



Operation Manual

PRODUCT NAME

5 Port Solenoid Valve

MODEL / Series / Product Number

VP4*50/VP4*70/VVP4*0 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.

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.



VP4*50/VP4*70/VVP4*0 Series

Precautions for 5 Port Air Operated Valve 1

Be sure to read before handling.

Design / Selection

⚠ Warning

1. Confirm the specification

Products represented in this 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 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 (cover installation or approach prohibition) to prevent potential danger caused by actuator operation.

3. Intermediate stopping

For 3-position closed center type, it is difficult to make a 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.

Refer to Specific Product Precautions for VP4350 Handling Precautions.

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 valves 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.

VP4*50, 4*70, VVP4*0 series are not designed for safety applications such as an emergency shutoff valve. If the valves are used for the mentioned 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 for the first time, 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 and to release the heat generated by the valve.

10. Extended periods of continuous energization

If a valve will be continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil.

For applications such as mounting a valve on a control panel, incorporate measure to limit the heat radiation so that it is within the operating temperature range.

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

It may cause human injury and/or an accident.

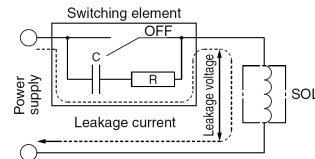
⚠ Caution

1. Momentary energization

If a double solenoid valve is operated with momentary energization, it should be energized for at least 0.1 second. However, depending on the condition of the secondary load, it should be energized until the cylinder reaches the stroke end position, since there is a possibility of malfunction.

2. Leakage voltage

Take note that the leakage voltage will increase when a resistor is used in parallel with switching element or a C-R circuit (surge voltage suppressor) is used for protecting a switching device because of the passing leakage voltage through the CR circuit. The suppressor residual leakage voltage should be as follows.



DC coil 5% or less of rated voltage

AC coil 15% or less of rated voltage

3. Solenoid valve drive for AC with a solid state output (SSR, TRIAC output, etc.)

1) Current leakage

When using a snubber circuit (C-R element) for surge protection of the output, a very small amount of electrical current will continue to flow even during the OFF state. This results in the valve not returning. In a situation where the tolerance is exceeded, as in the above case, take measures to install a bleeder resistor.

2) Minimum allowable load amount (Min. load current)

When the consumption current of a valve is less than the output's minimum allowable load volume or the margin is small, the output may not switch normally. Please contact SMC.

4. Surge voltage suppressor

If a surge protection circuit contains nonstandard diodes, such as Zener diodes or varistor, a residual voltage that is in proportion to the protective circuit and the rated voltage will remain. Therefore, take into consideration the surge voltage protection of the controller. In the case of diodes, the residual voltage is approximately 1 V.



VP4*50/VP4*70/VVP4*0 Series Precautions for 5 Port Air Operated Valve 2

Be sure to read before handling.

Design / Selection

⚠ Caution

5. Surge voltage intrusion

With non-polar type solenoid valves, at times of sudden interruption of the loading power supply, such as emergency shutdown, surge voltage intrusion may be generated from loading equipment with a large capacity (power consumption), and the solenoid valve in a deenergized state may switch over (see Figure 1).

When installing a breaker circuit for the loading power supply, consider using a solenoid valve with polarity (with polarity protection diode), or install a surge absorption diode between the loading equipment COM line and the output equipment COM line (see Figure 2).

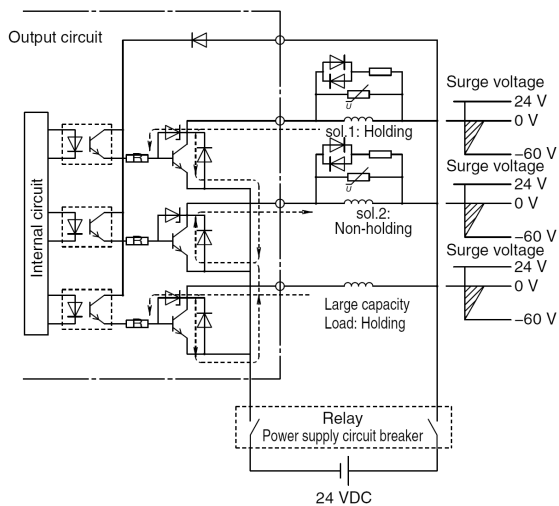


Figure 1. Surge intrusion circuit example (NPN outlet example)

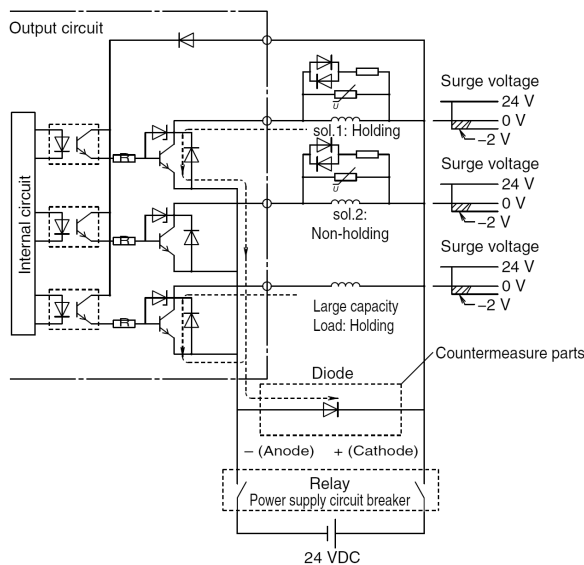


Figure 2. Surge intrusion circuit example (NPN outlet example)

6. Operation in a low temperature condition

Take appropriate measures to avoid freezing of drainage, moisture etc. in low temperature.

7. Mounting orientation

Mounting orientation is free.

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.

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 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.



VP4*50/VP4*70/VVP4*0 Series

Precautions for 5 Port Air Operated Valve 3

Be sure to read before handling.

Piping

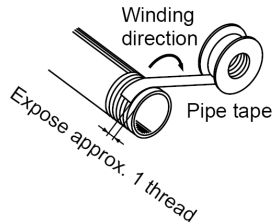
⚠ Caution

1. Preparation before piping

Before piping is connected, it should be thoroughly blow 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 pipe tape is used, leave 1 thread ridges exposed at the end of the threads.



3. Connection of fittings

When screwing fittings into valves, tighten as follows.

Tightening Torque for Piping

Connection thread	Proper tightening torque (N·m)
Rc1/8	3 to 5
Rc1/4	8 to 12
Rc3/8	15 to 20
Rc1/2	20 to 25
Rc3/4	28 to 30
Rc1	36 to 38
Rc1 1/4	40 to 42
Rc1 1/2	48 to 50

Follow the procedure of the manufacturer when fittings other than SMC is used.

4. Piping

Make P port piping so that supply air pressure does not become lower than operating pressure while operating.

If throttling air flow of P port, or opening A/B ports in the atmosphere (or opening in almost the same conditions), pressure drop at operating can cause malfunction of the valve.

5. Closed center types

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

Wiring

⚠ Caution

1. Polarity

No +/- polarity for this solenoid valve

2. Applied voltage

When electric power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.

3. Check the connections.

Check if the connections are correct after completing all wiring.

4. External force applied to lead wire

If an excessive force is applied to the lead wire, this may cause faulty wiring. Take appropriate measures so that a force of 30 N or more is not applied to the lead wire.

Lubrication

⚠ Caution

1. This valve needs lubrication. If lubrication is not provided or the amount of grease is insufficient, the friction resistance will increase in inverse proportion to the decrease of factory applied grease, and that may cause damage of valve or malfunction

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

2. Please contact SMC regarding class 2 turbine oil (with additive), ISO VG32.

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 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 and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

4. Use clean air

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

⚠ Caution

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

2. Air quality

Install an air filter and lubricator upstream near the valve. Select an air filter with a filtration size of 5 μ m 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 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 excessive carbon powder is seen, install a mist separator on the upstream side of the valve.

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 SMC's Best Pneumatics catalog.



VP4*50/VP4*70/VVP4*0 Series

Precautions for 5 Port Air Operated Valve 4

Be sure to read before handling.

Operating Environment

Warning

1. Do not use in an atmosphere having 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.
5. Remove any sources of excessive heat.
6. If it used in an environment where there is possible contact with oil, weld spatter, etc., exercise preventive measures.
7. When the solenoid valve is mounted in a control panel or its energized for a long time, make sure ambient temperature is within the specification of the valve.
8. Install silencer in EA/EB/Pilot EXH port to prevent dust from entering in the dusty ambient.

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 environme**
 - 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.

Maintenance

Warning

1. **Perform maintenance inspection according to the procedures indicated in the operation manual.**
If handled improperly, malfunction and damage of machinery or equipment may occur.
2. **Removal of equipment, and supply/exhaust of compressed air**
When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.
For 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 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. **Manual override**
When the manual override is operated, connected equipment will be actuated. Operate after safety is confirmed.

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

Perform periodic maintenance of the valve to confirm the operating condition, and if there is any air leakage.

Caution

1. Drain flushing

Remove drainage from the air filters regularly.

2. Lubrication

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

Use class 1 turbine oil (with no additive), ISO VG32 because if other lubricant oil is used, it may cause malfunction. Please contact SMC for suggested class 2 turbine oil (with additive), ISO VG32.



VP4*50/VP4*70/VVP4*0 Series Specific Product Precautions 1

Be sure to read this before handling.

Manifold Specification

1. When using 4 or more stations on the manifold, supply pressure from both sides of P port.
2. If several manifold valves are used at the same time, pressure drop may occur.

VP4350 (Closed Center) Type Precautions

Precautions at intermediate stop state of actuator

- 1) Extreme caution should be taken when exhausting or decreasing supply pressure to P port with an actuator in the intermediate stop state, as the actuator may move due to the change of holding pressure of actuator. (This valve is designed so that air pressure of A or B port will be exhausted by the residual pressure exhausting circuit in the valve when there is no air pressure left at P port in the intermediate stop state.)
- 2) Make sure there is no leakage from the piping and fittings. Check for leakage using soapy water.

Note) VP4350 is a closed center valve which performs intermediate stop of actuator by holding pressure on the actuator side.
In some cases intermediate stop cannot be performed if there is leakage from the valve, actuators, piping or other equipment.

VP4450 (Exhaust Center) Type Precautions

Precautions at intermediate stop state of actuator

In the neutral condition, pressure of A and B sides is exhausted from EA and EB respectively (exhaust center type). Therefore, no air pressure is applied to both ports of the actuator in this condition and so the actuator can easily be operated by external force. Particular care should be taken for a vertically mounted actuator, as it may move down due to its weight or load.

In the initial (neutral) condition, the pressure on both sides of the actuator is 0 (atmospheric pressure), so when it changes to the operating condition, pressure is supplied to only one side of the actuator, so the cylinder rod may lurch.

How to Use DIN Terminal

⚠ Caution

1. Disassembly

- 1) The connector can be removed from the valve by loosening the screw (1), then pulling the cover (4).
- 2) Pull out the screw (1), then remove the gasket (2a) or (2b).
- 3) On the bottom part of the terminal block (3), there is a cut-out (indicated by arrow) (3a). If a small flat head screwdriver is inserted into the cut-out in the bottom, the terminal block (3) can be removed from the cover (4).
- 4) Remove the cable gland (5), plain washer (6) and rubber seal (7).

2. Wiring

- 1) Pass cable (8) through cable gland (5), plain washer (6), and rubber seal (7) in that order, and then insert into the cover (4).
- 2) As shown below, strip the outer layer of cable (8) and crimp the crimped terminal (9) on to the ends.

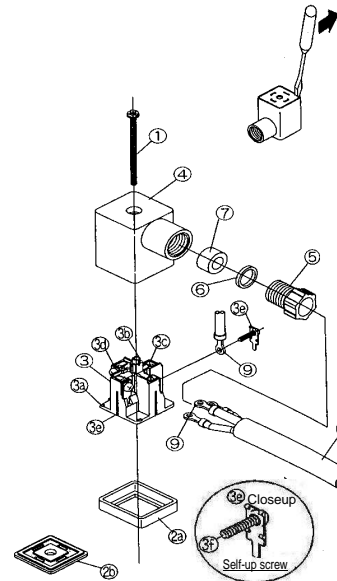
Note) Wire the power leads of the cable to No.1 and 2 terminals.
(The solenoid valve does not have polarity.)

- 3) Remove the screw with washer (3f) from the bracket (3e). (For Y-shape type terminal, loosen the screw.) Mount crimped terminal (9) as shown below, and then re-tighten the screw (3f).

Note) Tighten within the tightening torque of 0.5N·m±15%.

Note: a) Wiring is possible with a bare lead wire. In this case, loosen the screw with washer (3f) and place a lead wire (3d) into the bracket, and then re-tighten the screw.

- b) Maximum size of crimped terminal (9) is up to 1.25mm²-3.5 for O type terminal, and up to 1.25mm²-4 for Y type terminal.
 - c) For cable (8), use cables with external diameters of φ6 to φ12mm
- Note) For cables with external diameters between φ9 to φ12mm, remove the inside parts of the rubber seal (7) before using.



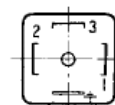
3. Assembly

- 1) Re-insert terminal block (3) into cover (4).
(Push it down until you hear a click sound.)
- 2) Ensure rubber seal (7) and plain washer (6) are on the cable in this order and insert them into the entry in the cover (4), then tighten the cable gland (5) securely.
- 3) Insert gasket (2a) or (2b) between the bottom part of the terminal block (3) and the plug on the equipment, screw in screw (1) from the top of the cover (4) and tighten it.
Note 1) Tighten within the tightening torque of 0.5N·m±20%.
Note 2) The orientation of the connector can be changed by 90° increments, by attaching the cover (4) in the desired direction to the terminal block (3).

DIN Terminal (Connection)

⚠ Caution

The solenoid is wired with male terminals of DIN connector as shown below. Connect with corresponding terminals of the connector.

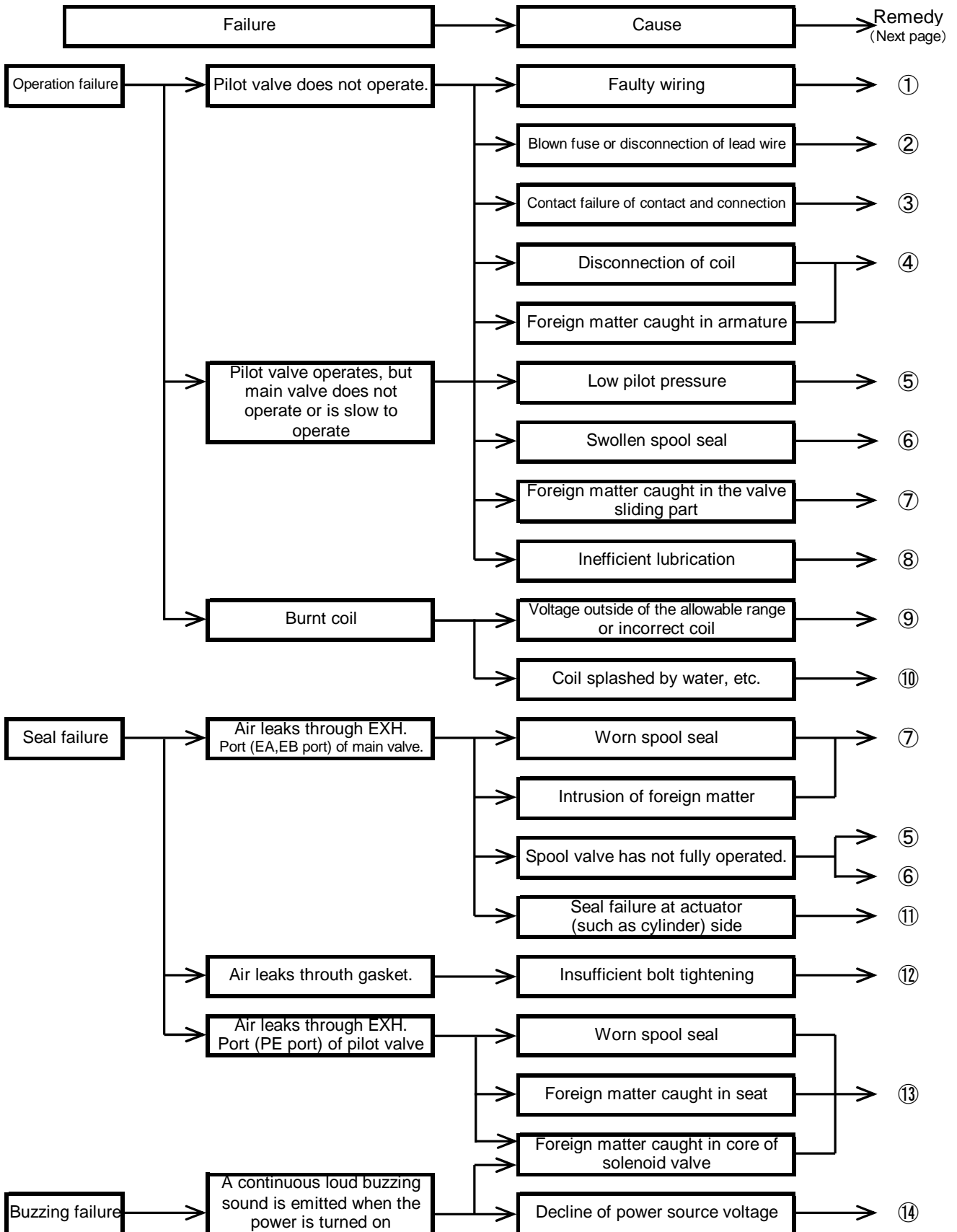


Terminal	Polarity
1	A side
2	B side
3	COM

Can be used as either "+ COM" or "- COM".

Trouble shooting

Check the cause of the failure starting from the cause which seems most likely, and implement countermeasures.



Remedy

No.	Remedy
①	Connect the wires again correctly.
②	Replace the part.
③	Replace the part or connect wires securely.
④	Replace pilot valve assembly.
⑤	Adjust pressure so that pilot pressure is within operating pressure range during operation.
⑥	- If the lubrication oil was incorrect, remove the oil by air blow and replace the valve. Lubricate with turbine oil class 1 (ISO VG32) after replacing the valve. - When a large amount of moisture is generated and cannot be removed, install either an auto-drain or a dryer, and replace the valve.
⑦	To remove foreign matter, clean the pipe by air blow. Replace valve.
⑧	If lubricating oil has not been supplied, supply it. If a lubricator is installed, check it for oil level and whether it is dropping oil properly.
⑨	Check voltage. Replace pilot valve assembly.
⑩	Protect the valve so that water does not splash the coil. Replace valve. Replace pilot valve assembly.
⑪	Fix or replace the actuator.
⑫	Isolate the valve and re-tighten the bolts.
⑬	Replace pilot valve assembly.
⑭	Regulate voltage so that the voltage when operating is within the specified range.

If no improvement is achieved even when these countermeasures are implemented, the inside of the valve may be damaged. In this case, stop using the valve immediately.

If any of the following actions have been carried out, the inside of the valve may be damaged. In this case, stop using the valve immediately.

1. Valve has been lubricated with a type of oil other than the specified type.
2. Lubrication has been stopped, or temporarily suspended.
3. The product has been directly exposed to water.
4. The product has been subjected to strong impact.
5. Foreign matter such as moisture or particles have entered the valve.
6. The valve has been used in a way prohibited in the "Precautions" section in this operation manual.

* Please return the failed valve to SMC in the exact state when the failure occurred.

Revision history		
A	Renewal	PX
B	Renewal	Uy

1st printing: CV

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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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