Doc. no.CJ2*-OM0067P

Operation Manual

PRODUCT NAME

Air cylinder

MODEL / Series / Product Number

C＊J2＊＊－＊Z

SMC Corporation

Contents

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **"Caution," "Warning"** or **"Danger."** They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1:Robots
etc.

Danger	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
Warning	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
Caution	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.

Safety Instructions

⚠ Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.
Use in non-manufacturing industries is not covered.
Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.
The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.[*2)]
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

1. Product Specifications

1-1. Specifications

<table>
<tr><td colspan="2">Fluid</td><td colspan="3">Air</td></tr>
<tr><td colspan="2">Proof pressure</td><td colspan="3">1.0 MPa</td></tr>
<tr><td colspan="2">Max. operating pressure</td><td colspan="3">0.7 MPa</td></tr>
<tr><td colspan="2" rowspan="2">Min. operating pressure</td><td>Ø6</td><td>Ø10</td><td>Ø16</td></tr>
<tr><td>0.12 MPa</td><td colspan="2">0.06 MPa</td></tr>
<tr><td colspan="2">Ambient and fluid temperature</td><td colspan="3">-10 to +70ºC. -10 to +60ºC with built-in magnet (No freezing)</td></tr>
<tr><td colspan="2">Lubrication</td><td colspan="3">Not required (non-lube)</td></tr>
<tr><td colspan="2">Stroke length tolerance</td><td colspan="3">$^{+1.0}_{0}$mm</td></tr>
<tr><td colspan="2">Cushion</td><td>Rubber bumper</td><td colspan="2">Rubber bumper / Air cushion</td></tr>
<tr><td colspan="2">Piston speed</td><td colspan="3">50 to 750 mm/s</td></tr>
<tr><td rowspan="2">Allowable kinetic energy</td><td>Rubber bumper</td><td>0.012 J</td><td>0.035 J</td><td>0.090 J</td></tr>
<tr><td>Air cushion</td><td>-</td><td>0.07J</td><td>0.18J</td></tr>
</table>

Use the actuator with allowable kinetic energy or less.

⚠ Warning

1) Confirm the specifications.

The product is designed for use only in industrial compressed air systems. Do not operate at pressures or temperatures etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)
SMC do not guarantee against any damage if the product is used outside the specification range.

2) A deceleration circuit or shock absorber etc, may be required.

If the driven object moves at high speeds or is heavy, it will be unfeasible for the cylinders cushion to absorb the shock. Therefore a speed reduction circuit should be provided to reduce the speed before the thrust is applied to the cushion, or an external damper fitted to absorb the shock. Confirm the rigidity of the equipment after the measures above are taken.

2. Installation and Handling

2-1. Air supply

The compressed air supplied to the cylinder should be filtered by SMC AF series air filter and regulated to the specified set pressure by SMC AR series regulator.

⚠ Warning

- Use clean air.

Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salts or corrosive gases etc., as this can cause damage or malfunction.

⚠ Caution

1) Install an air filter.

Install an air filter upstream near the valve. A filtration degree of 5 micron millimeter or less should be selected.

2) Take measure to ensure air quality, such as by installing an aftercooler, air dryer or water separator.

Compressed air that contains a large amount of moisture can cause malfunction of pneumatic equipment such as valves. Therefore, take appropriate measures to ensure air quality, such as providing an aftercooler, air dryer, or water separator.

3) Use the product within the specified fluid and ambient temperature range.

When operating at temperatures below 5°C, moisture in the circuit may freeze and cause breakage of seals or malfunction. Corrective measures should be taken to prevent freezing.

For compressed air quality, refer to Best Pneumatics No.5.

4) Lubrication of non-lubricating cylinder

Install a lubricator in the circuit, and use Class 1 turbine oil (with no additive) ISO VG-32. Stopping lubrication later may lead to malfunction because the new lubricant will displace the original lubricant. Therefore, lubrication must be continued once it has been started.

2-2. Design

⚠ Warning

1) There is a possibility of dangerous sudden action by cylinders if sliding parts of machinery are twisted due to external forces, etc.

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to operate smoothly and avoid such dangers.

2) If there is a chance that the product will pose a hazard to humans, install a protective cover.

If the moving portion of the product will pose a hazard to humans or will damage machinery or equipment, a construction that prevents direct contact with those areas must be provided.

3) Be certain that the secured portions will not loosen.

When the product operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

4) Design the system so that it will not apply any external force over the maximum to the product.

The product can break, causing a risk of injury to personnel or damage to equipment.

5) The cylinder generates a large force. Install on a sufficiently rigid mounting base, taking this force into consideration.

There is a risk of injury to personnel or damage to equipment.

6) Consider the possibility of a reduction in the circuit air pressure that could be caused by a power source related malfunction.

There is a danger of workpieces dropping if there is a decrease of thrust due to a drop in circuit pressure caused by a power source malfunction, etc. Therefore, safety equipment should be installed to prevent damage to machinery and/or injury to personnel. Suspension equipment and lifting devices also require measures to prevent dropping.

7) Consider the possibility of power source related malfunctions.

For equipment that relies on power sources such as compressed air, electricity, or hydraulic pressure, countermeasures should be adopted to prevent the equipment from causing a hazard to personnel or damage to the equipment in the event of malfunction.

8) Consider emergency stop.

Devise a safety system so that if a person engages the emergency stop, or if a safety device is tripped during a system malfunction such as a power outage, the movement of the cylinder will not cause a hazard to humans or damage the equipment.

9) Consider the action when operation is restarted after an emergency stop or abnormal stop.

Design the machinery so that injury to personnel or equipment damage will not occur upon the restart of the operation. Install manually controlled equipment for safety when the actuator has to be reset to the starting position.

10) Intermediate stop

It is difficult for this product to make a piston stop at the required intermediate position accurately and precisely by a 3 position closed center type directional control valve, due to the compressibility of air. Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for extended periods of time.

⚠ Caution

1) Operate the product within a range so that the piston will not collide with the cover and be damaged at the stroke end.

If the piston with inertia force is stopped by colliding with the cover at the stroke end, operate the cylinder within a range that will not cause damage. Refer to 2-6. Allowable kinetic energy (Page 11)

2) Avoid having a large gap between the clevis and mating bushing, as this exposes the pin to a bending load.

3) Do not let foreign matter such as cutting chips get into the product from the suction port.

4) Do not touch the cylinder during high speed and high frequency operation

When the cylinder is operating at a high speed and high frequency, the surface temperature of the cylinder tube increase, and may cause injury to personnel.

5) Do not use the air cylinder as an air-hydro cylinder.

If the working fluid of the air cylinder is turbine oil, oil leakage can result.

6) Grease is applied to cylinder.

7) The base oil of grease may seep out.

The base oil of grease in the cylinder may seep out of the tube, cover, crimped part or rod bushing depending on the operating conditions (ambient temperature 40 °C or more, pressurized condition, low frequency operation).

8) Resumption after a long stop.

When resuming operation after a long stop, there are cases in which the starting pressure rises or there is a delay in the piston starting time due to adhesion. Conducting several cycles of running-in operation will solve this problem. Please consider implementing this before resumption.

2-3. Mounting and Installation

1) There is a toleranced location diameter at the base of the cover mounting threads specifically for accurate alignment when mounting.

⚠ Caution

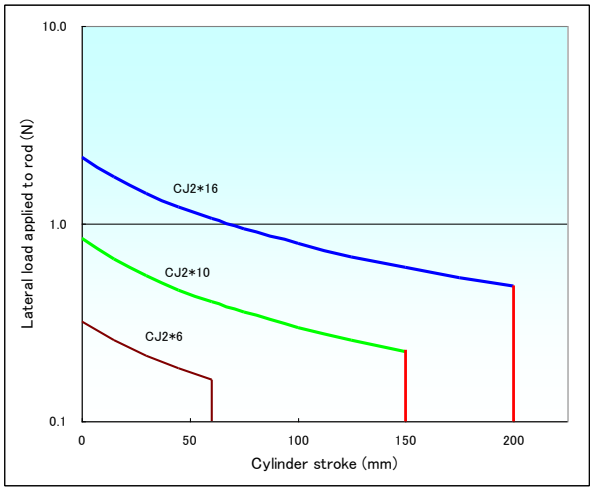
1) Do not apply excessive lateral load to the piston rod.

The bold solid lines in Fig. 1 show the allowable lateral load on the cylinder for a certain stroke length.

When 100mm or more stroke is used, the installation of a guide in the moving direction of the product is recommended.

Refer to 2-6. Allowable kinetic energy.(Page 11)

Allowable lateral load at the rod end



fR: Lateral load applied to rod end
Ft: Maximum force of cylinder

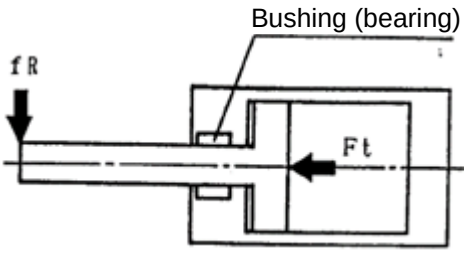


Fig. 1 Allowable lateral load applied to rod end

2) Make sure to connect the piston rod and the load so that their axial centers and movement directions match.

If they do not match, stress could be applied to the rod and the cylinder tube, causing wear to the inner surface of the cylinder tube, the bushing, the rod surface, and the seals may become damaged.

3) When mounting the cylinder, do not apply a lateral load to the rod. If a lateral load is unavoidable, keep the lateral load applied to the bushing 1/40 or less of the cylinder force.

4) When aligning the mounting bracket of work pieces transferred on the rail and the piston rod of the fixed cylinder (foot type or flange type) which operates the work pieces, check the centers are aligned when the piston rod is extended and retracted even if the cylinder operates normally.

5) When an external guide is used, connect the piston rod end and the load in such a way that there is no interference at any point within the stroke.

6) Do not apply any torque to the cover jointed part.

The rod cover and head cover have wrench flats. When installing the product, secure the cover of tightening side and apply appropriate tightening torque to mounting nuts, or to the body of the cover of tightening side.

Do not secure the cover of the other side of tightening, tighten mounting nuts or apply tightening torque to the body of the cover of the other side of tightening.

Excessive torque will reduce the clearance between the piston rod and bushing, causing operational failure. Use the appropriate torque given in Table 1 below.

Table 1 Appropriate tightening torque (Unit: Nm)

Bore size	Thread diameter	Torque
Ø6	M6x1.0	2.1 to 2.5
Ø10	M8x1.0	5.9 to 6.4
Ø16	M10x1.0	10.8 to 11.8

7) Do not strike or grasp the sliding parts of the cylinder tube and piston rod with other objects.

Cylinder bores are manufactured to precise tolerances, even a slight deformation may cause malfunction.

Moreover, scratches or dents, etc. in the piston rod may lead to damaged seals and cause air leakage.

8) Prevent the seizure of rotating parts.

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

9) Do not use the product until you have verified that the equipment can operate properly.

Verify correct mounting by function and leak tests after compressed air and power are connected following installation or repair.

10) Prevent foreign matter such as cutting chips getting into the product from the suction port.

When the product is installed on site, the debris from drilling mounting holes could get in the supply port of the product. Take sufficient care to prevent this.

2-4. Operating environment

⚠ Warning

1) Do not use in environments where there is a danger of corrosion.

2) Install a cover over the rod if it is used in an area that is dusty, or in an environment in which water or oil splashes on the cylinder.

3) Avoid storing the product in humid conditions.

Store the product with the piston rod retracted and avoid humidity, in order to prevent generation of rust.

⚠ Caution

1) Preparation before piping

Before piping is connected, the pipe should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from the inside.

2) Wrapping of sealant tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping.

If sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.

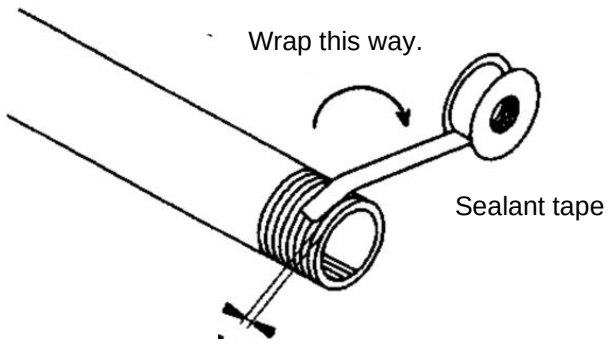


Fig. 2 Sealant tape

2-5. Speed control

When setting the piston speed, install SMC AS series speed controller near the air supply port and adjust to the specified speed. There are two methods of speed adjustment, one is to restrict air supplied to the product, and the other is to restrict air exhausted from the product. Normally, the latter method should be adopted.

⚠ Caution

Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.

2-6. Allowable kinetic energy

The applied kinetic energy must be within the allowable value when an inertial load is actuated.

Please refer to "Fig.1 Allowable lateral load applied to rod end" (Page 8)

Table 2 Operating range and kinetic energy

Bore size		Ø6	Ø10	Ø16
Allowable kinetic energy	Rubber bumper	0.012J	0.035J	0.090J
	Air cushion	-	0.07J	0.18J

⚠ Warning

Operate the actuator with allowable kinetic energy (Table 2) or less.

Operation with a kinetic energy over the allowable value shown can break the product and cause injury to personnel or damage to equipment. If excessive kinetic energy is expected, install an external absorber to prevent impact to the body of the product. In this case, confirm the rigidity of the equipment carefully.

⚠ Caution

1) Readjust with the cushion needle.

The cushion needle is adjusted when the product is shipped, but the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. The Cushion needle must be adjusted as stated otherwise the cushion seal may become worn and the cushioning effect may be decreased due to the operation of the cylinder over a long period of time.

2) Do not operate the cushion valve in the fully closed or fully open state.

This may damage the seal.

3) Do not open the cushion needle too much.

Do not open the cushion needle completely (3 turns or more from fully closed position), or the cushioning effect will be reduced and the impact maybe higher than the cylinders allowable kinetic energy.

2-7. Control of direction

To switch the operating direction of the cylinder, mount an applicable solenoid valve selected from SMC's range of solenoid valves.

⚠ Warning

1) Design a circuit to prevent sudden action of a driven object.

When the product is actuated by an exhaust center type directional control valve or when one side of the piston is pressurized with air exhaust, such as when the product is started after the exhaust of the residual pressure from the circuit, driven objects may act suddenly at high speed. In such cases, injury may occur, such as hands or feet getting caught in the machinery, or damage to the machinery itself may occur. Design the machinery using equipment to prevent sudden action.

2) Intermediate stop

It is difficult for this product to make a piston stop at the required intermediate position accurately and precisely by a 3 position closed center type directional control valve, due to the compressibility of air.

Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for extended periods of time.

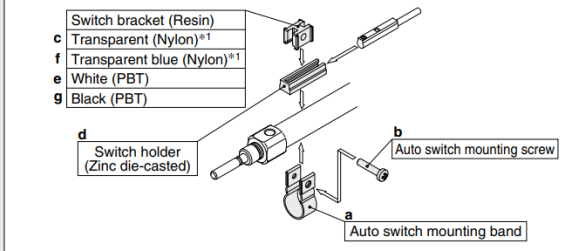
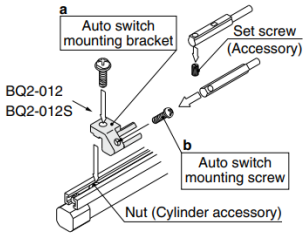
2-8. Auto switches

When an auto switch is mounted or its set position is changed, refer to pages 11 to 17.

Caution

- Use a specific mounting bracket (Table 3 on page 12.) and mount the product so that the band of the bracket will be perpendicular to the stroke of the product.
- Tighten mounting screws to the appropriate torque.
- The auto switch can only be used for cylinders with a built-in magnet for auto switch (e.g. CDJ2).
- The mounting of the switch is limited depending on stroke. (See Table 4 on page 15.)

Table 3 Auto Switch Mounting Bracket / Part No.

Auto switch mounting	Auto switch model	Bore size [mm]		
		6	10	16
Band mounting	**D-M9□** **D-M9□V** **D-M9□W** **D-M9□WV** **D-A9□** **D-A9□V**	BJ6-006 (A set of a, b, d, f)	BJ6-010 (A set of a, b, c, d)	BJ6-016 (A set of a, b, c, d)
	D-M9□A *2 **D-M9□AV***2	BJ6-006S (A set of a, b, d, g)	BJ6-010S (A set of a, b, d, e)	BJ6-016S (A set of a, b, d, e)
				
Band mounting	**D-H7□/H7□W** **D-H7BA/H7NF** **D-C7□/C80** **D-C73C/C80C**	BJ2-006 (A set of band and screw)	BJ2-010 (A set of band and screw)	BJ2-016 (A set of band and screw)
*4 Rail mounting	**D-M9□** **D-M9□V** **D-M9□W** **D-M9□WV** **D-M9□A** *4 **D-M9□AV***4 **D-A9□** **D-A9□V**	—	BQ2-012 (S) (A set of a and b)	BQ2-012 (S) (A set of a and b)
				

*1) Since the switch bracket (made from nylon) are affected in an environment where alcohol chloroform, methylamines, hydrochloric acid or sulfuric acid is splashed over, so it cannot be used.

*2) As the indicator LED is projected from the auto switch unit, indicator LED may be damaged if the switch bracket is fixed on the indicator LED.

*3) When the cylinder is shipped, the auto switch mounting bracket and the auto switch will be included.

*4) For D-M9lA(V), order the BQ2-012S, which uses stainless steel mounting screws.

Band Mounting Brackets Set Part No.

Set part no.	Contents	Bore size [mm]		
		6	**10**	**16**
BJ2-□□□	• Auto switch mounting band (a) • Auto switch mounting screw (b)	BJ2-006	BJ2-010	BJ2-016
BJ4-1	• Switch bracket (White/PBT) (e) • Switch holder (d)	—	●	●
BJ4-2	• Switch bracket (Black/PBT) (g) • Switch holder (d)	●	—	—
BJ5-1	• Switch bracket (Transparent/Nylon) (c)*1 • Switch holder (d)	—	●	●
BJ5-2	• Switch bracket (Transparent blue/Nylon) (f)*1 • Switch holder (d)	●	—	—

[Stainless Steel Mounting Screw]

The following stainless steel mounting screw kit is available. Use it in accordance with the operating environment. (Since the auto switch mounting bracket is not included, order it separately.)

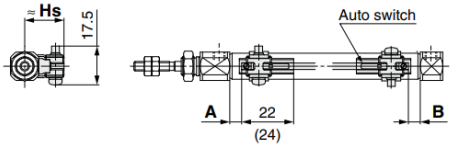
BBA4: For D-C7/C8/H7 types

*5) Refer to web catalogue page 1370 for details on the BBA4.

When the D-H7BA type auto switch is shipped independently, the BBA4 is attached.

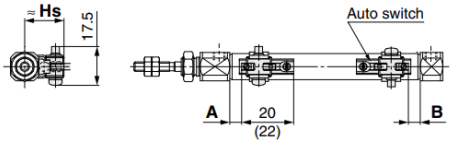
Auto Switch Proper Mounting Position (Detection at stroke end) and Its Mounting Height

Solid state auto switch
<Band mounting>
D-M9□
D-M9□W
D-M9□A



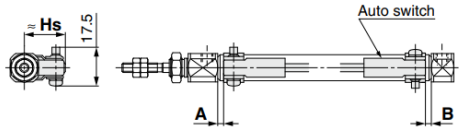
( ): Dimension of the D-M9□A.
A and B are the dimensions from the end of the head cover/rod cover to the end of the auto switch.

D-M9□V
D-M9□MV
D-M9□AV

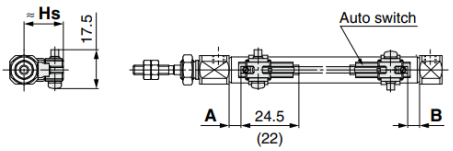


( ): Dimension of the D-M9□AV.
A and B are the dimensions from the end of the head cover/rod cover to the end of the auto switch.

D-H7□
D-H7□W
D-H7BA
D-H7NF
D-H7C

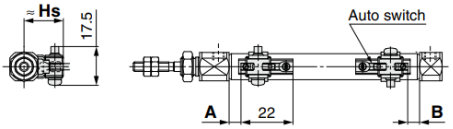


Reed auto switch
<Band mounting>
D-A9□



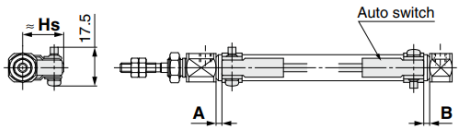
( ): Dimension of the D-A96.
A and B are the dimensions from the end of the head cover/rod cover to the end of the auto switch.

D-A9□V



A and B are the dimensions from the end of the head cover/rod cover to the end of the auto switch.

D-C7□/C80
D-C73C□/C80C



Auto Switch Proper Mounting Position (Single acting type excluded) [mm]

Auto switch model / Bore size	Band mounting							
	D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□A D-M9□AV		D-A9□ D-A9□V		D-H7□ D-H7C D-H7NF D-H7□W D-H7BA		D-C7□ D-C80 D-C73C D-C80C	
	A	B	A	B	A	B	A	B
6	5.5 (4.5) [12]	5.5 (4.5) [4]	1.5 (0.5) [8]	1.5 (0.5) [0]	1 (7.5)	1 (0)	2 (8.5)	2 (0.5)
10	(5) 6	(5) 6	(1) 2	(1) 2	1.5	1.5	2.5	2.5
16	(5.5) 6.5	(5.5) 6.5	(1.5) 2.5	(1.5) 2.5	2	2	3	3

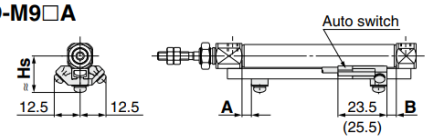
∗: The values in ( ) are measured from the end of the auto switch mounting bracket.
∗: The values in [ ] for bore size ø6 are for the double rod type (CJ2W series).

Auto Switch Mounting Height [mm]

Auto switch model / Bore size	Band mounting				
	D-M9□ D-M9□W D-M9□A D-A9□	D-M9□V D-M9□WV D-M9□AV D-A9□V	D-H7□/H7□W D-H7NF D-H7BA D-C7□/C80	D-H7C	D-C73C D-C80C
	Hs	Hs	Hs	Hs	Hs
6	15	16	15	18	17.5
10	17	18	17	20	19.5
16	20.5	21	20.5	23.5	23

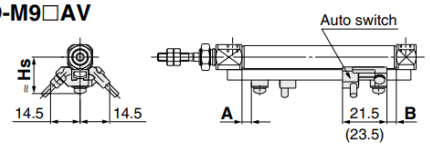
Auto Switch Proper Mounting Position (Detection at stroke end) and Its Mounting Height

<Rail mounting>
D-M9□
D-M9□W
D-M9□A



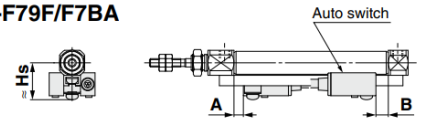
( ): Dimension of the D-M9□A.

D-M9□V
D-M9□WV
D-M9□AV

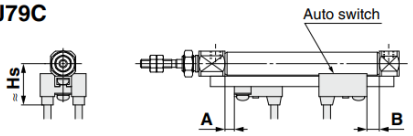


( ): Dimension of the D-M9□AV.

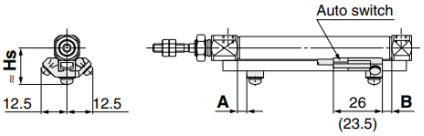
D-F7□/J79
D-F7□W/J79W
D-F79F/F7BA



D-F7□V/F7□WV
D-F7BAV
D-J79C

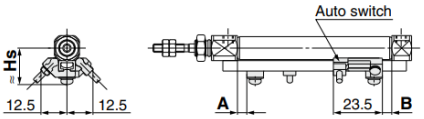


<Rail mounting>
D-A9□

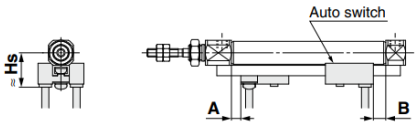


( ): Dimension of the D-A96.

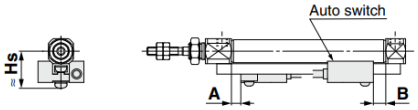
D-A9□V



D-A7□/A80
D-A73C/A80C
D-A79W



D-A7□H/A80H



Auto Switch Proper Mounting Position (Single acting type excluded)

[mm]

Auto switch model / Bore size	Rail mounting											
	D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□A D-M9□AV		D-A9□ D-A9□V		D-F7□/J79 D-F7□W/J79W D-F7□V/F7□WV D-F79F D-J79C D-F7BA D-F7BAV D-A7□H/A80H D-A73C/A80C		D-F7NT		D-A7□ D-A80		D-A79W	
	A	B	A	B	A	B	A	B	A	B	A	B
6	—	—	—	—	—	—	—	—	—	—	—	—
10	4.5	4.5	0.5	0.5	3.5	3.5	8.5	8.5	3	3	0.5	0.5
16	5	5	1	1	4	4	9	9	3.5	3.5	1	1

∗: Adjust the auto switch after confirming the operating condition in the actual setting.

Auto Switch Mounting Height

[mm]

Auto switch model / Bore size	Rail mounting						
	D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□A D-M9□AV D-A9□ D-A9□V	D-F7□/J79 D-F7□W/J79W D-F7BA/F79F D-F7NT D-A7□H/A80H	D-F7□V D-F7□WV D-F7BAV	D-J79C	D-A7□ D-A80	D-A73C D-A80C	D-A79W
	Hs	Hs	Hs	Hs	Hs	Hs	Hs
6	—	—	—	—	—	—	—
10	17.5	17.5	20	23	16.5	23.5	19
16	21	20.5	23	26	19.5	26.5	22

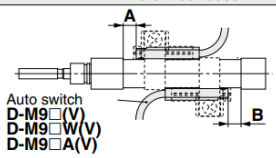
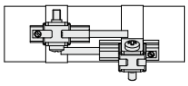
Table 4 Minimum Stroke for Auto Switch Mounting

[mm]

Auto switch mounting	Auto switch model	Number of auto switches				
		With 1 pc.	With 2 pcs.		With n pcs. (n: Number of auto switches)	
			Different surfaces	Same surface	Different surfaces	Same surface
Band mounting	**D-M9□ D-M9□W D-M9□A D-A9□**	10	15[*1]	45[*1]	$15 + 35\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	45 + 15 (n – 2) (n = 2, 3, 4, 5…)
	D-M9□V	5	15[*1]	35	$15 + 35\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	35 + 25 (n – 2) (n = 2, 3, 4, 5…)
	D-M9□WV D-M9□AV	10	15[*1]	35	$15 + 35\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	35 + 25 (n – 2) (n = 2, 3, 4, 5…)
	D-A9□V	5	10	35	$10 + 35\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	35 + 25 (n – 2) (n = 2, 3, 4, 5…)
	D-H7□/H7□W D-H7BA D-H7NF	10	15	60	$15 + 45\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	60 + 22.5 (n – 2) (n = 2, 3, 4, 5…)
	D-C7□ D-C80	10	15	50	$15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	50 + 20 (n – 2) (n = 2, 3, 4, 5…)
	D-H7C D-C73C D-C80C	10	15	65	$15 + 50\frac{(n-2)}{2}$ (n = 2, 4, 6…)[*3]	50 + 27.5 (n – 2) (n = 2, 3, 4, 5…)
Rail mounting	**D-M9□V**	5	—	5	—	10 + 10 (n – 2) (n = 4, 6…)[*4]
	D-A9□V	5	—	10	—	10 + 15 (n – 2) (n = 4, 6…)[*4]
	D-M9□ D-A9□	10 (5)[*5]	—	10	—	15 + 15 (n – 2) (n = 4, 6…)[*4]
	D-M9□WV D-M9□AV	10	—	15	—	15 + 15 (n – 2) (n = 4, 6…)[*4]
	D-M9□W	15 (10)[*5]	—	15	—	20 + 15 (n – 2) (n = 4, 6…)[*4]
	D-M9□A	15 (10)[*5]	—	20 (15)[*5]	—	20 + 15 (n – 2) (n = 4, 6…)[*4]
	D-F7□ D-J79	5	—	5	—	15 + 15 (n – 2) (n = 4, 6…)[*4]
	D-F7□V D-J79C	5	—	5	—	10 + 10 (n – 2) (n = 4, 6…)[*4]
	D-F7□W/J79W D-F7BA/F79F/F7NT	10	—	15	—	15 + 20 (n – 2) (n = 4, 6…)[*4]
	D-F7□WV D-F7BAV	10	—	15	—	10 + 15 (n – 2) (n = 4, 6…)[*4]
	D-A7□/A80 D-A7□H/A80H D-A73C/A80C	5	—	10	—	15 + 10 (n – 2) (n = 4, 6…)[*4]
	D-A7□H D-A80H	5	—	10	—	15 + 15 (n – 2) (n = 4, 6…)[*4]
	D-A79W	10	—	15	—	10 + 15 (n – 2) (n = 4, 6…)[*4]

[*3]: When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation.
[*4]: When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation. However, the minimum even number is 4. So, 4 is used for the calculation when "n" is 1 to 3.
[*5]: The dimension stated in ( ) shows the minimum mountable stroke when the auto switch does not project from the end face of the cylinder body and the lead wire bending space is not hindered.

[*1]: Auto switch mounting

Auto switch model	With 2 auto switches	
	Different surfaces[*1]	Same surface[*1]
	 The proper auto switch mounting position is 5.5 mm inward from the switch holder edge. The above A and B indicate values for band mounting in the table of page 174.	 The auto switch is mounted by slightly displacing it in a direction (cylinder tube circumferential exterior) so that the auto switch and lead wire do not interfere with each other.
D-M9□/M9□W/M9□A	Less than 20 stroke[*2]	Less than 55 stroke[*2]
D-A9□	—	Less than 50 stroke[*2]

[*2]: Minimum stroke for auto switch mounting in types other than those mentioned in [*1].

Table 5 Operating Range

[mm]

Auto switch model		Bore size		
		6	10	16
Band mounting	D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	2	2.5	3
	D-A9□	4.5	6	7
	D-H7□/H7□W D-H7BA/H7NF	3	4	4
	D-H7C	5	8	9
	D-C7□/C80/C73C/C80C	6	7	7
Rail mounting	D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	—	3	3.5
	D-A9□/A9□V	—	6	6.5
	D-F7□/J79/F7□W/J79W D-F7□V/F7□WV/F79F D-J79C/F7BA/F7BAV D-F7NT	—	5	5
	D-A7□/A80/A7H/A80H D-A73C/A80C	—	8	9
	D-A79W	—	11	13

∗: Values which include hysteresis are for guideline purposes only, they are not a guarantee (assuming approximately ±30% dispersion) and may change substantially depending on the ambient environment.

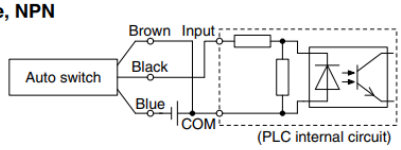
Other than the applicable auto switches listed in "How to Order", the following auto switches are mountable.
Refer to pages 1271 to 1365 for the detailed specifications.

Type	Mounting	Model	Electrical entry	Features	Applicable bore size
Sold state	Band mounting	D-H7A1/H7A2/H7B	Grommet (In-line)	—	ø6 to ø16
		D-H7NW/H7PW/H7BW		Diagnostic indication (2-color indicator)	
	Rail mounting	D-F79/F7P/J79		—	ø10, ø16
		D-F79W/F7PW/J79W		Diagnostic indication (2-color indicator)	
		D-F7NV/F7PV/F7BV	Grommet (Perpendicular)	—	
		D-F7NWV/F7BWV		Diagnostic indication (2-color indicator)	
Reed	Band mounting	D-C73/C76	Grommet (In-line)	—	ø6 to ø16
		D-C80		Without indicator light	
	Rail mounting	D-A73H/A76H		—	ø10, ø16
		D-A80H		Without indicator light	
		D-A73	Grommet (Perpendicular)	—	
		D-A80		Without indicator light	

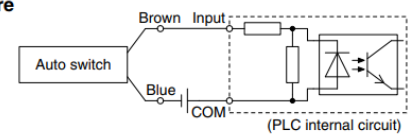
∗: With pre-wired connector is also available for solid state auto switches. For details, refer to pages 1340 and 1341.
∗: Normally closed (NC = b contact) solid state auto switches (D-M9□E(V)) are also available. For details, refer to page 1290.

Sink Input Specifications

3-wire, NPN

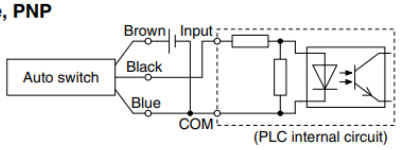


2-wire

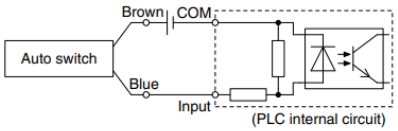


Source Input Specifications

3-wire, PNP



2-wire



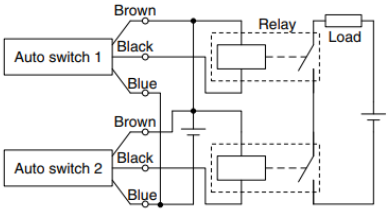
Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

Examples of AND (Series) and OR (Parallel) Connections

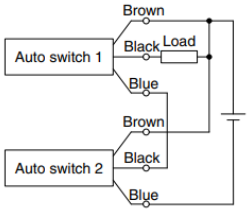
* When using solid state auto switches, ensure the application is set up so the signals for the first 50 ms are invalid. Depending on the operating environment, the product may not operate properly.

3-wire AND connection for NPN output

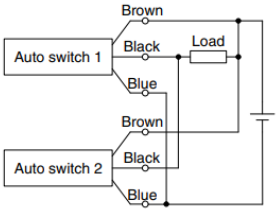
(Using relays)



(Performed with auto switches only)

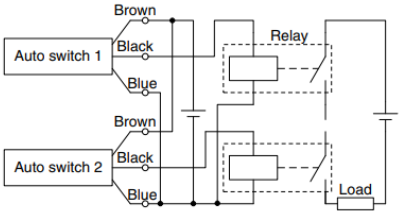


3-wire OR connection for NPN output

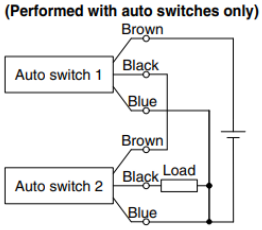


3-wire AND connection for PNP output

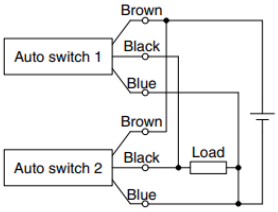
(Using relays)



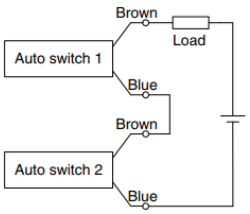
(Performed with auto switches only)



3-wire OR connection for PNP output



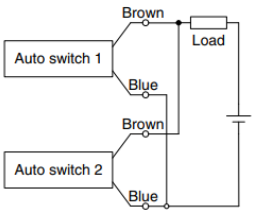
2-wire AND connection



When two auto switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up when both of the auto switches are in the ON state.
Auto switches with a load voltage less than 20 V cannot be used. Please contact SMC if using AND connection for a heat-resistant solid state auto switch or a trimmer switch.

Example) Load voltage at ON
Power supply voltage: 24 VDC
Internal voltage drop: 4 V
Load voltage at ON = Power supply voltage – Auto switch internal voltage drop x 2 pcs.
= 24 V – 4 V x 2 pcs.
= 16 V

2-wire OR connection



(Solid state)
When two auto switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

(Reed)
Because there is no current leakage, the load voltage will not increase when turned OFF. However, depending on the number of auto switches in the ON state, the indicator lights may sometimes grow dim or not light up, due to the dispersion and reduction of the current flowing to the auto switches.

Example) Load voltage at OFF
Leakage current: 1 mA
Load impedance: 3 kΩ
Load voltage at OFF = Leakage current x 2 pcs. x Load impedance
= 1 mA x 2 pcs. x 3 kΩ
= 6 V

3. Maintenance

⚠ Caution

For the CJ2-*Z series, the cover and cylinder tube are joined by rolling crimping, and cannot be disassembled.

Seals of CJ2-*Z series cannot be replaced.

3-1. Checks

3-1-1 Daily check

1) Smoothness of the operation
2) Changes in piston speed and cycle time.
3) Proper stroking

3-1-2 Regular check

1) Tightness of mounting nuts and rod end nuts
2) Tightness of mounting frame and any excessive deflection
3) Smoothness of the operation
4) Changes in piston speed and cycle time.
5) External leakage
6) Proper stroking
7) Damage to the piston rod
8) Whether drainage in the air filter is regularly discharged or not.

When any abnormality is found as a result of checking the points above, take necessary measures.

3-2. Consumable parts

Use our recommended grease.

Grease pack part number: GR-S-010 (10g), GR-S-020 (20g)

⚠ Warning

1) Maintenance should be performed according to the items above.

Improper handling can cause damage and malfunction of equipment and machinery.

2) Removal of equipment, and supply/exhaust of compressed air

When equipment is serviced, first confirm that measures are in place to prevent dropping of driven objects and run-away of equipment, etc. Then cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.

When machinery is restarted, check that operation is normal with actuators in the proper positions.

4. Basic Circuit for Cylinder Operation

The basic circuit for operating the product with air filter, regulator, solenoid valve and speed controller (meter-out) is shown in the following figure.

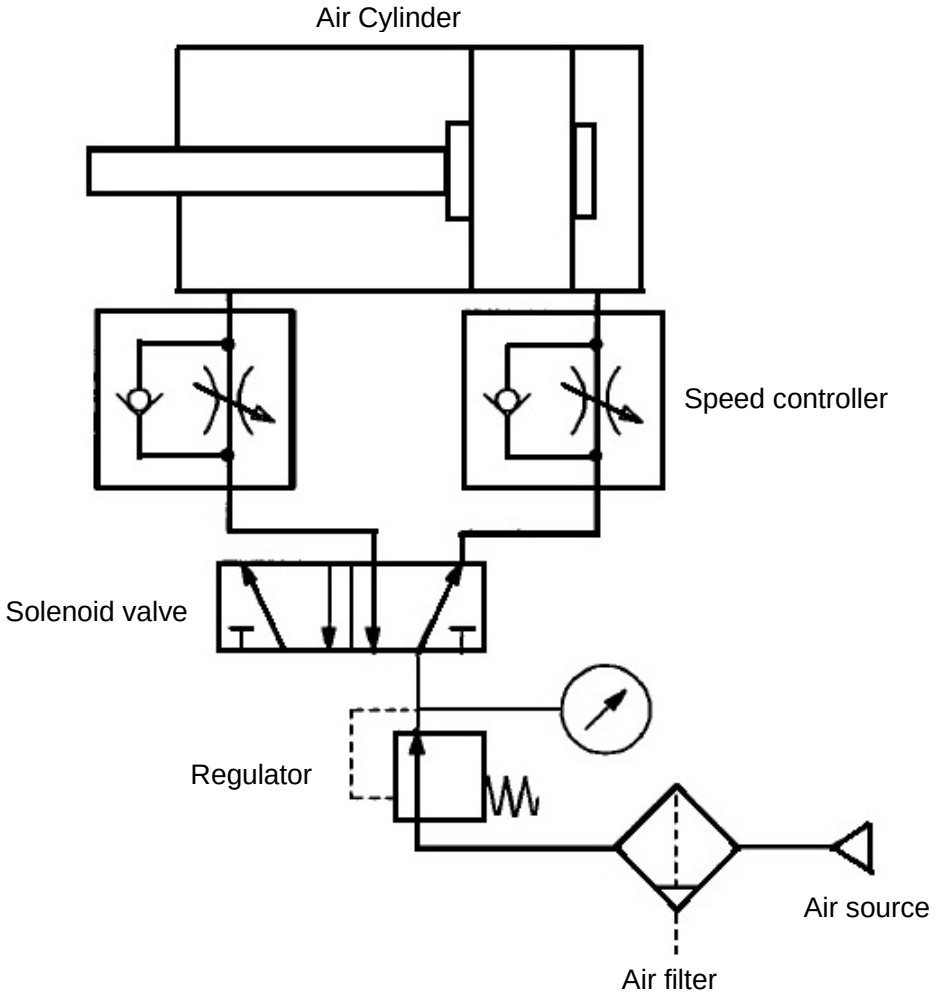


Fig.3 Basic Circuit

5. Troubleshooting

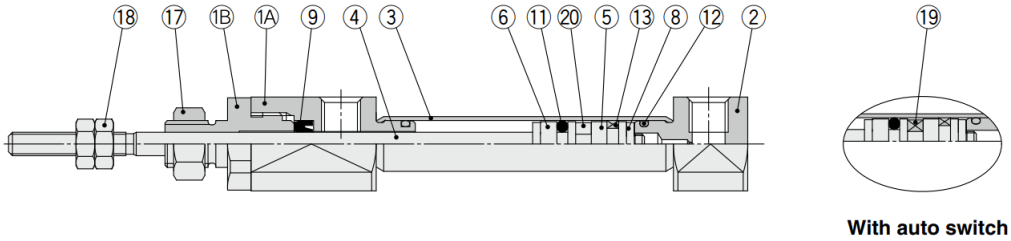
Trouble	Major causes	Countermeasures
Operation has lost smoothness.	1. Shortage of grease at the sliding part of the piston rod	- Apply the specified grease. GR-S-010（10g）, GR-S-020（20g）
	2. Deformation of piston rod	- Replace the cylinder with a new one. When reinstalling the product, adjust the load and mounting position.
	3. Insufficient pressure	- Supply appropriate pressure.
	4. Operation at a low speed outside of the limit.	- Keep the specified range.
Force has decreased.	1. Air leakage from piston seal	- Replace the cylinder with a new one.
	2. Air leakage from rod seal	- Replace the cylinder with a new one.
	3. Decreased pressure	- Secure sufficient pressure and review margin of air supply source.
	4. Insufficient flow rate	- The resistance in the fluid path may have increased due to deformation or foreign matter entering the product. Perform repair or cleaning.
	5. Incorrect mounting position of the product	- Mount in a proper position without any force applied to the product.
	6. Deformation of piston rod	- Replace the cylinder with a new one. When reinstalling the product, adjust the load and mounting position.
	7. Lubrication failure	- Refer to the countermeasure for the trouble “Operation has lost smoothness.”
Piston speed is too fast.	1. Lack of speed controller	- Use a speed controller suitable for the size of the product.
	2. Insufficient fine adjustment of speed controller	- Select an adjustable speed controller to obtain the required piston speed referring to the flow-rate characteristics curve.

Trouble	Major causes	Countermeasures
Piston speed is too slow.	1. Too small directional control valve.	- Use a valve of a larger size.
	2. Too large resistance of equipment used on the way of piping	- Use valves and equipment of an appropriate size. In particular, attention should be paid to the piping and fittings because they are often missed. Equipment and piping at the exhaust side should also be of an appropriate size.
The product sometimes does not operate.	1. Operation at a very low speed	- Operation at a very low speed can create a condition with almost no pressure difference between the supply side and exhaust side and lower sealing effect, which can cause operation failure. Keep the specified speed for operation.
	2. Problem of equipment other than this product	- Check all items in the system one by one to find the cause.
The product has become unable to operate.	1. Damage of piston seal	- Check that the exhaust port of the valve is exhausting all the time. - Replace the cylinder with a new one.
	2. Problem of equipment other than this product	- Check all items in the system one by one to find the cause.
	3. Insufficient pressure	- Supply appropriate pressure.
The piston rod has been deformed and broken.	1. Operation at high speed	- Operation at a high speed can cause impact, and deform and damage the product. Keep within the specified piston speed range.
	2. Excessive external force	- It may cause damage and deformation of the cylinder if the mechanism interferes or eccentric load or over load is applied to it. Remove these factors.
Piston speed cannot be adjusted with the speed controller.	1. Incorrect speed controller selection	- Use a speed controller of a suitable size for the required speed.
	2. Problem with the speed controller.	- Replace the speed controller with a new one.

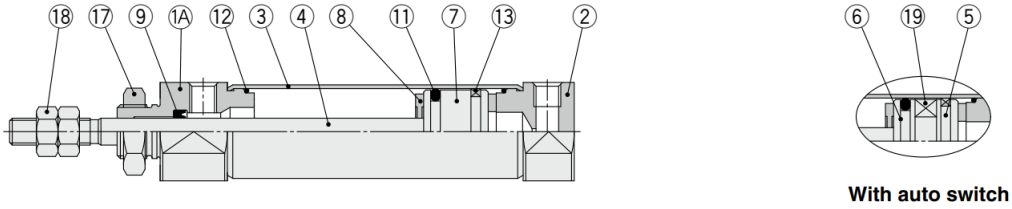
Trouble	Major causes	Countermeasures
The product has stick-slip movement.	1. Cylinder speed too slow	- Keep the specified range.
	2. Insufficient margin of force	- Increase operating pressure. - Replace with a product of a larger bore size.
	3. Use of a meter-in circuit	- Operation at a low pressure or low speed with a meter-in circuit can cause unstable motion. Use a meter-out circuit for speed adjustment.
The product shows sudden and fast movement after being stopped for extended periods of time.	1. Fluctuation of residual pressure in the product between continuous operation and operation after stoppage for extended periods of time	- Consider the use of a valve to prevent sudden action of the product.

6. Construction

ø6
Rubber bumper



ø10, ø16
Rubber bumper



ø10, ø16
Air cushion

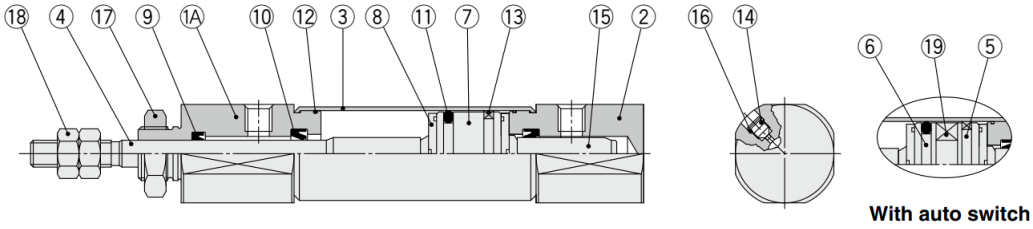


Fig. 4 Standard product: Double acting/single rod

No.	Description	Material	Note
1A	**Rod cover**	Aluminum alloy	
1B	**Seal retainer**	Aluminum alloy	ø6 only
2	**Head cover**	Aluminum alloy	
3	**Cylinder tube**	Stainless steel	
4	**Piston rod**	Stainless steel	
5	**Piston A**	Aluminum alloy	
6	**Piston B**	Aluminum alloy	
7	**Piston**	Aluminum alloy	
8	**Bumper**	Urethane	
9	**Rod seal**	NBR	
10	**Cushion seal**	NBR	

No.	Description	Material	Note
11	**Piston seal**	NBR	
12	**Tube gasket**	NBR	
13	**Wear ring**	Resin	
14	**Cushion needle**	Carbon steel	
15	**Cushion ring**	Aluminum alloy	
16	**Needle seal**	NBR	
17	**Mounting nut**	Rolled steel	
18	**Rod end nut**	Rolled steel	
19	**Magnet**	—	
20	**Spacer**	Aluminum alloy	ø6: Without magnet

Revision history
1 Add φ6
2 Add φ10,16 Air cushion type Add Safety instructions
3 Change Safety instructions 2.Installation and Handling →2-2.Design→Add Caution 8)

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