Smooth Cylinder

Series CQSY

ø12, ø16, ø20, ø25

Specifications and auto switch information not provided below are the same as those of the **anti-lateral load type of Series CQS□S**.
Please refer to page 2.2-30 and the subsequent pages of Best Pneumatics Vol. 2.

How to Order

Standard CQSY **B** **20** – **30** **D** **C**

With auto switch CDQSY **B** **20** – **30** **D** **C** – **M9BW** **S**

With auto switch
(Built-in magnet)

Mounting

B	Through-hole/Both ends tapped (Standard)
L	Foot
F	Front flange
G	Rear flange
D	Double clevis

∗ Mounting brackets are not mounted and are supplied loose at the time of shipment.

Bore size

12	12 mm
16	16 mm
20	20 mm
25	25 mm

Cylinder stroke (mm)
→ Refer to "Standard stroke table" on page 2.

Bumper/Rod end thread

C	Rubber bumper & Rod end female thread
CM	Rubber bumper & Rod end male thread

Action

D	Double acting

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	n pcs.

Auto switch

Nil	Without auto switch (Built-in magnet)

∗ Please select the applicable auto switch model from the table below.
∗ Auto switches are not mounted and are supplied loose at the time of shipment.
Note) Please also confirm whether the selected auto switch can be mounted at the desired position. Auto switches of models A9□V and M9□V may not be mounted on the side with ports due to the cylinder stroke or the size of the fittings.

Applicable Auto Switches /

For detailed auto switch specifications, please refer to page 5.3-2 of Best Pneumatics Vol. 2.
For the specifications of D-M9, please refer to SMC Information '02-E500.

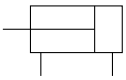
Type	Special function	Electrical entry	Indicator	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model: Perpendicular	Auto switch model: In-line	Lead wire (m)∗ 0.5 (Nil)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Reed switch	–	Grommet	Yes	3-wire (Equiv. NPN)	–	5 V	–	**A96V**	**A96**	●	●	–	–	IC	–
				2-wire	24 V	12 V	100 V	**A93V**	**A93**	●	●	–	–	–	Relay, PLC
Solid state switch	–	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	–	**M9NV**	**M9N**	●	●	–	–	IC	Relay, PLC
				3-wire (PNP)				**M9PV**	**M9P**	●	●	–	–		
				2-wire		12 V		**M9BV**	**M9B**	●	●	–	–	–	
	–			3-wire (NPN)		5 V, 12 V		**M9NV**	**M9N**	●	●	○	○	IC	
				3-wire (PNP)				**M9PV**	**M9P**	●	●	○	○		
				2-wire		12 V		**M9BV**	**M9B**	●	●	○	○	–	
	Diagnostic indication (2-colour)			3-wire (NPN)		5 V, 12 V		**M9NWV**	**M9NW**	●	●	○	○	IC	
				3-wire (PNP)				**M9PWV**	**M9PW**	●	●	○	○		
				2-wire		12 V		**M9BWV**	**M9BW**	●	●	○	○	–	
	Water resistant (2-colour)							–	**M9BA**	–	●	○	○		

∗ Lead wire length 0.5 m ····· Nil (Example) A93
3 m ····· L (Example) A93L
5 m ····· Z (Example) M9NWZ

∗ ○: Manufactured upon receipt of order.

In addition to the models in the above table, there are some other auto switches that are applicable. For more information, refer to page 2.2-37 of Best Pneumatics Vol. 2.

JIS symbol



Specifications

Model	Pneumatic (Non-lube)
Action	Double acting, single rod
Fluid	Air
Proof pressure	1.05 MPa
Maximum operating pressure	0.7 MPa
Ambient and fluid temperature	Without auto switch –10 to 70°C (with no freezing)
	With auto switch –10 to 60°C (with no freezing)
Cushion	Rubber bumper
Rod end thread	Female thread
Rod end thread tolerance	JIS class 2
Stroke length tolerance	$^{+1.0}_{0}$
Mounting	Through-hole/Both ends tapped
Operating piston speed	5 to 500 mm/s
Allowable leakage rate	0.5 ℓ/min (ANR) or less

Minimum Operating Pressure

Unit: MPa

Bore size (mm)	**12**	**16**	**20**	**25**
Minimum operating pressure	0.03		0.02	

Standard Stroke Table

Bore size (mm)	Standard stroke (mm)
12, 16	5, 10, 15, 20, 25, 30
20, 25	5, 10, 15, 20, 25, 30, 35, 40, 45, 50

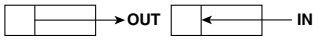
Replacement Parts: Seal Kits

Bore size (mm)	Kit No.	Contents	
12	CQSY12-PS	Piston seal	1 pc.
16	CQSY16-PS	Rod seal	1 pc.
20	CQSY20-PS	Tube gasket	1 pc.
25	CQSY25-PS	Grease pack (10 g)	1 pc.

When only grease for maintenance is necessary, please order by the following part numbers.

Grease pack GR-L-005 (5 g)
GR-L-010 (10 g)
GR-L-150 (150 g)

Theoretical Output Table



Unit: N

Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)		
				0.3	0.5	0.7
12	6	IN	84.8	25	42	59
		OUT	113	34	57	79
16	8	IN	151	45	75	106
		OUT	201	60	101	141
20	10	IN	236	71	118	165
		OUT	314	94	157	220
25	12	IN	378	113	189	264
		OUT	491	147	245	344

Intermediate Strokes

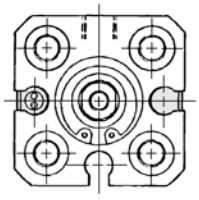
Method		Installation of spacer on standard stroke body.	
Model no.		Refer to page 1 for standard model no.	
Standard stroke	**Method**	Intermediate strokes at 1 mm intervals are available by using spacers with standard stroke cylinders.	
	Stroke range	Bore size (mm)	Stroke range (mm)
		12, 16	1 to 29
		20, 25	1 to 49
Example		Model no.: CQSYB25-47DC CQSYB25-50DC with 3 mm width spacer inside. B dimension is 77.5 mm. Calculation:ø25, B dimension 27.5 mm (without switch) 27.5 (B dimension) + 50 (st) = 77.5 (mm)	

Dimensions/ø12 to ø25

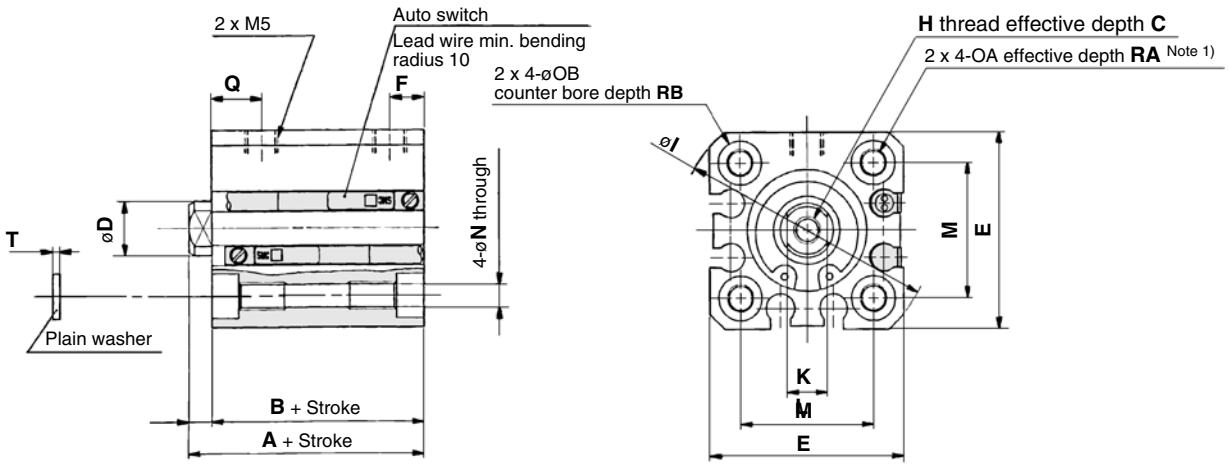
Mounting bracket dimensions are the same as those of the **anti-lateral load type of Series CQS□S**.
Please refer to page 2.2-30 and the subsequent pages of Best Pneumatics Vol. 2.

Standard (Through-hole/Both ends tapped)/CQSYB, CDQSYB

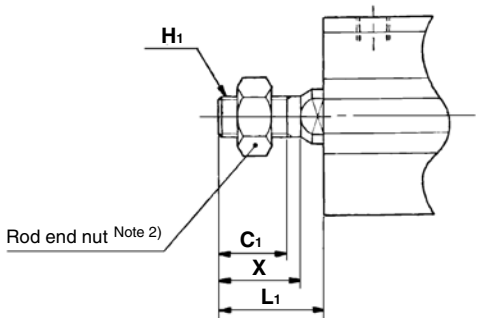
ø12



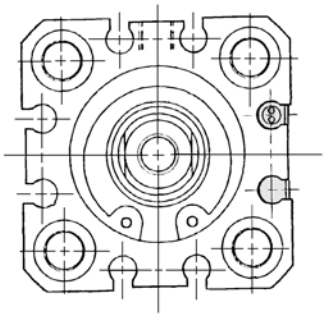
ø16



ø20, ø25



Rod end male thread



Rod end male thread (mm)

Bore size (mm)	C_1	H_1	L_1	X
12	9	M5	14	10.5
16	10	M6	15.5	12
20	12	M8	18.5	14
25	15	M10 x 1.25	22.5	17.5

Standard (mm)

Bore size (mm)	Stroke range (mm)	Without auto switch		With auto switch		C	D	E	F	H	I	K	L	M	N	OA	OB	Q	RA	RB	T
		A	B	A	B																
12	5 to 30	25.5	22	30.5	27	6	6	25	5	M3	32	5	3.5	15.5	3.5	M4	6.5	7.5	7	4	0.5
16	5 to 30	25.5	22	30.5	27	8	8	29	5	M4	38	6	3.5	20	3.5	M4	6.5	7.5	7	4	0.5
20	5 to 50	29	24.5	39	34.5	7	10	36	5.5	M5	47	8	4.5	25.5	5.4	M6	9	9	10	7	1
25	5 to 50	32.5	27.5	42.5	37.5	12	12	40	5.5	M6	52	10	5	28	5.4	M6	9	11	10	7	1

Note 1) Threaded through hole is used for the standard of ø20 with 5 to 10 mm strokes and ø25 with a 5 mm stroke.
Note 2) For more information about the rod end nut and accessories, please refer to page 2.3-18 of Best Pneumatics Vol. 2.

Smooth Cylinder
Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of **"Caution", "Warning"** or **"Danger"**. To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

⚠Caution : Operator error could result in injury or equipment damage.

⚠Warning : Operator error could result in serious injury or loss of life.

⚠Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems
Note 2) JIS B 8370: Pneumatic system axiom

⚠Warning

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

Since the products specified here are used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalogue information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if handled incorrectly. Assembly, handling or maintenance of pneumatic systems should be performed by trained and experienced operators.

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

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, and therefore requires special safety analysis.

Smooth Cylinder
Actuator Precautions 1
Be sure to read befor handling.

Design

⚠Warning

1. There is a possibility of dangerous sudden action by air 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 avoid such dangers.

2. A protective cover is recommended to minimize the risk of personal injury.

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

3. Securely tighten all stationary parts and connected parts so that they will not become loose.
Please refer to specific product precautions.

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

When a driven object is operated at high speeds or the load is heavy, a cylinder's cushion will not be sufficient to absorb the shock. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the shock. In this case, the rigidity of the machinery should also be examined.

5. Consider a possible drop in operating pressure due to a power outage, etc.

When a cylinder is used in a clamping mechanism, there is a danger of work dropping if there is a drop in circuit pressure caused by a power outage, etc.
Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

6. Consider a possible loss of power source.

Measures should be taken to protect against human injury and equipment damage in the event that there is a loss of power to equipment controlled by air pressure, electricity or hydraulics, etc.

7. Design circuitry to prevent sudden lurching of driven objects.

When a cylinder is driven by an exhaust center directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speeds if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder.
Therefore, equipment should be selected and circuits designed to prevent sudden lurching, because there is a danger of human injury and/or damage to equipment when this occurs.

8. Consider emergency stops.

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

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

Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder has to be reset at the starting position, install manual safety equipment.

10. When the cylinder transfers work pieces that can fall or break due to vibration, take measures such as the installation of a guide.

⚠Caution

1. Avoid application of excessive lateral load to the cylinder.

Application of excessive lateral load can cause the cylinder to malfunction or fall below the specifications.

2. Design a structure that will prevent vibration of the cylinder.

Influence of vibration may cause malfunction.

3. Avoid use of a guide that can cause changes in the sliding resistance.

Use of a guide that can cause changes in the sliding resistance or change of the external load can lead to unstable operation.

4. Avoid structures that can cause changes in the mounting orientation.

Changes in the mounting orientation may lead to unstable in operation.

5. Avoid operation where there are large changes in temperature.
When the cylinder is operated at a low temperature, make sure that no frost is formed inside the cylinder or on the piston rod.

Large changes in temperature and formation of frost may lead to unstable operation.

6. Avoid high-frequency operation.

As a guideline, operate the cylinder at 30 c.p.m or below.

7. Speed adjustment should be conducted in the environment where the cylinder is used.

In a different environment, the speed adjustment may be incorrect.

Selection

⚠Warning

1. Check the specifications.

The products advertised in this catalogue are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure, temperature, etc., are out of specification, damage and/or malfunction may be caused. Do not use under these conditions.
Consult SMC if you use a fluid other than compressed air.

2. Intermediate stops.

When intermediate stopping of a cylinder piston is performed with a 3 position closed center directional control valve, it is difficult to achieve stopping positions as accurate and minute as with hydraulic pressure, due to the compressibility of air.
Furthermore, since valves and cylinders, etc. are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

Smooth Cylinder
Actuator Precautions 2

Be sure to read befor handling.

Selection

⚠Caution

1. Operate within the limits of the maximum usable stroke.

Refer to the selection procedures for the air cylinder to be used for the maximum usable stroke.
The piston rod will be damaged if operated beyond the maximum stroke.

2. Operate the piston within a range such that collision damage will not occur at the end of the stroke.

Operate within a range such that damage will not occur when the piston having inertial force stops by striking the cover at the stroke end. Refer to the cylinder selection procedures for the range within which damage will not occur.

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

4. Provide an intermediate support for a cylinder with a long stroke.

If the cylinder has a long stroke, provide an intermediate support to prevent the rod from sagging and the tube from flexing, as well as to prevent damage to the rod due to vibrations or external loads.

5. When the cylinder has a long stroke, take measures to prevent increase of the sliding resistance caused by the deflection of the piston rod and other factors.

Pneumatic Circuit

⚠Caution

1. Keep the piping length between the speed controller and cylinder port as short as possible.

A large distance between the speed controller and cylinder may lead to unstable speed control.

2. To control the speed, use speed controllers that allow easy control in low-speed operation or dual speed controllers (Series ADS) that prevent sudden movement.

(The maximum speed may be limited when speed controllers for low-speed operation are used.)
Please refer to the recommended circuits on page 7.

3. Allow sufficient margin when setting the pressure supplied to the cylinder.

If the operating pressure is low, low-speed and low-pressure operation may lack stability depending on the load conditions. Also, the maximum speed may be limited depending on the pneumatic circuit and operating pressure.

4. Consider the piping resistance of the pneumatic circuit when the sliding resistance is to be decreased.

With some pneumatic circuits, the piping resistance may increase, resulting in larger sliding resistance.

Mounting

⚠Caution

1. Make sure to connect the rod and the load so that their axial center and movement directions match.

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

2. When an external guide is used, connect the external slider and the load in such a way that there is no interference at any point within the stroke.

3. Do not scratch or gouge the sliding portion of the cylinder tube or the piston rod by striking it with an object, or squeezing it.

The tube bore is manufactured under precise tolerances. Thus, even a slight deformation could lead to a malfunction. Furthermore, any scratches or gouges on the sliding portion of the piston rod could damage the seals, which could lead to air leakage.

4. Prevent the rotating parts from seizing.

Apply grease to the rotating parts (such as the pin) to prevent them from seizing.

5. Do not use until you verify that the equipment can operate properly.

After mounting, repair or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak inspections.

6. Instruction manual.

The product should be mounted and operated after thoroughly reading the manual and understanding its contents.
Keep the instruction manual where it can be referred to as needed.

Piping

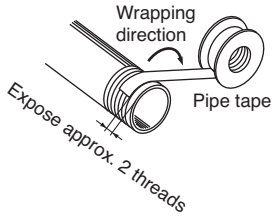
⚠Caution

1. Preparation before piping.

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

2. Wrapping of sealant tape.

When connecting pipes and fittings, etc., be certain that cutting chips from the pipe threads and sealing material do not get inside the piping.
Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe/fitting.



Smooth Cylinder
Actuator Precautions 3

Be sure to read befor handling.

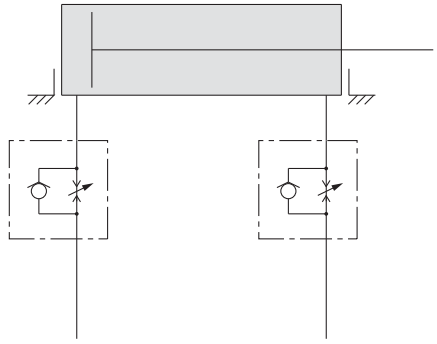
Recommended Pneumatic Circuit

Please refer to the following information when speed control is conducted with the smooth cylinder.

⚠Warning

Horizonal actuation (Speed control)

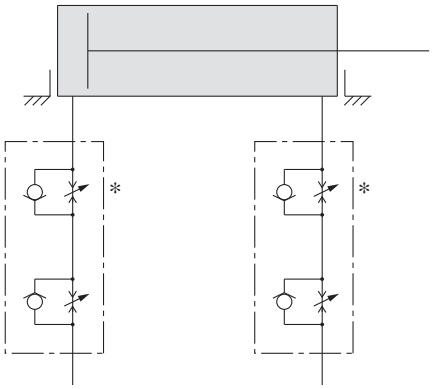
I



Meter-in speed controller

Meter-in speed controllers can not only control the speed but also reduce sudden movement. Easy adjustment is possible with two handles.

II

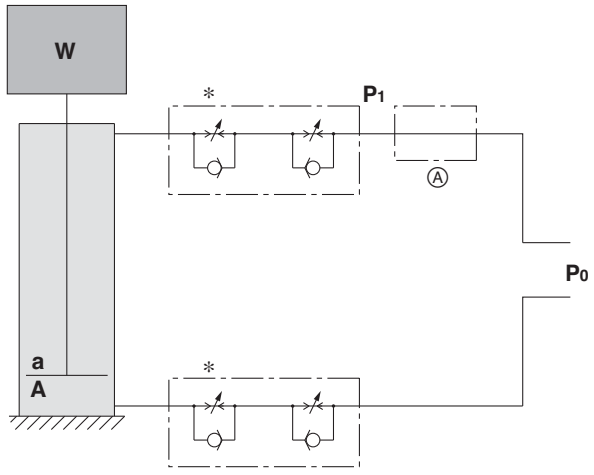


Dual speed controller

Meter-out speed control is conducted. Combine meter-in control to reduce sudden movement. Compared with circuits that only use meter-in control, this circuit achieves more stable low-speed operation.

Vertical actuation (Speed control)

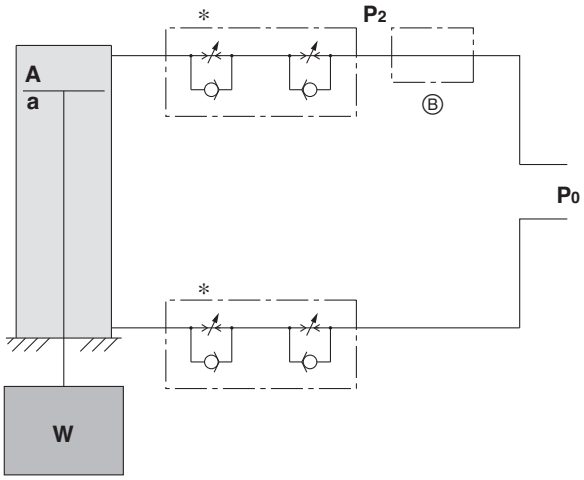
I



(1) Basically, meter-out control is used. Combine meter-in control to reduce sudden movement.*

(2) Depending on the size of the load, installation of a regulator with check valve at the (A) position is effective to reduce sudden movement in downward operation or delay in upward operation.
Guideline
When **W** + **P0a** > **P0A**:
Adjust **P1** so that **W** + **P1a** = **P0A**.

II



(1) Basically, meter-out control is used. Combine meter-in control to reduce sudden movement.*

(2) Installation of a regulator with check valve at the (B) position is effective to reduce sudden movement in downward operation or delay in upward operation.
Guideline
Adjust **P2** so that **W** + **P2a** = **P0a**.

W: Load (N) **P0**: Operating pressure (MPa) **a**: Rod side piston area (mm^2) **A**: Head side piston area (mm^2)

Smooth Cylinder
Actuator Precautions 4

Be sure to read befor handling.

Lubrication

⚠Caution

1. Do not lubricate the cylinder.

Lubrication may cause malfunction.

2. Do not use greases other than those specified by SMC.

The low speed cylinder and low speed cylinder of clean room specification use different greases. Use of a grease outside the specification may lead to malfunction and particle generation.

- When only grease for maintenance is necessary, please order by the following part numbers.
  Grease
  GR-L-005 (5 g), GR-L-010 (10 g), GR-L-150 (150 g)

3. Do not wipe off the grease adhering to the sliding part of the cylinder.

Wiping off the grease adhering to the sliding part of the air cylinder may lead to malfunction.

Air Supply

⚠Warning

1. Use clean air.

If compressed air includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., it can cause damage or malfunction.

⚠Caution

1. Install air filters.

Install air filters at the upstream side of valves. The filtration degree should be 5 m or less.

2. Install an after cooler, air dryer, drain catch, etc.

Air that includes excessive condensate may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, after cooler, etc.

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

Take measures to prevent freezing, since moisture in circuits will be frozen under 5C, and this may cause damage to seals and lead to malfunction.
Refer to SMC's Best Pneumatics catalogue vol. 4 for further details on compressed air quality.

4. Take measures to prevent possible fluctuations in pressure.

Fluctuations in pressure may cause malfunction.

Operating Environment

⚠Warning

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

2. Do not use in environments where a large amount of dust is present or where water or oil splashes on the cylinder.

Maintenance

⚠Warning

1. Maintenance should be done according to the procedures indicated in the operating manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Machine maintenance, and supply and exhaust of compressed air.

When machinery is serviced, first check measures to prevent dropping of driven objects and run-away of equipment, etc. Then cut off the supply pressure and electric power, and exhaust all compressed air from the system.
When machinery is restarted, check that proper measures are taken to prevent shooting out and that operation is normal with actuators in the proper positions.

⚠Caution

1. Drain flushing.

Remove condensate from air filters regularly.

Smooth Cylinder
Auto Switch Precautions 1

Be sure to read befor handling.

Design & Selection

⚠Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications of current load, voltage, temperature or impact.

2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm. (When the allowable separation is indicated for each cylinder series, use the specified value.)

3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V\ (mm/s) = \frac{\text{Auto switch operating range (mm)}}{\text{Time load applied (ms)}} \times 1000$$

In cases of high piston speed, the use of an auto switch (D-F5NT, F7NT and G5NT) with a built-in OFF delay timer (approx. 200ms) makes it possible to extend the load operating time.

4. Wiring should be kept as short as possible.

<Reed switch>
As the length of the wiring to a load gets longer, the inrush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

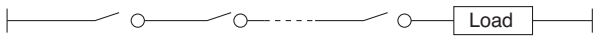
1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5m or longer.
2) Even if an auto switch has a built-in contact protection circuit, when the wiring is more than 30m long, it is not able to adequately absorb the inrush current and its life may be reduced. It is again necessary to connect a contact protection box in order to extend its life. Please contact SMC in this case.
   <Solid state switch>
3) Although wire length should not affect switch function, use a wire 100m or shorter.

5. Take precautions for the internal voltage drop of the switch.

<Reed switch>

1) Switches with an indicator light except (D-A56, A76H, A96, A96V, C76 and Z76)

● If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diode. (Refer to internal voltage drop in the auto switch specifications.)
[The voltage drop will be "n" times larger when "n" auto switches are connected.]
Even though an auto switch operates normally, the load may not operate.



● In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Power supply voltage} - \text{Switch internal voltage drop} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Models D-A6□, A80, A80H, A90, A90V, C80 and Z80)

<Solid state switch>

3) Generally, the internal voltage drop will be greater with a 2-wire solid state auto switch than with a reed switch. Take the same precautions as in 1).
   Also, note that a 12 VDC relay is not applicable.

6. Pay attention to leakage current.

<Solid state switch>
With a 2-wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (Input OFF signal of controller)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3-wire switch if this specification will not be satisfied.
Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

7. Do not use a load that generates surge voltage.

<Reed switch>
If driving a load such as a relay that generates a surge voltage, use a switch with a built-in contact protection circuit or use a contact protection box.

<Solid state switch>
Although a zener diode for surge protection is connected at the, output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a switch with a built-in surge absorbing element.

8. Cautions for use in an interlock circuit.

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also perform periodic maintenance and confirm proper operation.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

Smooth Cylinder
Auto Switch Precautions 2

Be sure to read befor handling.

Mounting & Adjustment

⚠Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s^2 or more for reed switches and 1000m/s^2 or more for solid state switches) while handling.
Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not break the lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the specified tightening torque, the mounting screws, mounting bracket, or switch may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position. (Refer to switch mounting for each series regarding switch mounting, moving, and fastening torque, etc..)

4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in a catalog indicates the optimum, position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

Wiring

⚠Warning

1. Avoid repeatedly bending or stretching the lead wire.

Repeatedly applying bending stress or stretching force to the lead wire will cause it to break.

2. Be sure to connect the load before power is applied.

<2-wire type>
If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3 .Confirm proper insulation of wiring.

Make sure that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a auto switch.

4. Do not wire in conjunction with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits, including auto switches, may malfunction due to noise from these other lines.

5. Do not allow loads to short circuit.

<Reed switch>
If the power is turned ON with a load in a short circuit condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switch>
Models D-M9□, J51, M9BA, G5NB and all models of PNP output switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged.
Take special care to avoid reverse wiring between the brown power supply line and the black output line on 3-wire type switches.

6. Avoid incorrect wiring.

<Reed switch>
A 24 VDC switch with indicator light has polarity. The brown lead wire or terminal No.1 is (+), and the blue lead wire or terminal No.2 is (–).

1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.
   Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.
   Applicable models:
   D-A73, A73H, A73C, C73, C73C, Z73
   D-A93, A93V
   D-A33, A34, A33A, A34A, A44, A44A
   D-A53, A54, B53, B54
2) However, when using a two color indication auto switch (D-A79W, A59W, B59W), be aware that the switch will constantly remain ON if the connections are reversed.

<Solid state switch>

1) If connections are reversed on a 2-wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.
2) If connections are reversed (power supply line + and power supply line –) on a 3-wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue (black) wire and the power supply line (–) is connected to the black (white) wire, the switch will be damaged.

∗ Lead wire colour changes

Lead wire colours of SMC switches and related products have been changed in order to meet NECA (Nippon Electric Control Equipment Industries Association) Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided. Special care should be taken regarding wire polarity during the time that the old colours still coexist with the new colours.

2-wire

	Old	New
Output (+)	Red	Brown
Output (–)	Black	Blue

Solid state with diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Diagnostic output	Yellow	Orange

3-wire

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black

Solid state with latch diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Latch diagnostic output	Yellow	Orange

Smooth Cylinder
Auto Switch Precautions 3

Be sure to read befor handling.

Operating Environment

⚠Warning

1. Never use in an atmosphere with explosive gases.

The structure of auto switches is not designed to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches except D-A3□/A44□/G39□/K39□ satisfy the IEC standard IP67 structure (JIS C 0920: anti-immersion structure), do not use switches in applications where they are continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

4. Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with temperature cycles.

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as they may be adversely affected.

6. Do not use in an environment where there is excessive impact shock.

<Reed switch>

When excessive impact (300m/s^2 or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

7. Do not use in an area where surges are generated.

<Solid state switch>

When there are units (solenoid lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around cylinders with solid state auto switches, this may deteriorate or damage the switch. Avoid sources of surge generation and disorganized lines.

8. Avoid accumulation of iron powder or close contact with magnetic substances.

When a large amount of ferrous powder such as machining chips or spatter is accumulated, or a magnetic substance is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

⚠Warning

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Secure and tighten switch mounting screws.
   If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.
2) Confirm that there is no damage to lead wires.
   To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.
3) Confirm the lighting of the green light on the 2-colour indicator switch.
   Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

Other

⚠Warning

1. Consult SMC concerning water resistance, elasticity of lead wires, and usage at welding sites, etc.