	No pressure or insufficient pressure is applied.	Secure sufficient pressure.
	No signal is input to directional control valve.	Repair the control circuit.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Piston packing is damaged.	Replace the cylinder.
Does not operate smoothly.	Speed is lower than minimum working piston speed.	Mitigate load fluctuation.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.
	Load is too large.	Increase the pressure. Enlarge the bore size.
	Speed control valve has meter-in circuit.	Change the mounting direction of the speed control valve.
Cylinder is damaged or deformed.	Force of shock due to high-speed actuation is excessive.	Decrease the speed. Lighten the load. Install a more effective cushion mechanism. (external cushion mechanism)
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.

5.1.2 Switch

Problem	Cause	Solution
Switch turns on but indicator does not blink.	Contact is welded.	Replace the switch.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Indicator is damaged.	Replace the switch.
	External signal is faulty.	Check the external circuit.
Switch does not turn on.	Cables are disconnected.	Replace the switch.
	External signal is faulty.	Check the external circuit.
	Voltage is wrong.	Use specified voltage.
	Switch is not mounted in right place.	Mount the switch in right place.
	Switch is not positioned correctly.	Position and tighten the switch correctly.
	Switch is facing opposite direction.	Mount the switch so that it faces the correct direction.
	Load (relay) cannot respond for intermediate position detection.	Lower the speed. Replace the relay with one recommended by CKD.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
Switch does not turn off.	Piston is not moving.	Move the piston.
	Contact is welded.	Replace the switch.
	Rating of relay is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Ambient temperature is too high or too low.	Use the switch at an ambient temperature of −10°C to 60°C.
	Magnetic field is nearby.	Install a magnetic shield.
	External signal is faulty.	Check the external circuit.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. WARRANTY PROVISIONS

6.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

6.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.