

Compact Cylinder SMG-HP1 Series

INSTRUCTION MANUAL

SM-A09356-A/3



- 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.

PREFACE

Thank you for purchasing CKD's **"SMG-HP1 Series" Compact 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.
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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.

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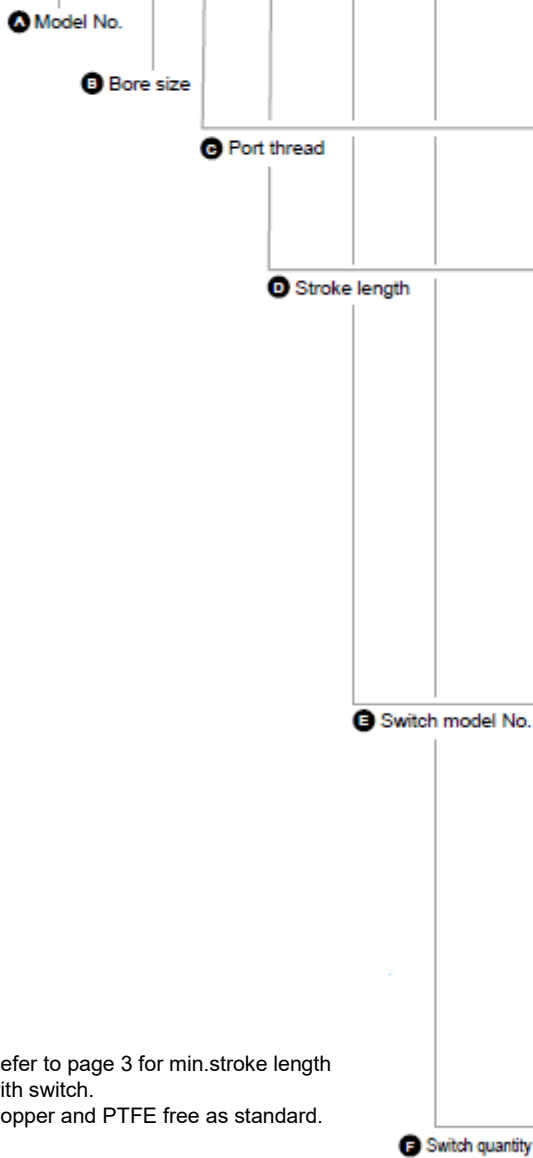
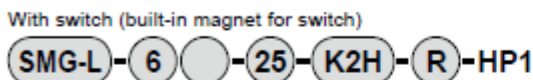
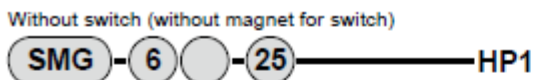
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1. PRODUCT OVERVIEW

1.1 Model Number Indication

1.1.1 Product model number

■ Example of model number indication : SMG-HP1 series



Code	Description
A Model No.	
SMG	Double acting
SMG-L	Double acting/with switch

B Bore size (mm)	
6	ø8
10	ø10
16	ø16
20	ø20
25	ø25
32	ø32

C Port thread	
Blank	Rc thread
NN	NPT thread (ø32 or more) (made to order)
GN	G thread (ø32 or more) (made to order)

Stroke length (mm)	Applicable bore size					
	ø6	ø10	ø16	ø20	ø25	ø32
Standard stroke length	5	●	●	●	●	●
	10	●	●	●	●	●
	15	●	●	●	●	●
	20	●	●	●	●	●
	25	●	●	●	●	●
	30	●	●	●	●	●
	40	●	●	●	●	●
	50	●	●	●	●	●
	60	●	●	●	●	●
	70				●	●
	80				●	●
	90				●	●
	100				●	●

E Switch model No.						
Lead wire straight type	Radial lead wire	Contact	Voltage		Indicator	Lead wire
			AC	DC		
K0H*	K0V*	Reed	●	●	1-color display	2-wire
			●	●	Without indicator lamp	
K2H*	K2V*	Proximity		●	1-color display	2-wire
				●		3-wire
K3PH*	K3PV*	Proximity		●	1-color display (made to order)	3-wire
K2YH*	K2YV*			●	2-color display	2-wire
K3YH*	K3YV*			●		3-wire

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

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

※ Refer to page 3 for min.stroke length with switch.

※ Copper and PTFE free as standard.

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

Without switch (without magnet for switch) *1

SMG - 32 - 25 ——— P40 - HP1

With switch (built-in magnet for switch)

SMG-L - 32 - 25 - SW51 - R - P4 P40 - HP1

A Model No.

B Bore size

C Stroke

D Switch model No.

E Switch quantity

Code	Description						
A Model No.							
SMG	Double acting						
SMG-L	Double acting/with switch						
B Bore size (mm)							
6	ø6						
10	ø10						
16	ø16						
20	ø20						
25	ø25						
32	ø32						
C Stroke (mm)							
	Applicable bore size						
	ø6 ø10 ø16 ø20 ø25 ø32						
Standard Stroke	5	●	●	●	●	●	●
	10	●	●	●	●	●	●
	15	●	●	●	●	●	●
	20	●	●	●	●	●	●
	25	●	●	●	●	●	●
	30	●	●	●	●	●	●
	40	●	●	●	●	●	●
	50	●	●	●	●	●	●
	60	●	●	●	●	●	●
	70				●	●	●
	80				●	●	●
	90				●	●	●
100				●	●	●	
D Switch model No.							
For switch model number, refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A) .							
E Switch quantity							
R	1 on rod side						
H	1 on head side						
D	2						

- ※ Refer to page 3 for min.stroke length with switch.
- ※ Without switch type of HP1 is P4 specification.

■ Stroke length

Bore size(mm)	Standard stroke length(mm)	Min.stroke length (mm)
φ6	5,10,15,20,25,30,40,50,60	5
φ10		
φ16		
φ20	5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100	
φ25		
φ32		

※ The custom stroke length is available in 5 mm increments.

■ Min.stroke with switch

Switch Bore size(mm)	1-color display		2-color display	
	K□H	K□V	K□YH	K□YV
φ6	5		5	
φ10				
φ16				
φ20				
φ25				
φ32				

1.2 Specifications

1.2.1 Product specifications

Model	SMG-HP1,SMG-L-HP1					
Descriptions	SMG-P40-HP1,SMG-L-P40-HP1					
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	0.12	0.06		0.05		
Proof pressure MPa	1.05					
Ambient temperature °C	-10 to 60 (no freezing)					
Port size	M5					Rc1/8
Stroke tolerance mm	+1.5 0					
Working piston speed mm/s	50 to 500					
Cushion	With rubber cushion					
Lubrication	Not required					
Allowable absorbed energy J	0.012	0.036	0.1	0.1	0.19	0.5



The min. working pressure in the specifications column indicates the initial value.
Depending on the conditions of use or duration of use, the specifications may be exceeded.

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	3 V or less (For DC, when the load current is 30mA)		0.1 V or less (Internal resistance 0.5 Ω or less.)	
Indicator	Red LED (Lights up when turned on)		—	
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	10mA 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	10 μ A 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 M Ω or more with 500 VDC megger		100 M Ω 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

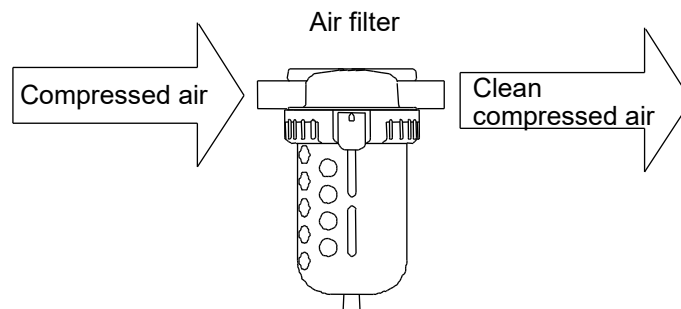
2.1 Environment

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).



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

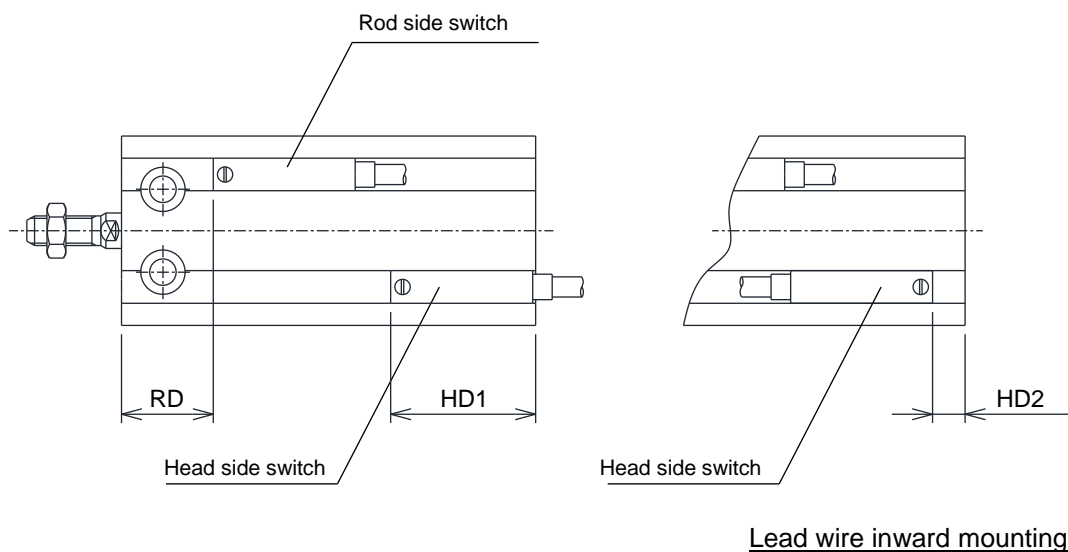
2.3.1 Mounting the Body

Observe the following values for the tightening torque when installing this product.

Bore size(mm)	Bolt size	Tightening torque (N·m)
φ6,10	M3	0.6 to 1.1N·m
φ16	M4	1.5 to 2.7N·m
φ20,25	M5	3.0 to 5.4N·m
φ32	M6	5.2 to 9.2 N·m

2.3.2 Mounting the switch

■ Mounting position



< 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 >

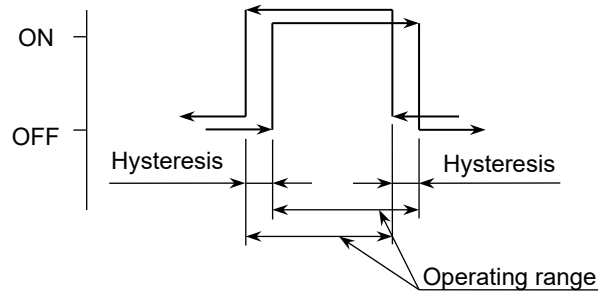
For the switch to function at an intermediate position of the stroke, secure the piston at the position where the switch needs to function and then slide the switch on the piston back and forth to find the positions where the switch turns on when slid forward and when slid backward. The intermediate 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 of switch when mounted at stroke end (HD,RD), Operating range, Hysteresis (unit : mm)

The maximum sensitivity position

Switch model	K□H/V			K□YH/V		
Mounting position Bore size (mm)	HD1	HD2	RD	HD1	HD2	RD
φ6	20	1	13	21	0	12
φ10	23.5	4.5	12.5	24.5	3.5	11.5
φ16	24.5	5.5	15.5	25.5	4.5	14.5
φ20	27	8	19	28	7	18
φ25	29	10	21	30	9	20
φ32	30.5	11.5	21.5	31.5	10.5	20.5

Operating range, Hysteresis

Descriptions Bore size (mm)	Proximity switch				Reed switch	
	Operating range		Hysteresis		Operating range	Hysteresis
	1-color display	2-color display	1-color display	2-color display		
φ6	1.5 to 7	3.5 to 7.5	2 or less	1.5 or less	3 to 9.5	3 or less
φ10	1.5 to 7	3.5 to 7.5			3.5 to 9.5	
φ16	1.5 to 7	4.5 to 8.5			4 to 11	
φ20	2.5 to 9	5 to 9			5 to 12.5	
φ25	3.5 to 11	5.5 to 9.5			6.5 to 14	
φ32	3.5 to 11.5	1.5 to 10.5			5.5 to 14	

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.



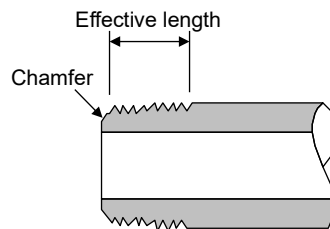
To tight switch,use minus tip screw driver of less than 0.3mm thick,less than 2.4mm wide with grip handle diam.of 5 to 6mm(such as watch repair driver and precision driver).
Tightening torque is 0.1 to 0.2N·m for K2,K3,K0,K5,K3P, 0.5 to 0.7 N·m for K2Y,K3Y.

2.4 Piping

WARNING

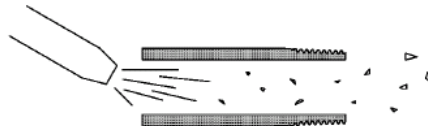
Insert the tube into the fitting until it firmly rests on the tube end and make sure that the tube does not come off before use.

- 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

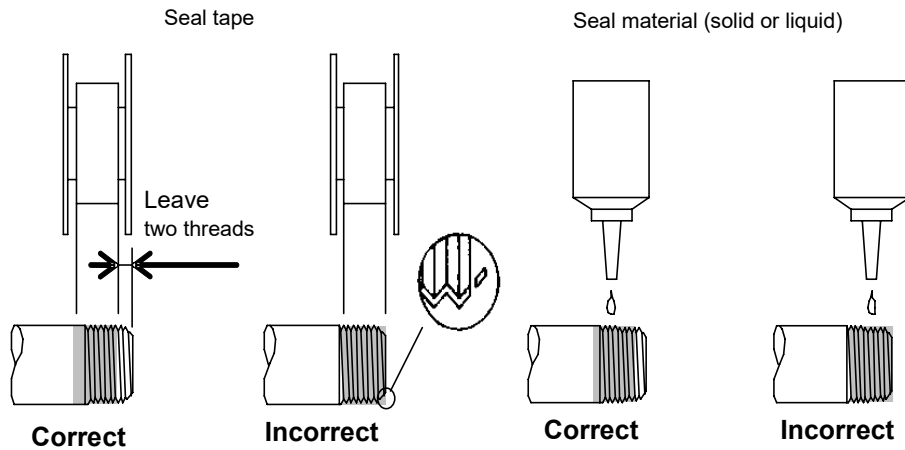
Use a seal tape or a seal material to stop leakage from piping.

Apply a seal tape or seal material to the screw threads leaving two or more threads 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.



2.4.1 Piping joint

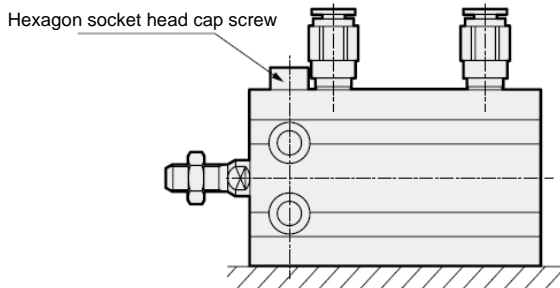
Because the usable piping joint has limitations, for using it, see the below.

Bore size	Port size	Recommended fittings	Bore size	Port size	Recommended fittings
6	M5	SC3W-M5-4,6 SC3U-M5-4,6 GWS4-M5 GWS6-M5 <small>Note 1</small> GWS4,6-M5-S GWL4-M5 GWL6-M5 <small>Note 1</small>	20	M5	SC3W-M5-4,6 SC3U-M5-4,6 GWS4-M5 <small>Note 1</small> GWS6-M5 <small>Note 1</small> GWS4,6-M5-S GWL4-M5 GWL6-M5 <small>Note 1</small>
10	M5	SC3W-M5-4,6 SC3U-M5-4,6 GWS4,6-M5 GWS4,6-M5-S GWL4,6-M5	25	M5	SC3W-M5-4,6 SC3U-M5-4,6 GWS4,6-M5 GWS4,6-M5-S GWL4,6-M5
16	M5	SC3W-M5-4,6 SC3U-M5-4,6 GWS4-M5 <small>Note 1</small> GWS6-M5 <small>Note 2</small> GWS4-M5-S GWS6-M5-S <small>Note 1</small> GWL4-M5 <small>Note 1</small> GWL6-M5 <small>Note 2</small>	32	Rc1/8	SC3W-6-4,6,8 SC3U-6-4,6,8 GWS4,6,8-6 GWS4,6,8-6-S GWL4,6,8-6

Note1: Excluding 5 stroke length or mounting method in "Fig. 1".

Note2: Excluding 5,10 stroke length or mounting method in "Fig. 1".

Fig. 1



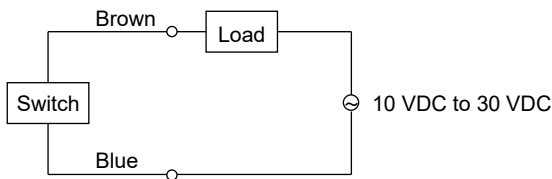
2.5 Wiring

2.5.1 Proximity switch

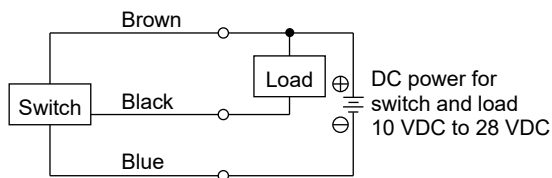
■ Connection of lead wires

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.

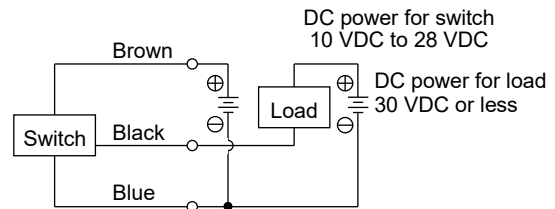
If the switch is not wired correctly or the load is short-circuited, it may cause damage not only to the switch but also to the electric circuit on the load side.



Example of 2-wire basic circuit



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

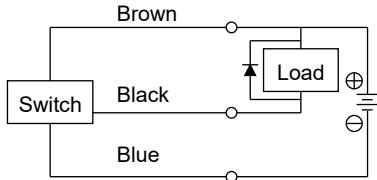


Example of 3-wire basic circuit (2)
(When separate power is used for switch and load)

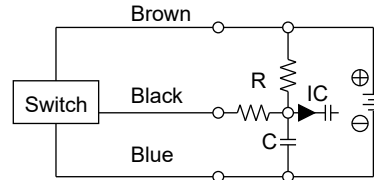
■ Protection of the output circuit

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)

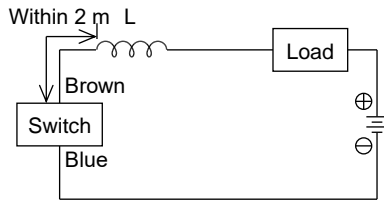


Ex. 1 Using inductive load with surge absorption element (diode). (For diode, use V06C manufactured by Hitachi or equivalent.)

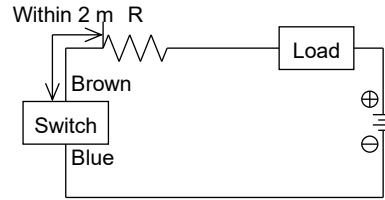


Ex. 2 Using capacious load with current regulating resistor R.
Use the following formula to figure out resistance R (Ω).

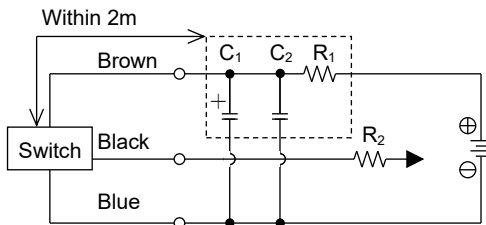
$$\frac{V}{0.05} = R (\Omega)$$



Ex. 3 - Choke coil
L = Several hundred μH to several mH
Excellent high frequency characteristic
- Wire near the switch (within 2 m).



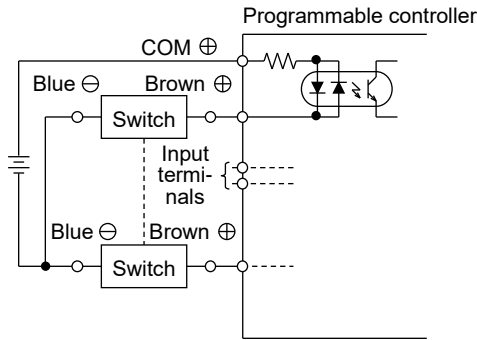
Ex. 4 - Starting current restriction resistor
R = Highest possible resistance for the load circuit.
- Wire near the switch (within 2 m).



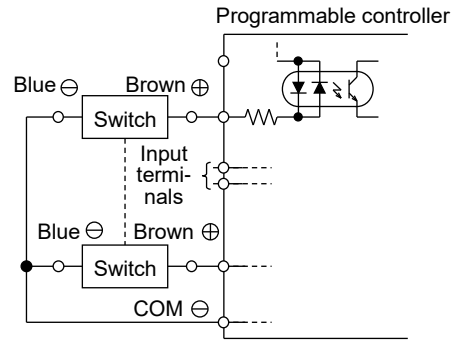
Ex. 5 - Power supply noise absorption circuit
C₁=20 μF to 50 μF electrolytic capacitor (withstand voltage 50V or more)
C₂=0.01 μF to 0.1 μF ceramic capacitor
R₁=20 Ω to 30 Ω
- Starting current restriction resistor
R₂= Highest possible resistance for the load circuit.
- Wire near the switch (within 2 m)

■ Connection to the programmable controller

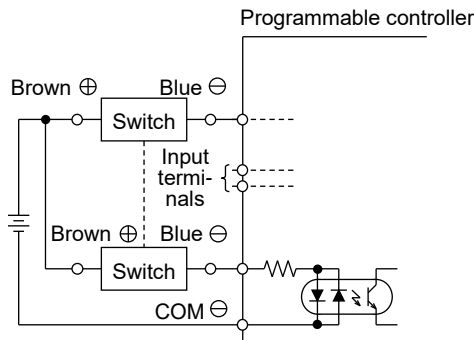
The connection method depends on the type of the programmable controller. Connect as shown below.



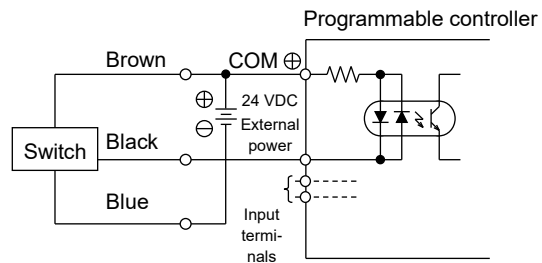
2-wire connection to source input (external power)



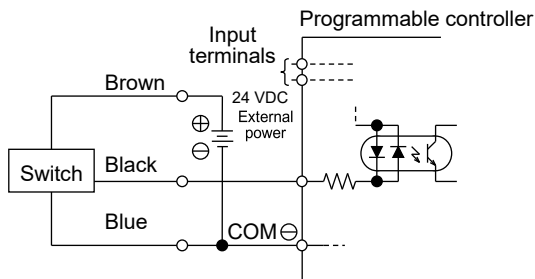
2-wire connection to source input (internal power)



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 μ A 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:

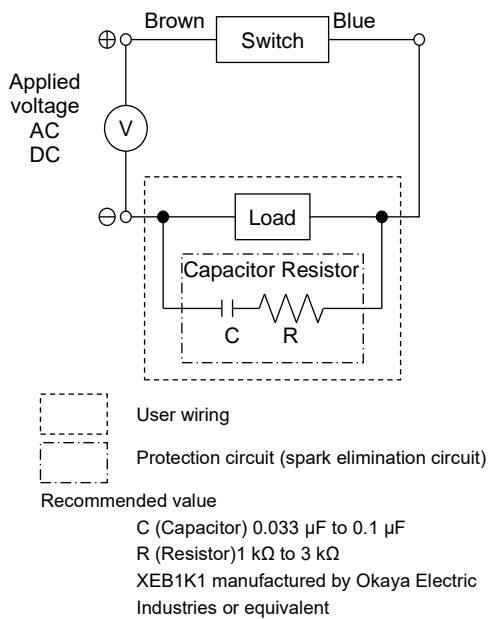
- When the switch is used with DC power, connect the brown wire to the positive side and the blue wire to the negative side. If the polarity of the connection of wires is reversed, the switch will turn on but the indicator will not light up.
- When the switch is connected to the input of a relay or a 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

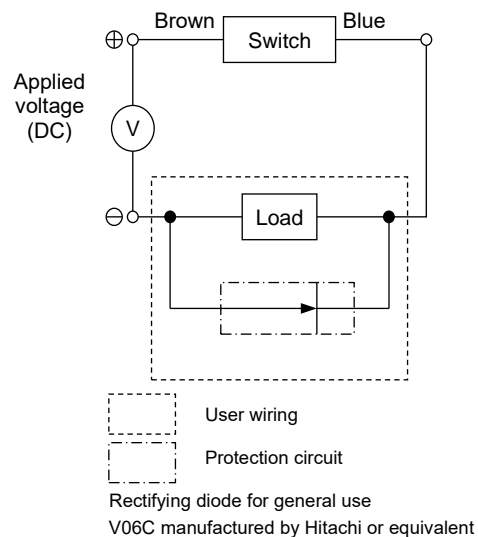
When the switch is used with an inductive load such as a relay or when the wiring length exceeds the value shown in the table to the right, install a contact protection circuit.

Power	Wiring length
DC	100 m
AC	10 m

<Protection when connecting an inductive load>

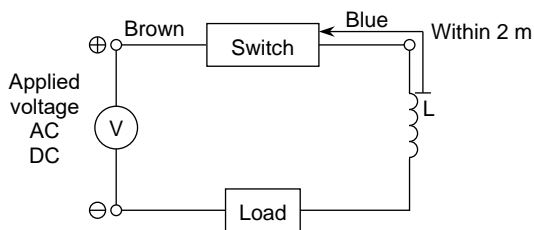


When capacitor and resistor are used

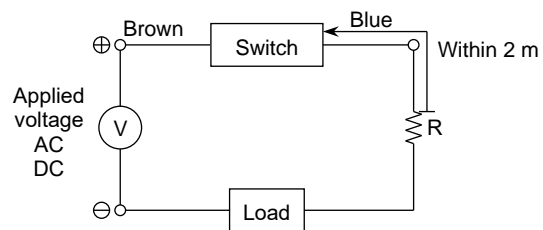


When diode is used

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



- Choke coil
L = Several hundred μ H 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 CorporationMY type
- Fuji Electric Co., Ltd.HH5 type
- Panasonic CorporationHC 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

CAUTION

Keep the range of load connected to the rod reasonable to prevent rod from being damaged due to the excessive energy of momentum inertia.

Carefully prevent lateral load to the rod to avoid irregular wear and tear of rod cover or rod itself.

■ Working pressure range

Use the cylinder within the following pressure range:

Model	Bore size	Pressure range
SMG-HP1	φ6	0.12 to 0.7MPa
	φ10,16	0.06 to 0.7MPa
	φ20,25,32	0.05 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)	0.012	0.036	0.1	0.1	0.19	0.5

■ Adjustment of the piston speed

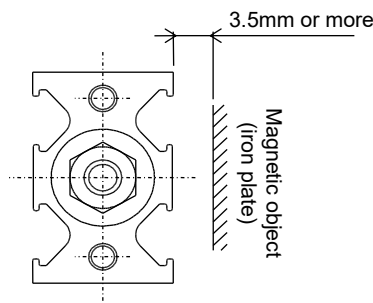
Mount a speed controller to adjust the piston speed.

3.2 Using the 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 object such as a steel plate installed nearby. Make sure that there is a distance of at least 3.5 mm between the magnetic object and the surface of the cylinder.



- The cylinder switch may malfunction if the cylinder units are placed adjacently. Make sure to provide the following distance between each unit.

Adjacent conditions		Switch model No.	φ6	φ10	φ16	φ20	φ25	φ32	Remarks		
Two cylinders in parallel	Horizontal mounting 	A	27	29	37	45	55	67			
		K0,K5									
	B	K0,K5	4.5								
		K2,K3									
	Vertical mounting Switches are attached on the side of the adjacent cylinders 	A	K0,K5	28	21	25	33	41		46	Note that switch position cannot be adjusted if the length of the screwdriver is longer than B dimension with cylinders mounted.
		B	K0,K5	5.5	5.5	5.5	6.5	8.5		5.5	
K2,K3			11.5	12.5	14.5	14.5	17.5	14.5			
A		K0,K5	14	16	21	27	33	41			
	K2,K3	0.5									
Three or more cylinders in parallel	Horizontal mounting 	A	27	29	37	45	55	67			
		K0,K5									
	B	K0,K5	4.5								
		K2,K3									
	Vertical mounting 	A	K0,K5	19	22	26	34	42		47	Note that switch position cannot be adjusted if the length of the screwdriver is longer than B dimension with cylinders mounted.
		B	K0,K5	6.5	6.5	6.5	7.5	9.5		6.5	
K2,K3			13.5	13.5	14.5	17.5	18.5	15.5			
A		K0,K5	27	29	35	44	51	56			
	K2,K3										

■ 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

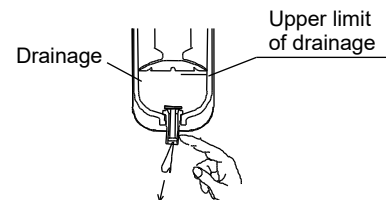
Check the items above and refer to "5. TROUBLESHOOTING" to correct any abnormality found. If there are loose threaded connections, tighten them.

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

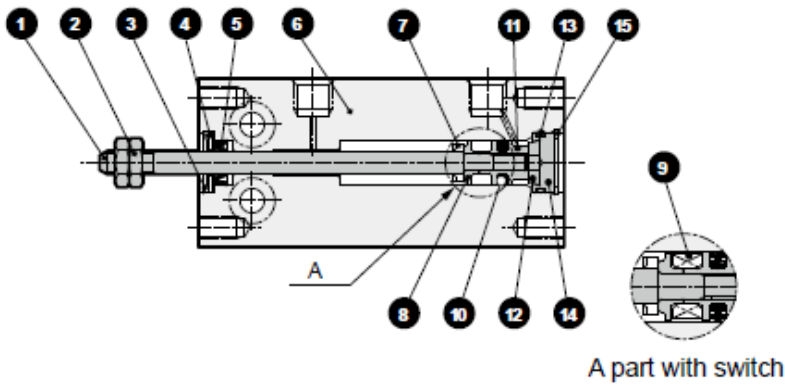
If any failure occurs such as air leakage, disassemble the product, referring to the internal structural diagram, and exchange the parts in the consumable parts list.



Follow reverse steps of disassembling during the process of assembling after cleaning parts. Carefully avoid giving damage to packings to prevent malfunction or air leakage.

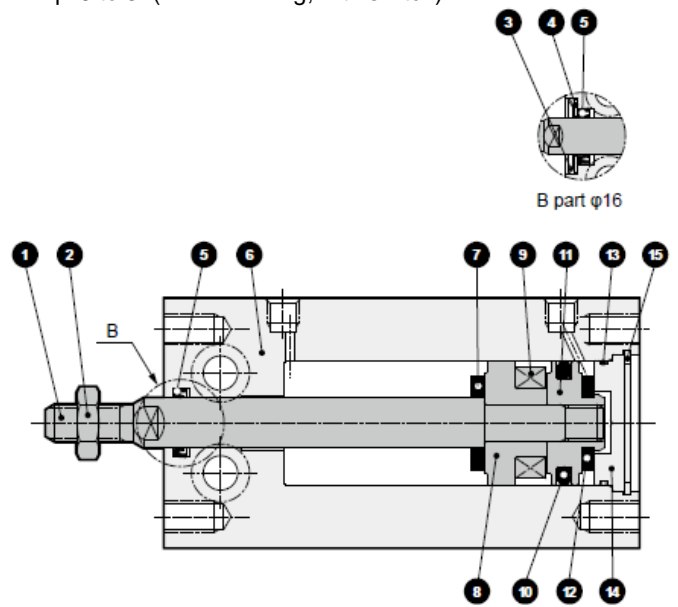
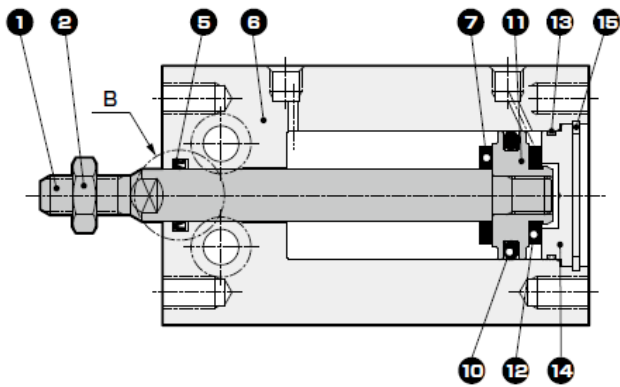
4.2.1 Internal structural diagram

<φ6,φ10(Double acting)>



<φ16 to 32(Double acting)>

<φ16 to 32(Double acting,With switch)>



Parts list

No.	Part name	Material	Remarks
1	Piston rod	Stainless steel	φ20,25,32 Industrial chrome plating
2	Rod nut	Steel	Nickeling
3	C type snap ring	Stainless steel	
4	Cap	Stainless steel	
5	Rod packing	Nitrile rubber	
6	Body	Aluminum alloy	Hard alumite
7	Cushion rubber(R)	Urethane rubber	
8	Spacer	Aluminum alloy	Chromate
9	Magnet	—	
10	Piston packing	Nitrile rubber	
11	Piston	Aluminum alloy	Chromate
12	Cushion rubber(H)	Urethane rubber	
13	Cover gasket	Nitrile rubber	
14	Cover	Aluminum alloy	Chromate
15	C type snap ring	Steel	Zinc phosphate

Note 1: 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

Bore size (mm)	Kit no.	Remarks
φ6	SMG-6K-HP1	Part no.3,5,7,10,12,13
φ10	SMG-10K-HP1	
φ16	SMG-16K-HP1	

Bore size (mm)	Kit no.	Remarks
φ20	SMG-20K-HP1	Part no.5,7,10,12,13
φ25	SMG-25K-HP1	
φ32	SMG-32K-HP1	

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.