



3/4/5 Port Solenoid Valves

Precautions 1

Be sure to read this before handling.

Design / Selection

Warning

1. Confirm the specifications.

Products represented in this catalog 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 or double check valve 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.

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.

Also, since the SQ1000 4-position dual 3 port valves is 4 port valve specification (R1 and R2 are common), one back pressure check valve can be installed. As a result, back pressure from valves in other stations can be prevented, but back pressure inside this valve cannot be prevented.

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 catalog 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 or double check valve type, 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 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.

12. 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. This will likely adversely affect the performance of the solenoid valve and any nearby peripheral equipment. Therefore, when it is continuously energized or the energized period per day is longer than the de-energized period use either: SY series DC specification, SY series power-saving type, VQ series low power consumption specification, or other series continuous energization type. Also, please contact SMC because depending on the application, there may be additional valves not mentioned above that may be used (especially in DC specification). In addition, it is possible to shorten the energized time by making a valve with an N.O. (normally open) specification.
- 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. Do not touch the valves during or after energization. For example, the temperature will be high when a 3 station manifold or larger is put next to other valves and continuously energized or the long and continuous energization on both the A and B sides (simultaneous) of the SJ, SZ, SV, VQ, SQ series dual 3 port valves. Please contact SMC for the SY, VQ series AC specification.

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

It may cause human injury and/or an accident.



3/4/5 Port Solenoid Valves Precautions 2

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Design / Selection

Warning

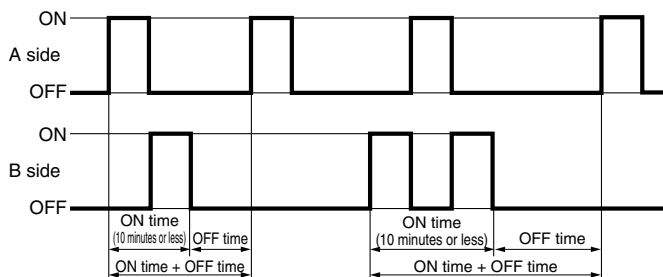
Latching Type [VQ/SQ series double (latching) type]

"The latching solenoid is equipped with a self-holding mechanism, which permits a movable iron core in the solenoid to hold the Set position or Reset position during momentary energization (20 ms or longer)," there is no need for continuous energization. Depending on conditions, continuous energization may cause a rise in the coil temperature resulting in malfunction.

<Special precaution to be taken with the latching type>

1. Do not continuously energize the latching type.

When it is necessary to energize it continuously, keep the energized period to 10 minutes or less, and then leave a deenergized period (on both the A side and B side) lasting longer than the energized period, before operating it again. The duty ratio should be 50% or less.



• Maximum ON time is 10 minutes.

• Duty ratio $\leq 50\%$ (Duty ratio = $\frac{\text{ON time}}{\text{ON time} + \text{OFF time}}$)

Example: When energization lasts for five minutes, it should be followed by five or more minutes of deenergization. Because the latching type has only one solenoid, both the A side and B side should be off for five minutes or more.

However, a minimum energization time of 20 msec is recommended.

[Ambient temperature]

The product should be installed in an environment with an ambient temperature of -10° to 50°C . Especially in environments with poor heat dissipation, such as installing in a panel, the heat of the coil can cause the ambient temperature to rise, so please exercise caution.

2. Use a circuit in which the Set and Reset signals will not be energized at the same time.
3. The minimum energization time for self-holding is 20 ms.
4. Even when there is no problem with normal operations and locations, please consult with SMC before using in locations with a vibration of 30 m/s^2 or more, or a strong magnetic field.
5. Even though this valve is held on to reset position (passage: A $\rightarrow$ R), it may switch to the Set position during transportation, or due to impact when mounting valves, etc. Therefore, check the initial position by means of power supply or manual override prior to use.

Latching	Passage	Indicator light
A-C ON (set)	P $\rightarrow$ A	Orange
B-C ON (reset)	A $\rightarrow$ R	Green

Single	Passage	Indicator light
A-C ON	P $\rightarrow$ A	Orange
OFF	A $\rightarrow$ R	—

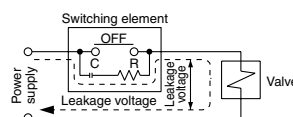
Caution

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 as follows.



DC coil

- SV, SY, SYJ, SX, SZ, SJ, VV061 (V060), VQZ, VF, VFR, VFS, VP7, VS7, VP300, VP500, VP700, VT307, VG342 } 3% or less of rated voltage
- VQ, VQC, VQD, VZ, VZS, VK, VT317, VT325, SQ } 2% or less of rated voltage
- VT301, VT315, VP31□5, VP4□50, VP4□70 } 5% or less of rated voltage

AC coil

- VK, VF, VFR, VFS, VP7, VS7, VT317, VP300, VP500, VP700 } 20% or less of rated voltage
- VZ, VZS, VT307, VG342, VT301, VT315, VT325, VP31□5, VT4□50, VP4□70 } 15% or less of rated voltage
- VQ } 12.5% or less of rated voltage
- SY, SYJ, VQZ } 8% 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.



3/4/5 Port Solenoid Valves Precautions 3

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Design / Selection

⚠ Caution

5. Surge voltage intrusion

Applicable series (non-polar type solenoid valves)

VQ100 and 3/4/5 port solenoid valves VQ(C), VQZ, VQD (2 W type) series

SY100, V100, and 3/4/5 port solenoid valves SY, SYJ, SX, SZ, SV, SJ series

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).

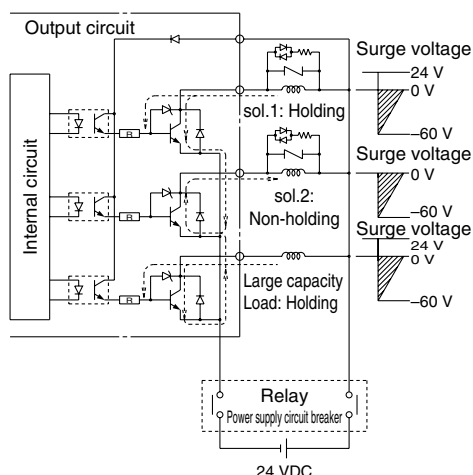


Figure 1. Surge intrusion circuit example (NPN outlet example)

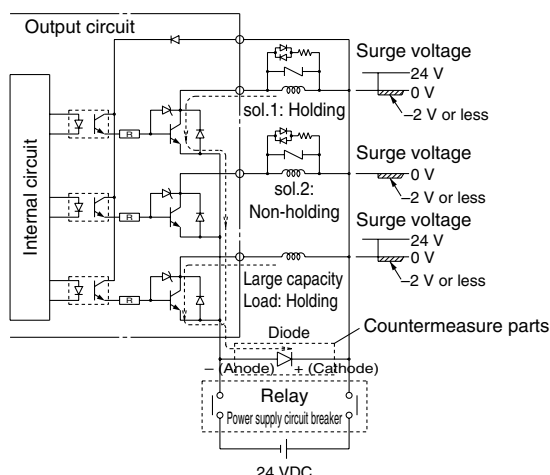


Figure 2. Surge intrusion circuit example (NPN outlet example)

6. Operation in a low temperature condition

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.

7. Operation for air blowing

When using a 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.

8. Mounting orientation

Rubber seal: Refer to the specifications of each series.

Please consult with SMC for models not indicated in the specification column.

Metal seal: Mounting orientation of a single solenoid is universal.

No specific orientation is necessary. When installing a double solenoid or a 3-position configuration, mount the valve so that spool valve is horizontal.

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.



3/4/5 Port Solenoid Valves

Precautions 4

Be sure to read this before handling.

Piping

⚠ Caution

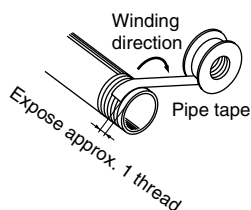
1. Refer to the Fittings and Tubing Precautions (Best Pneumatics No. 6) for handling one-touch fittings.

2. 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.

3. 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.



4. Closed center and double check valve types

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

5. Connection of fittings

When screwing fittings into valves, tighten as follows.

(1) Follow the procedures below when installing an SMC fitting, etc.

1) M3

After tightening the fitting by hand, use a wrench to tighten the fitting an additional approximately 1/4 turn. As a reference value, tightening torque is 0.4 to 0.5 N·m.

2) M5, M6, 10-32UNF

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.

(2) Follow the procedure of the manufacturer when fittings other than SMC are used.

3) Rc

Tighten with the proper torque shown below.

Tightening Torque for Piping

Connection thread	Proper tightening torque (N·m)
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38
Rc 1 1/4	40 to 42
Rc 1 1/2	48 to 50
Rc 2	48 to 50

6. Piping to products

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

Wiring

⚠ Caution

1. Polarity

When connecting power to a solenoid valve with a DC specification and equipped with a light or surge voltage suppressor, check for polarity.

If there is polarity, take note of the following.

No diode to protect polarity:

If a mistake is made regarding the polarity, damage may occur to the diode in the valve, the switching element in a control device or power supply equipment, etc.

With diode to protect polarity:

If polarity connection is wrong, the valve does not operate.

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.

Lubrication

⚠ Warning

1. Lubrication

[Rubber seal]

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

Valves to be lubricated

VP4□50, VP4□70, VP31□5, VPA4□50, VPA4□70, VPA31□5

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.

[Metal seal]

1) These valves can be used without lubrication.

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

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

Class 1 Turbine Oil (with no additive), ISO VG32

Lubricant manufacturer	Class 1 turbine oil (with no additive), ISO VG32
Idemitsu Kosan Co., Ltd.	Diana Fresia S32
Nippon Oil Corp.	Turbine Oil 32
Cosmo Oil Co., Ltd.	Cosmo Turbine 32
Japan Energy Corp.	Turbine 32
Kygnus Oil Co.	Turbine Oil 32
Fuji Kosan Co., Ltd.	Fucoal Turbine 32

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



3/4/5 Port Solenoid Valves

Precautions 5

Be sure to read this before handling.

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. This may 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.

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 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.

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 IP65 and IP67 enclosures (based on IEC60529) are protected against dust and water, however, these products cannot be used in water.

3. Products compliant to IP65 and IP67 satisfy the specifications through mounting. Be sure to read the Precautions for each product.

Operating Environment

Warning

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 or double check valve 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.

Caution

1. Drain flushing

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

2. Lubrication

In the case of rubber seals, once lubrication has been started, it must be continued.

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