



Operation Manual

Solenoid Valve

PRODUCT NAME

SV Series

MODEL / Series / Product Number

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 regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.



SV Series

5 Port Solenoid Valve / Precautions 1

Be sure to read before handling.

Design / Selection

Warning

1. Confirm the specifications.

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 stops

For 3-position closed center, it is difficult to make a piston stop at the required position accurately due to the compressibility of air.

Furthermore, since valves and actuators 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 malfunction by using it with an individual EXH spacer assembly, a back pressure check valve or an individual exhaust manifold.

5. Holding pressure (including vacuum)

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

6. Not suitable for use as an emergency shutoff valve, etc.

The valves listed in this manual 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. Operation in a vacuum condition

When a valve is used for switching a vacuum, take measures to install a suction filter or similar to prevent external dust or other foreign matter from entering inside the valve.

In addition, at the time of vacuum adsorption, be sure to vacuum at all times. Failure to do so may result in foreign matter sticking to the adsorption pad, or air leakage causing the workpiece to drop.

9. Regarding a vacuum switch valve and a vacuum release valve

If a non-vacuum valve is installed in the middle of piping system having a vacuum, the vacuum condition will not be maintained. Use a valve designed for use under vacuum condition.

10. Double solenoid type

When using the double solenoid 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 operating the actuator.

11. Ventilation

Provide ventilation when using a valve in 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.

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

It may cause human injury and/or an accident.

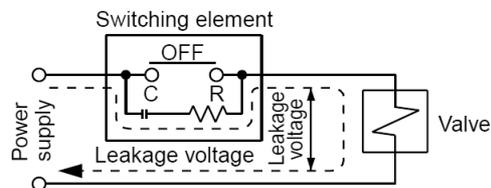
Caution

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 C-R circuit. The suppressor residual leakage voltage should be 3% or less of rated voltage.



3. 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 1V.



SV Series

5 Port Solenoid Valve / Precautions 2

Be sure to read before handling.

Design / Selection

Caution

4. 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).

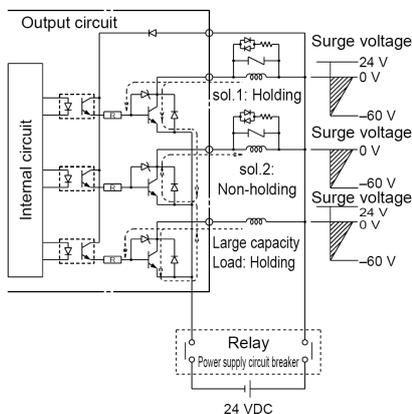


Figure 1. Surge intrusion circuit example (NPN outlet example)

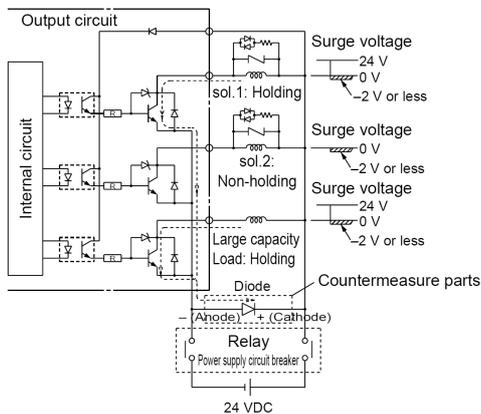


Figure 2. Surge intrusion circuit example (NPN outlet example)

5. Operation in a low temperature condition

It is possible to operate a valve in extreme temperature, as low as -10°C . Take appropriate measures to avoid freezing of drainage, moisture etc. in low temperature.

6. Operation for air blowing

When using solenoid valve for air blowing, use an external pilot type.

Use caution because the pressure drop caused by the air blowing can have an affect on the internal pilot type valve when the internal pilot type valves and external pilot type valves are used on the same manifold.

Additionally, when compressed air within the pressure range of the established specifications is supplied to the external pilot type valve's port, and a double solenoid valve is used for air blowing, the solenoids should normally be energized when air is being blown.

7. Mounting orientation

Mounting orientation is universal.

No specific orientation is necessary.

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 operate 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.



SV Series

5 Port Solenoid Valve / Precautions 3

Be sure to read before handling.

Piping

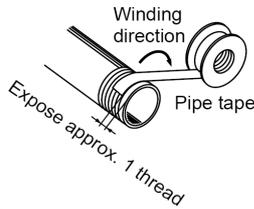
⚠ Caution

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 pipe tape is used, leave 1 thread ridge exposed at the end of the threads.



3. Using closed center

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

4. Connection of fittings

When screwing fitting into the valve, tighten it as follows.

1) When using SMC's fitting, follow the procedures below to tighten it.

- M5

After tightening the fitting by hand, use a wrench to tighten the fitting an additional approximately 1/6 to 1/4 turn. As a reference value, tightening torque is 1 to 1.5 N·m.

Note) If tightened excessively, the thread of the product may break or the gasket may deform. If tightened insufficiently, the thread of the product may become loose. In either case, air leakage can occur.

- When using a fitting other than SMC fitting, follow the instructions given by relevant fitting manufacturer.

2) When screwing the Rc thread or fitting, follow the procedures below to tighten it.

Tighten with the proper torque shown below.

Tightening torque for fitting

Connection thread	Proper tightening torque (N·m)
Rc1/8	7 to 9
Rc1/4	12 to 14
Rc3/8	22 to 24

5. Piping to products

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

Lubrication

⚠ Warning

Lubrication

1) All valves have been lubricated for life by the manufacturer and therefore, do not require lubrication while in service.

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

Once a lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

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

3) Please contact SMC for details about class 2 turbine oil (with additives) 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 cause 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 gases, etc., as it can cause damage or malfunction.

Wiring

⚠ Caution

1. 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.

2. Check the connections.

Check if the connections are correct after completing all wiring.



SV Series

5 Port Solenoid Valve / Precautions 4

Be sure to read before handling.

Air Supply

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 $5\ \mu\text{m}$ 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 powder 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.

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. Products with IP67 enclosures (based on IEC60529) are protected against dust and water, however, these products cannot be used in water.

3. Products compliant to IP67 satisfy the specifications through mounting. Be sure to read the Precautions for each product.

4. 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.

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

6. The valve should not be exposed to prolonged sunlight. Use a protective cover.

7. Remove any sources of excessive heat.

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

9. 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.

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, 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.

Caution

1. Drain flushing

Remove drainage from the air filters regularly. (Refer to the specifications.)



SV Series

Specific Product Precautions 1

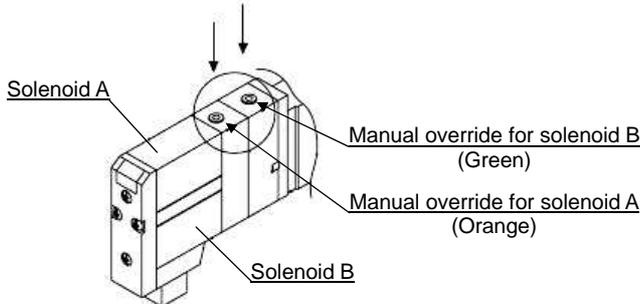
Be sure to read this before handling.

Manual Override Operation

⚠ Warning

Handle carefully, as connected equipment can be actuated through manual override operation.

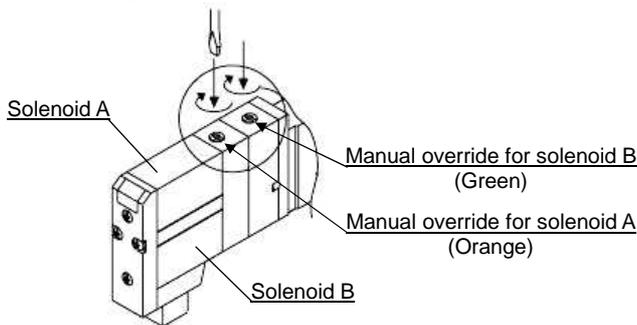
■ Non-locking push type



■ Push-turn locking slotted type

After pushing down, turn in the direction of the arrow.

If it not turned, it can be operated the same away as the non-locking type.



⚠ Caution

When locking the manual override with the push-turn locking slotted type, be sure to push it down before turning.

Turning without first pushing it down can cause damage to the manual override and other trouble such as air leakage, etc.

Exhaust Restriction

⚠ Caution

Since Series SV is a type in which the pilot valve exhaust joins the main valve exhaust inside the valve, use caution, so that the piping from the exhaust port is not restricted.

Series SV Used as a 3 Port Valve

⚠ Caution

In the case of using a 5 port valve (as a 3 port valve)

Series SV can be used as normally closed (N.C.) or normally open (N.O.) 3 port valves by closing one of the cylinder ports (A or B) with a plug. However, they should be used with the exhaust ports kept open. They are convenient at times when a double solenoid type 3 port valve is required.

Plug position		B port	A port
Actuation		N.C.	N.O.
Number of solenoids	Single		
	Double		

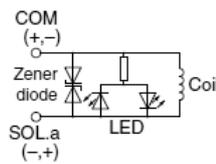
Light/Surge Voltage Suppressor

⚠ Caution

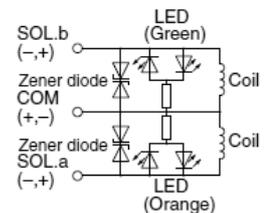
Solenoid valves have no polarity.

Light/Surge voltage Suppressor

Single solenoid

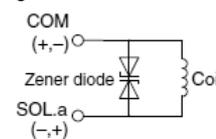


Double solenoid, 3 position type

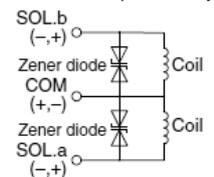


Surge voltage suppressor

Single solenoid



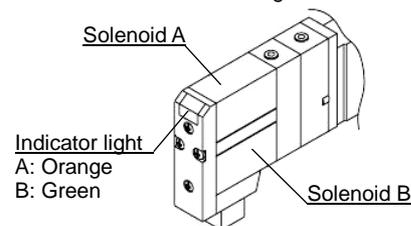
Double solenoid, 3 position type



Light Indication

⚠ Caution

When equipped with indicator light and surge voltage suppressor, the light window turns orange when solenoid A is energized, and it turns green when solenoid B is energized.





SV Series

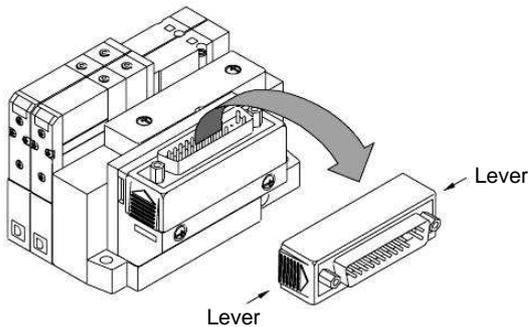
Specific Product Precautions 2

Be sure to read this before handling.

Connector Entry Directions

⚠ Caution

Connector entry directions for D-sub connectors and flat ribbon cables can be changed. To change the connector's entry direction, press the levers on both sides of the connector, take it off, and change the direction as shown in the drawing. Since lead wire assemblies are attached to the connector, excessive pulling or twisting can cause broken wires or other trouble. Also, take precautions so that lead wires are not caught and pinched when installing the connector.

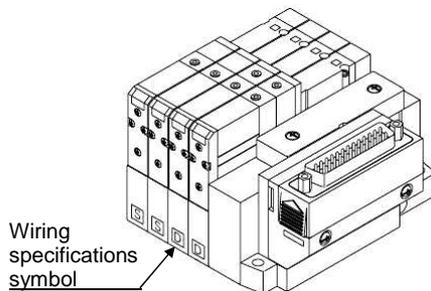


How to Order Manifold

⚠ Caution

The letter "S" or "D" is indicated on manifold blocks for series SV as shown below. This indication refers to the type of substrate assembly (single wiring or double wiring) inside the manifold blocks.

When the manifold specification sheet does not include a wiring specification, all stations will be double wiring specification (D). In this case, single and double solenoid valves can be mounted in any position, but when a single valve is used, there will be an unused control signal. To avoid this, indicate positions of manifold blocks for single wiring specification (S) and double wiring specification (D) on a manifold specification sheet. [Note that double, 3 or 4 position valves cannot be used for manifolds blocks with single wiring specification (S).]



Substrate Assemblies inside Manifolds

⚠ Caution

Substrate assemblies inside of manifolds cannot be taken apart. Attempting to do so may damage parts.

One-touch Fittings

⚠ Caution

Tube attachment/detachment for One-touch fittings

1. Attaching of tube

- 1) Take a tube having no flaws on its periphery and cut it off at a right angle. When cutting the tube, use tube cutters TK-1, 2 or 3. Do not use pinchers, nippers or scissors, etc. If cutting is done with tools other than tube cutters, there is the danger that the tube may be cut diagonally or become flattened, etc., making a secure installation impossible, and causing problems such as the tube pulling out after installation or air leakage. Also allow some extra length in the tube.
- 2) Grasp the tube and push it in slowly, inserting it securely all the way into the fitting.
- 3) After inserting the tube, pull on it lightly to confirm that it will not come out. If it is not installed securely all the way into the fitting, this can cause problems such as air leakage or the tube pulling out.

2. Detaching of tube

- 1) Push in the release button sufficiently, and push the collar evenly at the same time.
- 2) Pull out the tube while holding down the release button so that it does not come out. If the release button is not pressed down sufficiently, there will be increased bite on the tube and it will become more difficult to pull it out.
- 3) When the removed tube is to be used again, cut off the portion which has been chewed before reusing it. If the chewed portion of the tube is used as is, this can cause trouble such as air leakage or difficulty in removing the tube.

Other Tubing Brands

⚠ Caution

When using tube other than SMC brand, confirm that the following specifications are satisfied with respect to the outside diameter tolerance of the tube.

- | | |
|------------------------|---|
| 1) Nylon tubing | within $\pm 0.1\text{mm}$ |
| 2) Soft nylon tubing | within $\pm 0.1\text{mm}$ |
| 3) Polyurethane tubing | within $+0.15\text{mm}$
within -0.2mm |

Do not use tubing which does not meet these outside diameter tolerances. It may not be possible to connect them, or they may cause other trouble, such as air leakage or the tube pulling out after connection.

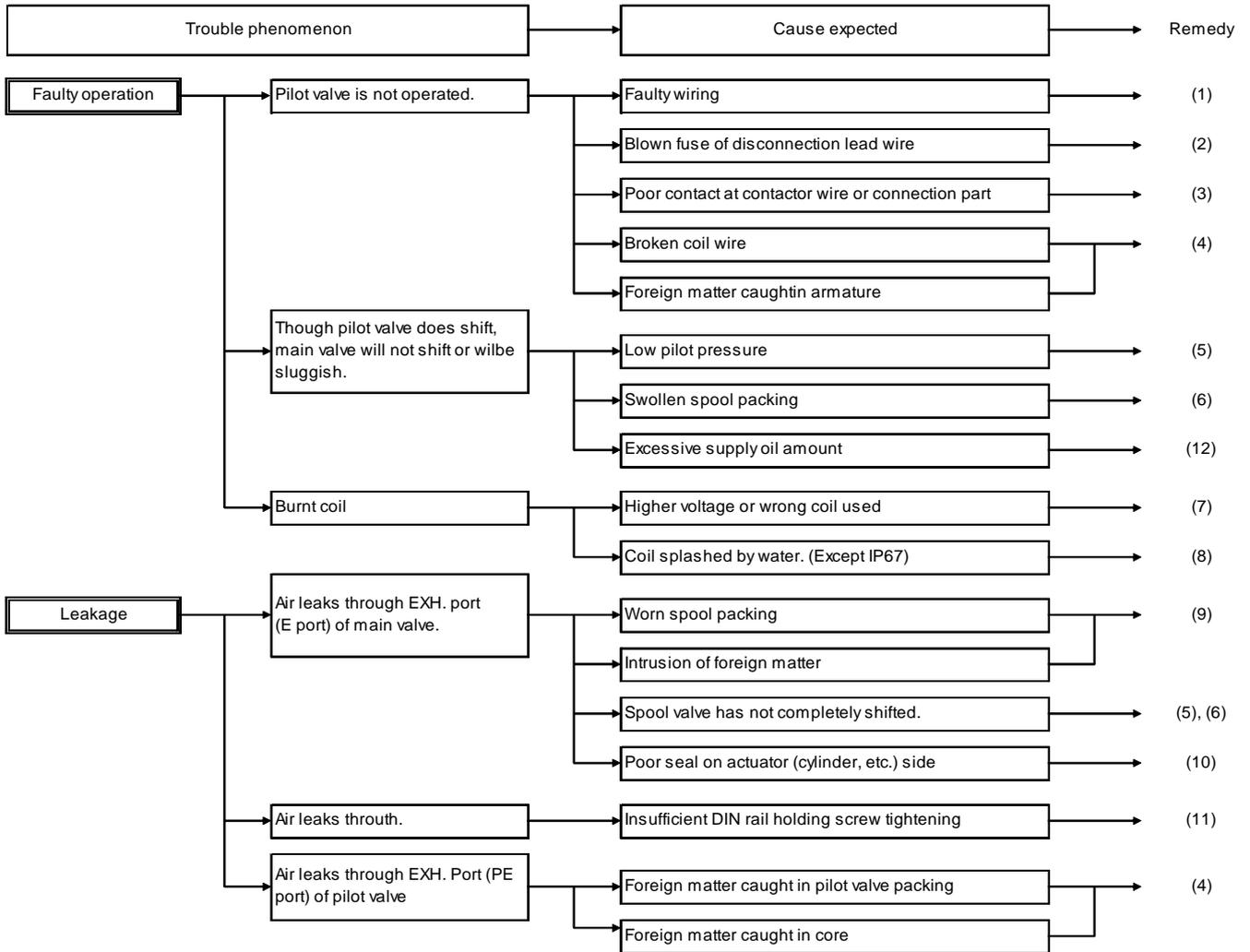
Back Pressure Check Valve Built-in Type

⚠ Caution

- 1) Valves with built-in back pressure check valve is to protect the back pressure inside a valve. For this reason, use caution the valves with external pilot specification cannot be pressurized from exhaust port [3/5(E)]. As compared with the types which do not integrate the back pressure check valve, C value of the flow characteristics goes down. For details, Please contact SMC.
- 2) Do not switch valves when A or B port is open to the atmosphere, or while the actuators and air operated equipment are in operation. The back pressure prevention seal may be peeled off, which may cause air leakage or malfunctions. Use caution especially when performing a trial operation or maintenance work.

TROUBLE SHOOTING

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)	Re-wire correctly.
(2)	Replace part.
(3)	Replace part or re-wire positively.
(4)	Replace valve.
(5)	Adjust pressure so that pilot pressure will fall within operating pressure range during operation.
(6)	- 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.
(7)	Check voltage. Replace pilot valve assembly.
(8)	Protect the valve so that water does not splash the coil. Replace pilot valve assembly.
(9)	To remove foreign matter, clean the pipe by air blow. Replace valve.
(10)	Repair or replace actuators.
(11)	Please stop the air, and please re-tighten the DIN rail holding screw with suppressing both ends of the manifold.
(12)	Lessen the oil supply amount to the degree that oil does not spout out of the exhaust port (E port).

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. Voltage out of rated voltage has been used.
2. Oil other than specified one has been lubricated.
3. Lubrication has been stopped intermediately, or lubrication was suspended temporary.
4. Water splashed directly. (Except IP67)
5. Strong impact was given.
6. Alien substance such as drain and particle got into. Drain or garbage invaded a valve.
7. 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	Safety Instructions	MW
B	Renewal	SU

A	Safety Instructions	MW
B	Renewal	SU

1st printing: FS

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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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