



Operation Manual

PRODUCT NAME

5 Port Air Operated Valve

MODEL / Series / Product Number

VPA4*50/4*70/VVPA4*0 Series

SMC Corporation

Contents

Safety Instructions	2,3
Precautions on Design	4,5
Selection	4,5
Mounting	4
Piping	4,5
Lubrication	5
Air Supply	5
Operating Environment	5
Maintenance	5,6
Specific Product Precautions	7
Trouble Shooting	8



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: Manipulating industrial robots -Safety.

etc.



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

1. 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, 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 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.

Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.



VPA4*50/4*70/VVPA4*0 Series

Precautions for 5 Port Air Operated Valve ①

Be sure to read before handling.

Design / Selection

Warning

1. Confirm the specification

This product is designed only for use in compressed air systems (including vacuum). Do not operate at pressures, temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Please contact SMC when using a fluid other than compressed air (including vacuum).

We do not guarantee against any damage if the product is used outside of the specification range.

2. Actuator drive

When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures (such as the installation of a cover or the restricting of access to the product) to prevent potential danger caused by actuator operation.

3. Intermediate stops

For 3-position closed center type, it is difficult to make the piston stop at the required position accurately 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 an extended period of time.

Please contact SMC if it is necessary to hold a stopped position for an extended period of time.

4. Effect of back pressure when using a manifold

Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure. For 3-position exhaust center valve or single acting cylinder, take appropriate measures to prevent the malfunction by using it with an individual exhaust manifold.

5. Holding of pressure

Since the valve are subject to air leakage, they cannot be used for applications such as holding pressure in a pressure vessel.

6. Not suitable for use as an emergency shut-off valve, etc.

VPA4*50, 4*70, VVPA4*0 series are not designed for safety applications such as an emergency shutoff valve. If the valves are used in such applications, additional safety measures should be adopted.

7. Release of residual pressure

For maintenance purposes install a system for releasing residual pressure. Especially in the case of 3-position closed center valve, ensure that the residual pressure between the valve and the cylinder is released.

8. Double pilot type

When using the double pilot type, actuators may travel in an unexpected direction depending on the switching position of the valve. Implement measures to prevent any danger from occurring when operation the actuator.

9. Ventilation

Provide ventilation when using a valve in a confined area, such as in a closed control panel. For example, install a ventilation opening, etc. in order to prevent pressure from increasing inside of the confined area.

10. Do not disassemble the product or make any modifications, including additional machining.

Doing so may cause human injury and/or an accident..

Caution

1. Operation in low temperature conditions

This product can be used at 0°C. Take appropriate measures to avoid the freezing of drainage, moisture, etc., in low temperatures.

2. Mounting orientation

Mounting orientation is not specified.

Mounting

Warning

1. Operation manual

Install the products and operate them only after reading the operation manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.

2. Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance and inspection.

3. Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

4. If air leakage increases or equipment does not operated properly, stop operation.

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

5. Painting and coating

Warnings or specifications printed on or affixed to the product should not be erased, removed, or covered up.

Please consult with SMC before applying paint to resinous parts, as this may have an adverse effect due to the solvent in the paint.

Piping

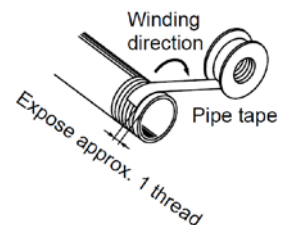
Caution

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 pipe tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping. Also, if sealant tape is used, leave 1 thread ridge exposed at the end of the threads.



3. Connection of fittings

For a fitting with sealant R or NPT, first, tighten it by hand, then use a suitable wrench to tighten the hexagonal portion of the body an additional two or three turns.

For the tightening torque, refer to the table below.

Connection thread size (R, NPT)	Proper tightening torque (N·m)
3/8	15 to 20
1/2	20 to 25
3/4	28 to 30
1	36 to 38
1 1/4	40 to 42
1 1/2	48 to 50



VPA4*50/4*70/VVPA4*0 Series

Precautions for 5 Port Air Operated Valve ②

Be sure to read before handling.

Piping

⚠ Caution

4. Piping

Make sure that the supply pressure to the P port does not become lower than the specified range.

If the P port piping is restricted, or the A or B port is released to the atmosphere, or the condition is close to this, the valve may malfunction due to the pressure drop.

5. When closed centre style (VPA4350) is used.

For closed center, check the piping to prevent air leakage from the piping between the valve and the cylinder.

6. Piping to products

When piping to a product, refer to the operation manual to avoid mistakes regarding the supply port, etc.

Lubrication

⚠ Warning

1. Lubrication

If a lubricant is used in the system, use class 1 turbine oil (no additives), ISO VG32.

Once lubricant is utilized within the system, since the original lubricant applied within the product during manufacturing will be washed away, please continue to supply lubrication to the system. Without continued lubrication, malfunctions could occur.

If turbine oil is used, refer to the Safety Data Sheet (SDS) of the oil.

2. Lubrication amount

If the lubrication amount is excessive, the oil may accumulate inside the valve, causing malfunction or response delay. So, do not apply a large amount of oil.

Air Supply

⚠ Warning

1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

2. When there is a large amount of drainage

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow. This may cause the malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to the SMC Best Pneumatics No. 6 catalog.

4. Use clean air

Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

⚠ Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.

2. Install an air filter.

Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 μm or smaller.

3. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.

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

4. If an excessive amount of carbon powder is present, install a mist separator on the upstream

If excessive carbon dust is generated by the compressor, it may adhere to the inside of a valve and cause it to malfunction. For compressed air quality, refer to the SMC Best Pneumatics No. 6 catalog.

Operating Environment

⚠ Warning

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

2. Do not use in an environment where flammable gas or explosive gas exists. Usage may cause a fire or explosion. The products do not have an explosion proof construction.

3. Do not use in a place subject to heavy vibration and/or shock.

4. The valve should not be exposed to prolonged sunlight. Use a protective cover. Note that the valve is not for outdoor use.

5. Remove any sources of excessive heat.

6. If it is used in an environment where there is possible contact with oil, weld spatter, etc., exercise preventive measures.

7. When the product is used in a dusty environment, install a silencer to EA and EB ports to prevent the dust from entering into the valve.

⚠ Caution

1. Temperature of ambient environment

Use the valve within the range of the ambient temperature specification of each valve. In addition, pay attention when using the valve in environments where the temperature changes drastically.

2. Humidity of ambient environment

- When using the valve in environments with low humidity, take measures to prevent static.

- If the humidity rises, take measures to prevent the adhesion of water droplets on the valve.



VPA4*50/4*70/VVPA4*0 Series

Precautions for 5 Port Air Operated Valve ③

Be sure to read before handling.

Maintenance

Warning

1. **Perform maintenance and inspection according to the procedures indicated in the operation manual.**

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

2. **Removal of equipment, and supply/exhaust of compressed air**

Before components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply air and electric power, and exhaust all air pressure from the system using the residual pressure release function.

For the 3-position closed center type, exhaust the residual pressure between the valve and the cylinder.

When the equipment is operated after remounting or replacement, first confirm that measures are in place to prevent the lurching of actuators, etc. Then, confirm that the equipment is operating normally.

3. **Low frequency operation**

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

4. **If the volume of air leakage increases or the valve does not operate normally, do not use the valve.**

Perform periodic maintenance on the valve to confirm the operating condition and check for any air leakage.

Caution

1. **Drain flushing**

Remove drainage from the air filters regularly.

2. **Lubrication**

This valve requires lubrication. Once lubrication has been started, it must be continued.

Use class 1 turbine oil (with no additives), VG32. If other lubricant oil is used, it may cause a malfunction. Please contact SMC for information on the suggested class 2 turbine oil (with additives), VG32.



VPA4*50/4*70/VVPA4*0 Series

Specific Product Precautions 1

Be sure to read this before handling.

Handling Precautions of manifold

Up to 3 stations can be added to the manifold when pressure is applied from only one air supply port (P port). Up to 10 stations when pressure is applied from both air supply ports (P port). (Up to 8 stations for VVPA460)

Simultaneous Operation with Manifold Valves

Pressure drop will occur by simultaneously using manifold valves.

Handling Precautions of closed centre (VPA4350)

Precautions when the actuator stops at the intermediate position

- 1) When the supply pressure to the P port is exhausted or lowered with the actuator stopped at an intermediate position, the pressure holding the actuator will fluctuate and the actuator will move. (This valve constitutes the residual pressure exhaust circuit, which exhausts the air pressure of A or B port when the air pressure $P < A$ or B when the valve is stopped at the intermediate position.
 - 2) Make sure that there is no leakage in the fittings.
Check air leakage by using soap water.
- Note) The VPA4350 valve stops the actuator at an intermediate position by holding the pressure of the actuator side (closed center type). The actuator may not stop at the intermediate position if there is even a small amount of air leakage from the valve, actuator, piping or equipment.

Handling Precautions of exhaust centre (VPA4450)

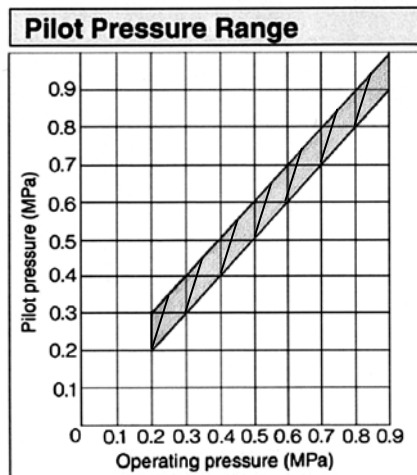
Precautions when the actuator stops at the intermediate position

In the intermediate position, the pressure of A and B side is exhausted from EA and EB respectively (exhaust center type). In this status, the actuator (cylinder) is free from any force, it is easily moved by an external force. Especially, when the product is mounted vertically, the actuator moves downward due to its own weight or load.

In the initial (neutral) position, the pressure on both sides of the actuator is at atmospheric pressure. When the mode is switched to operation mode, the pressure is applied to only one side of the actuator and the cylinder rod may extend suddenly.

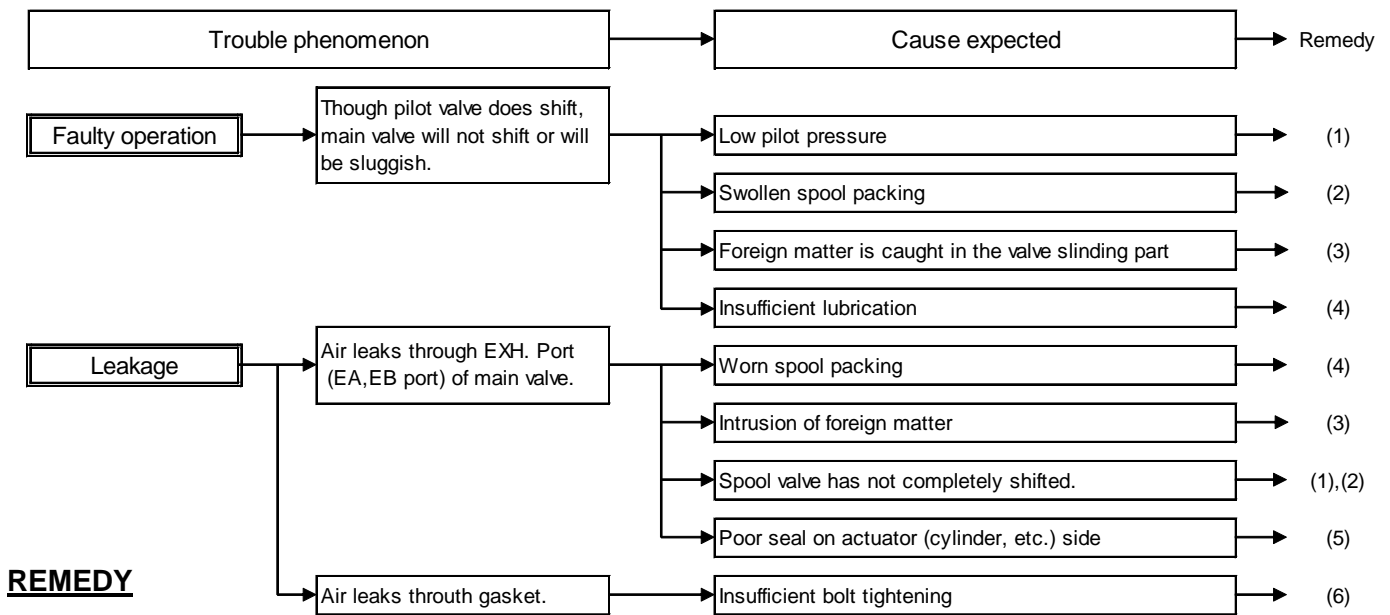
Pilot Pressure Range

Please keep the pilot pressure within the range of the graph below.



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)	Adjust pressure so that pilot pressure will fall within operating pressure range during operation.
(2)	-If wrong oil used, completely air blow to remove oil and replace valve. After valve is replaced, use turbine oil class 1 (ISO VG32). -When a large quantity of drain is given and cannot carry out drain omission surely, install either an auto-drain or a dryer. The valve should be replaced.
(3)	To remove foreign matter, clean the pipe by air blow. Replace valve.
(4)	If lubricating oil has not been supplied, supply it. In the case where a lubricator is installed on, check it for oil level and positive drop.
(5)	Repair or replace actuators.
(6)	Isolate the valve and re-tighten the bolts.

If no improvement is achieved in spite of the above countermeasure, inside of the valve may have some abnormality. 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. Drain or garbage invaded a valve.
6. Prohibited way of using the valve which is written at "Precautions" section in this operation manual was carried out excluding above-mentioned.

In addition, in the case of trouble, please send it back to the supplier for repair or replacement.

Revision history

A	Renewal	NQ
B	Safety Instructions	Po
C	Safety Instructions	WQ

1st printing : AQ

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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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