



# Operation Manual

**3 Port Air Operated Valve**

PRODUCT NAME

**SYJA500 Series**

MODEL/ Series

# SMC Corporation

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# 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 relating to systems
- ISO 4413: Hydraulic fluid power -- General rules relating to systems
- IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
- ISO 10218-1992: Manipulating industrial robots -- Safety



## Caution

**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



## Warning

**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



## Danger

**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious 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. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



# Safety Instructions

## Caution

**The product is provided for use in manufacturing industries.**

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

## 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.\*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 regulation 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.**



## SYJA 500 Series

# Air Operated Valve / Precautions ①

Be sure to read before handling.

### Design

## Warning

### ① Operation of actuator

When an actuator, e.g. air cylinder, is to be operated using a valve, take appropriate measures to prevent potential personnel injuries caused by the actuator movement.

### ② Effect of back pressure when using a manifold.

Use caution when valves are used on a manifold, an actuator malfunction due to back-pressure may occur.

### ③ Holding of pressure(including vacuum)

Since valves are subject to air leakage, they cannot be used for applications such as holding pressure (including vacuum) in a pressure vessel.

### ④ Cannot be used as an emergency shut off valve, etc.

The valves presented in this operation manual are not designed for safety applications such as an emergency shut off valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

### ⑤ Maintenance space

The installation should allow sufficient space for maintenance activities (removal of valve, etc.).

### ⑥ Release of residual pressure

Provide a residual pressure release function for maintenance purpose.

### ⑦ About ventilation

When using a valve in closed control panel, etc., install a ventilating opening, etc. in order not to increase the pressure inside a control panel by ventilating air and not to pack the heat generated by valve.

### Selection

## Warning

### Confirm the specifications

The products presented in this operation manual are designed only for use in compressed air systems (including vacuum). Do not operate at pressures or temperatures, etc. beyond the range of specifications, as this can cause damage or malfunction. (Refer to specifications.) Contact SMC when using a fluid other than compressed air (including vacuum).

### Selection

## Caution

### ① Low temperature operation

Unless otherwise indicated in the specifications for each valve, operation is possible to  $-10^{\circ}\text{C}$ , but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

### ② Using for air blow

When a single solenoid valve is used with port A or B released to atmosphere for an application such as an air blow, a pressure drop might occur and give an effect to the valve.

### ③ Mounting orientation

No specific orientation is necessary.

### ④ With regards to a breathing port

Do not plug a breathing port. Also take care not to prevent intrusion of foreign matters such as dust and water into the breathing port.

### Mounting

## Warning

### ① If air leakage increases or equipment does not operate properly, stop operation.

Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.

### ② Instruction manual

Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

### ③ Painting and Coating

Warnings or specifications printed or pasted on the product should not be erased, removed or covered up. Consult SMC if paint is to be applied to resinous parts, as this may have an adverse effect due to the paint solvent.



# SYJA 500 Series

# Air Operated Valve / Precautions ②

Be sure to read before handling.

## Piping

## Lubrication

### ⚠ Caution

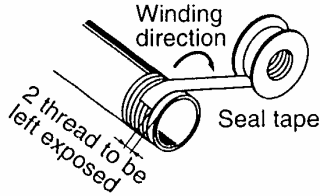
### ⚠ Caution

#### ① Preparation before piping

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

#### ② Wrapping of sealant tape

When connecting pipes and fittings, etc. be sure that chips from the pipe thread and sealing materials do not get inside the valve. Furthermore, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



#### ③ Tightening torque

When installing fittings, etc., follow the procedures below.

##### M5

1) When using SMC's fitting, etc.

After tightening by hand, give it additional 1/6 turn with a wrench. (1/4 turn for miniature fittings.)

In case that two gaskets are equipped such as universal elbow or universal tee, give it additional 1/2 turn with a wrench.

Note) If fittings are over-tightened, air leakage may result due to breaking of fitting threads or deformation of the gaskets.

However, if fittings are not tightened sufficiently, loosening of the threads and air leakage may occur.

2) Follow the indication when using fittings over than SMC.

#### ① Lubrication

1) The valve has been lubricated for life at the factory, and does not require any further lubrication.

2) In the event that it is lubricated, use class 1 turbine oil (without additives), ISO VG32.

However, once lubrication is applied it must be continued, as loss of the original lubricant may lead to malfunction.

Contact SMC regarding class 2 turbine oil (with additives), ISO VG32.

#### Tightening torque for piping

Connection threads	Proper tightening torque N·m
1/8	7 to 9



# SYJA 500 Series

# Air Operated Valve / Precautions ③

Be sure to read before handling.

## Air source

### Warning

#### ① Use clean air

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

### Caution

#### ① Install air filter

Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.

#### ② Install an air dryer, after cooler or Drain Catch(water separator), etc.

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipments. To prevent this, install an air dryer, after-cooler, or water separator, etc.

#### ③ If excessive carbon dust is generated, eliminate it by installing mist separators at the upstream side of valves.

If excessive carbon dust is generated by the compressor, it may adhere to the inside of valves and cause malfunction.

Refer to 'SMC Best Pneumatics catalog vol.4' for compressed air quality.

## Operating Environment

### Warning

① Do not use valve in atmosphere of corrosive gases, chemicals, salt water, water or steam or where there is direct contact with any of these.

② Do not use in locations subject to vibration or impact. Confirm the specifications in the main section of this catalog.

③ A protective cover, etc., should be used to shield valves from direct sunlight.

④ Shield valves from radiated heat generated by nearby heat sources.

⑤ Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

## Maintenance

### Warning

#### ① Perform maintenance procedures as shown in the instruction manual.

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

#### ② Equipment removal and supply/exhaust of compressed air

When equipment is removed, first confirm that measures that measures are in place to prevent dropping of work pieces 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 the equipment is to be started again after remounting or replacement, first confirm that measures are in place to prevent lurching of actuators, etc., and then confirm that the equipment is operating normally.

#### ③ Low frequency operation

Valves should be switched at least once every 30 days to prevent malfunction. (Use caution regarding the air supply..)

#### ④ Manual override operation

When the manual override is operated, connected equipment will be actuated. Confirm safety before operating.

### Caution

#### Drain flushing

Remove drainage from air filters regularly.

## How to Find the Flow Rate (at air temperature of 20 °C)

Subsonic flow when  $(P2+0.100)/(P1+0.100) > 0.5$

$$Q = 240S \sqrt{\Delta P (P1 + 0.100)}$$

Sonic flow when  $(P2+0.100)/(P1+0.100) \leq 0.5$

$$Q = 120S (P1 + 0.100)^{3/2}$$

Q: Air flow rate [dm<sup>3</sup>/min(ANR)]

S: Effective sectional area (mm<sup>2</sup>)

Δ P: Differential pressure P1- P2 [MPa]

P1: Upstream pressure [MPa]

P2: Downstream pressure [MPa]

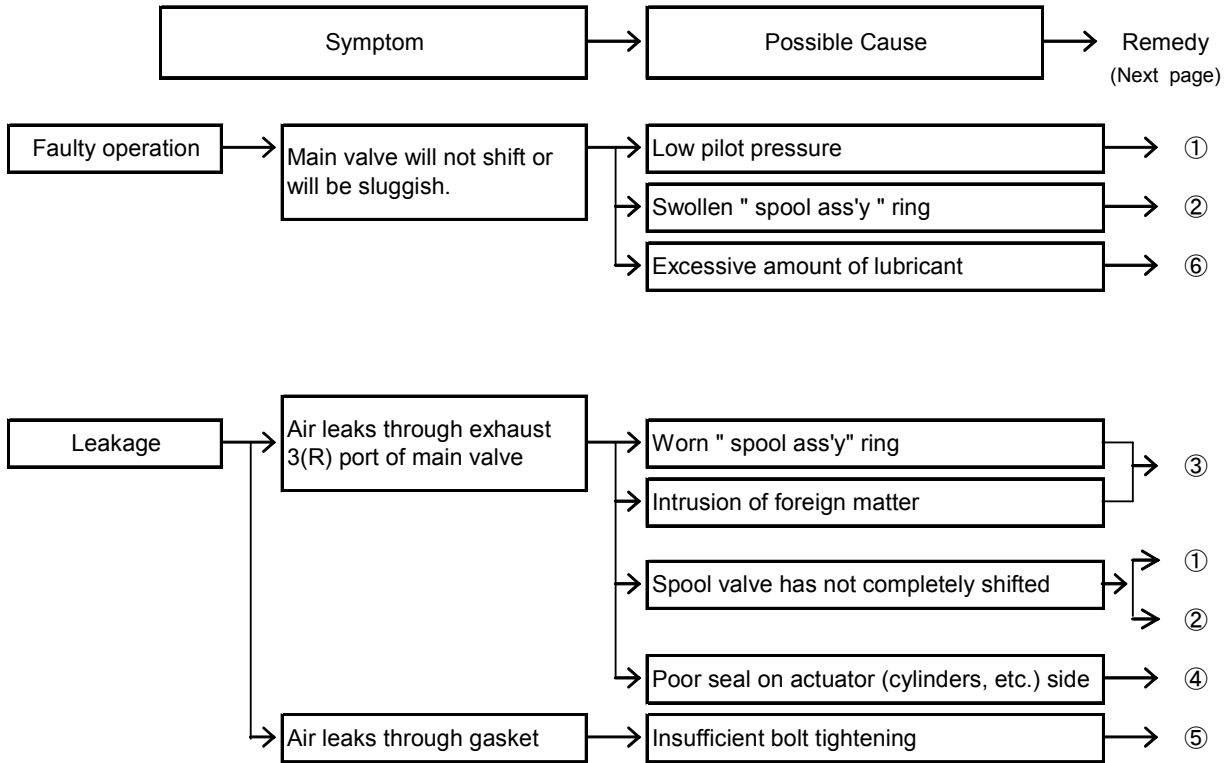
※ Correction for different air temperatures

Multiply the flow rate calculated with the about formula by a coefficient from the table below.

Air temperature (°C)	-20	-10	0	10	30	40	50	60
Correction coefficient	1.08	1.06	1.04	1.02	0.98	0.97	0.95	0.94

# TROUBLESHOOTING

Should any trouble be found during operation, trace the source of the trouble in the following order and take corrective action.





## Remedy

No.	Remedy
①	Regulate pressure so that pilot pressure will fall within operating pressure range during operation.
②	○If wrong oil is used, completely air blow to remove oil, and replace valve. After valve is replaced, use turbine oil class 1 (ISO VG32).
	○In applications where excessive condensate is produced, install either an auto-drain or a dryer. The valve should be replaced.
③	Replace worn spool valve. To remove foreign matter, air blow piping, then replace valve.
④	Repair or replace actuators.
⑤	Isolate the valve and re-tighten the bolts.
⑥	Reduce the amount of lubricant to the degree that no oil splashes out of the air exhaust [3(R) and PE] port.

If no improvement is achieved in spite of the above countermeasure, inside of the valve may have some failure. In this case, stop using the valve immediately.

If any of followings are carried out, inside of the valve may have some failure. In this case, stop using the valve immediately.

- ① Oil other than the specified one has been lubricated.
- ② Lubrication has been stopped intermediately, or lubrication was suspended temporary.
- ③ Water splashed directly.
- ④ Strong impact was given.
- ⑤ Alien substance such as drain and particle got into.
- ⑥ Prohibited way of using the valve which is written at "Precautions" section in this operation manual was carried out excluding above-mentioned.

If any trouble should happen with the uni, please send it back to the supplier for repair or replacement.

Revision history

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.  
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