



Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO 4414 ^{Note 1)}, JIS B 8370 ^{Note 2)} and other safety practices.

⚠ Caution : Operator error could result in injury or equipment damage.

⚠ Warning : Operator error could result in serious injury or loss of life.

⚠ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power--General rules relating to systems.

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

⚠ Warning

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driver objects have been confirmed.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc.

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



2/3 Port Process Valve Precautions 1

Be sure to read before handling.

For detailed precautions on every series, refer to main text.

Caution on Design

⚠ Warning

- 1. Cannot be used as an emergency shutoff valve, etc.**
The valves presented in this catalog are not designed for safety applications such as an emergency shutoff valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.
- 2. Extended periods of continuous energization**
Please consult with SMC if valves will be continuously energized for extended periods of time.
- 3. Solenoid valves are not allowed to use as an explosion proof one.**
- 4. Maintenance space**
The installation should allow sufficient space for maintenance activities (removal of valve, etc.).
- 5. Liquid rings**
In cases with a flowing liquid, provide a by-pass valve in the system to prevent the liquid from entering the liquid seal circuit.
- 6. Operation of actuator**
When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures to prevent potential danger caused by actuator operation.
- 7. Holding pressure (including vacuum)**
Since the valve may have slight internal air leakage, it may not be suitable for holding pressure (including vacuum) in a tank or other vessel for an extended period of time.
- 8. When the conduit type is used as equivalent to an IP65 enclosure, install a wiring conduit, etc. (Series VC)**
For details, refer to page 17-6-7.

Selection

⚠ Warning

- 1. Check the specifications.**
Give careful consideration to operating conditions such as the application, fluid and environment, and use within the operating ranges specified in this catalog.
- 2. Operating fluids**
 - 1) Type of operating fluids
Select model according to the operating fluid for its material. Viscosity of the operating fluids must be less than 50 cst in general.
Please contact SMC for further information.
 - 2) Flammable oil or gases
Confirm the specifications for the internal/external leakage.
 - 3) Corrosive gases
Since corrosive gases may cause stress corrosion, cracking or other accidents, it is not applicable for valves in this catalog.
 - 4) Use a Non-lube valve when impurities such as oil should not be in the fluid passage.
 - 5) Option and fluids may not be usable on the operating conditions. General use of option and fluids are shown in the catalog to be referred for model selection.

Selection

⚠ Warning

- 3. Quality of operating fluids**
Since the use of fluid which contains foreign matter can cause problems such as malfunction and seal failure by promoting wear of the valve seat and core, and by sticking to the sliding parts of the armature, etc., install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 80 to 100 mesh.
When used to supply water to boilers, substances such as calcium and magnesium which generate hard scale and sludge are included. Since this scale and sludge can cause valve malfunction, install water softening equipment, and a filter (strainer) directly upstream from the valve to remove these substances.
- 4. Quality of operating air**
 - 1) **Use clean air.**
If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas, etc., it can lead to damage or malfunction.
 - 2) **Install an air filter.**
Install an air filter at the up stream side to the valve. Filtration degree should be 5 μm or less.
 - 3) **Install an air dryer, after cooler, etc.**
Compressed air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer or after cooler, etc.
 - 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 valves and cause malfunction. For compressed air quality, refer to "Air Cleaning Equipment" catalog.
- 5. Ambient environment**
Operate within the ambient operating temperature range. After confirming the compatibility of the product's component materials with the ambient environment, operate so that fluid does not adhere to the product's exterior surfaces.
- 6. Countermeasures for static electricity**
Since static electricity may be generated depending on the fluid being used, implement suitable countermeasures.



2/3 Port Process Valve Precautions 2

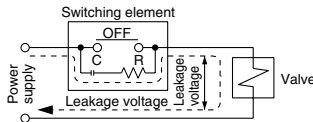
Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Selection

⚠ Caution

1. Leakage voltage

Particularly when using a resistor in parallel with a switching element and using a C-R element (surge voltage suppressor) to protect the switching element, take note that leakage current will flow through the resistor and C-R element, etc., creating a danger that the valve may not shut OFF.



Series VC, VD, VQ

AC coil: 10% or less of rated voltage
DC coil: 2% or less of rated voltage

Series VX

AC coil: 20% or less of rated voltage
DC coil: 2% or less of rated voltage

Series VN

AC coil: 15% or less of rated voltage
DC coil: 3% or less of rated voltage

2. Low temperature operation

- Valve use is possible to temperature extremes of -10°C . Take appropriate measures to avoid freezing of drainage, moisture etc. by using an air dryer.
- When using valves for water application in cold climates, take appropriate countermeasures to prevent the freezing in tubing after cutting the water supply from the pump, e.g. drain the water, etc. When heating by steam, be careful not to expose the coil portion to steam. Installation of dryer, heat retaining of the body are recommended to prevent the freezing in condition that dew-point temperature is high and ambient temperature is low.

Mounting

⚠ Warning

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

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

2. Do not apply external force to the coil section.

Apply spanner to the external connection part when tightening.

3. Avoid installing the coil downward.

Foreign materials in the fluid may stick to the armature and it could cause malfunction. (In the case of VX series)

4. Do not warm the coil assembly part by the heat insulating material, etc.

Tape heater for anti-freezing is applicable to use only for piping or body.

5. Other than fittings made of stainless steel or copper should be tightened with a bracket.

6. Do not use in locations subjected to vibrations. If impossible, arm from the body should be as short as possible to prevent resonance.

7. Instruction manual

Install only after reading and understanding the safety instructions. Keep the catalog on life so that it can be referred to when necessary.

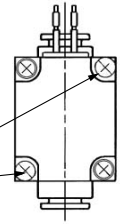
8. Coating

Warnings or specifications indicated on the product should not be erased, removed, or covered up.

Series VQ20/30

When mounting the valve, secure with brackets. When mounting it directly, tighten the mounting screws with the appropriate torque (0.2 to 0.23 N·m).

Mounting screw
Tightening torque 0.2 to 0.23 N·m



Port Direction

⚠ Caution

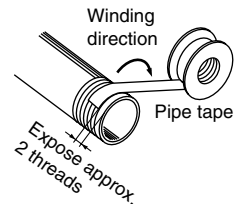
1. Preparation before piping

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.

Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.

2. Sealant tape

When installing piping or fitting into a port, ensure that sealant material does not enter the port internally. Furthermore, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



3. Avoid connection of ground lines to piping, as this may cause electric corrosion of the system.

4. Always tighten threads with the proper tightening torque.

When screwing fittings into valves, tighten with the proper tightening torque shown below.

Tightening Torque for Piping

Connection thread	Applicable tightening torque (N·m)
M5	1.5 to 2
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

* Reference

How to tighten M5 threads on the fittings

After tightening by hand, use a tightening tool to add about 1/6 turn more. But when using miniature fittings, after tightening by hand, use a tightening tool to add 1/4 turn more. (When there are gaskets for universal elbow, universal tee, etc. in 2 locations, tighten them with twice as 1/2 turn.)

5. Connection of piping to products

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

6. Steam generated in a boiler contains a large amount of drainage.

Be sure to operate with a drain trap installed.

7. In applications such as vacuum and non-leak specifications, use caution specifically against the contamination of foreign matters or airtightness of the fittings.



2/3 Port Process Valve Precautions 3

Be sure to read before handling.

For detailed precautions on every series, refer to main text.

Port Direction

⚠ Caution

Series LV

1. Use the tightening torques shown below when making connections to the pilot port.

Operating Port Tightening Torque

Operating port	Torque (N·m)
M5	1/6 turn with a tightening tool after first tightening by hand 0.8 to 1.0
Rc, NPT 1/8	0.8 to 1.0

2. Use of metal fittings

Do not use metal fittings for piping on taper threads made of resin, as this may cause damage to the threads.

3. Use pilot ports and sensor (breathing) ports as indicated below.

	PA Port	PB port	Sensor (breathing) port
N.C.	Pressure	Exhaust	Exhaust
N.O.	Exhaust	Pressure	Exhaust
Double acting	Pressure	Pressure	Exhaust

In the case of N.C. and N.O. types, the port which does not receive operating pressure is released to atmosphere. When intake and exhaust directly from the valve is not desired due to problems with the ambient environment or scattering of dust, etc., install piping and perform intake and exhaust at a location which does not present a problem.

4. For tubing connections, refer to pages 17-5-38 to 39.

Wiring

⚠ Caution

1. Use electrical wires for piping with more than 0.5 to 1.25 mm².
Further, do not allow excessive force to be applied to the lines.
2. Use electrical circuits which do not generate chattering in their contacts.
3. Use voltage which is within 10% of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within 5% of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
4. When electrical circuit is not acceptable for surge voltage generated by solenoid, install a surge absorber in parallel to the solenoid or use a optional type with surge killer.
(VCB, VCL: Class H coil, Series VCS, VDW, VX, VQ)
5. Series VX, VQ
Use the option with surge voltage suppressor, with surge voltage protection circuit.

Electrical Connections

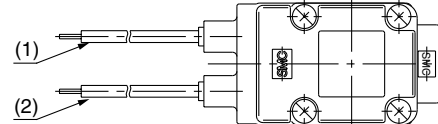
⚠ Caution

Series VC

Grommet

Class H coil: AWG18

Class B coil: AWG20



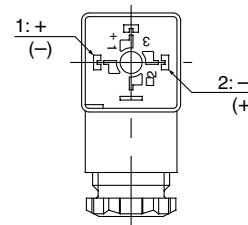
Rated voltage	Lead wire color	
	(1)	(2)
DC (Type B only)	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

* There is no polarity.

Series VC, VX

DIN terminal (Class B only)

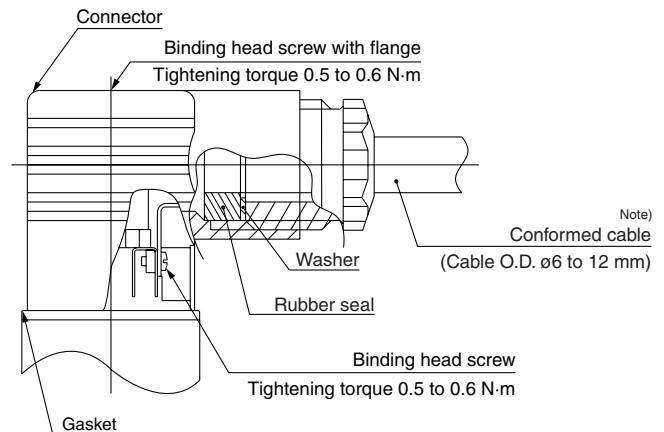
The figure below shows the internal connection of DIN terminal, so connect DIN terminals with power supply.



Terminal no.	1	2
DIN terminal	+ (-)	- (+)

* There is no polarity.

- Heavy-duty cord can be used up to the cable O.D. ø6 to 12.
- Use the tightening torques below for each section.



Note) For the one with outside diameter of the cable ø9 to 12 mm, remove the internal parts of the rubber seal before using.



2/3 Port Process Valve Precautions 4

Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Electrical Connections

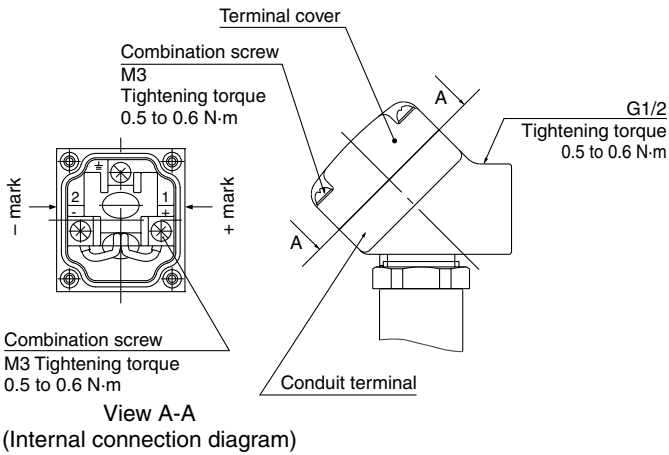
Warning

Series VC, VX

Conduit terminal

In the case of the conduit terminal, make connections according to the marks shown below.

- Use the tightening torques below for each section.
- Properly seal the terminal connection (G 1/2) with the special wiring conduit, etc.

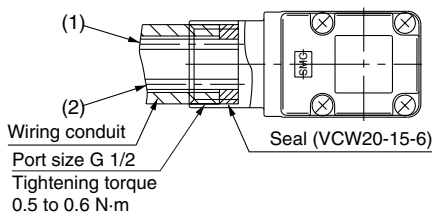


Series VC

Conduit

When used as an IP65 equivalent, use seal (Part no. VCW20-15-6) to install the wiring conduit. Also, use the tightening torque below for the conduit.

- Class H coil: AWG18
- Class B coil: AWG20



Rated voltage	Lead wire color	
	(1)	(2)
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

* There is no polarity.

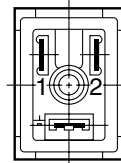
Description	Part no.
Seal	VCW20-15-6

Note) Please order separately.

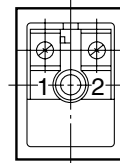
Series VN

The figures below show the internal connection of DIN terminal or terminal box, so connect them with power supply.

With DIN terminal box

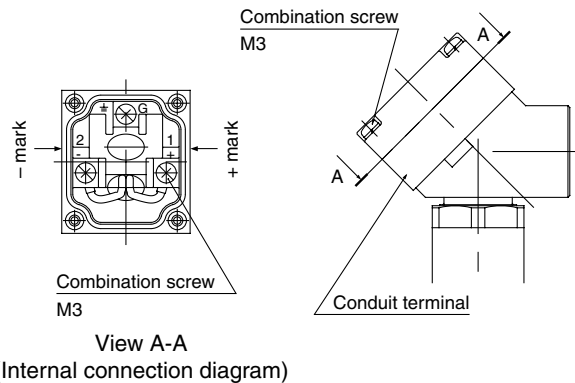


With terminal box



Terminal no.	1	2
DIN terminal	+	-
Terminal	+	-

Connect the conduit terminal according to the marks shown below.





2/3 Port Process Valve Precautions 5

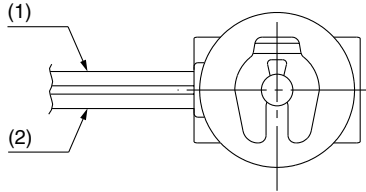
Be sure to read before handling.

For detailed precautions on every series, refer to main text.

Electrical Connections

⚠ Caution

Series VDW

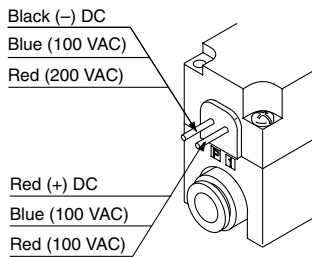


Rated voltage	Lead wire color	
	(1)	(2)
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

* There is no polarity.

Series VQ20/30

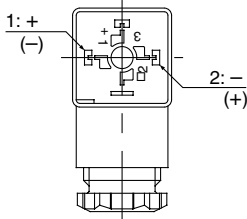
Grommet



* For energy-saving circuit, there is the polarity.

DIN terminal

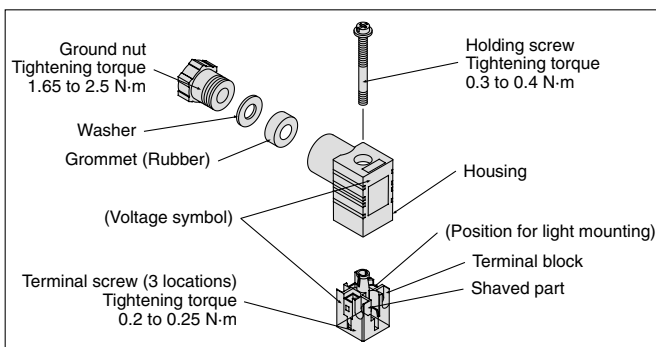
Since internal connections are as shown below for the DIN terminal, make connections to the power supply accordingly.



Terminal no.	1	2
DIN terminal	+	-

* For energy-saving circuit, there is the polarity.

Heavy-duty cord can be used up to the cable O.D. ϕ 3.5 to 7.



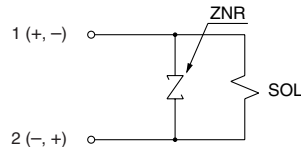
Electrical Circuit

⚠ Caution

Series VC (Class B coil)

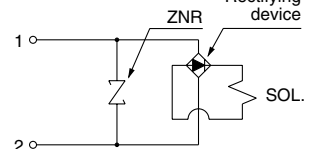
Grommet, Conduit, Conduit terminal, DIN connector

DC circuit



Without indicator light

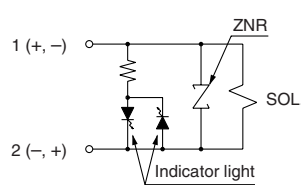
AC circuit



Without indicator light

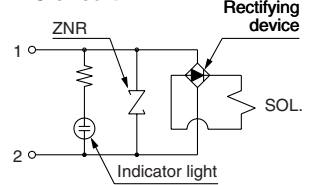
Conduit terminal, DIN terminal

DC circuit



With indicator light

AC circuit

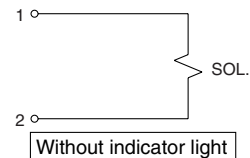


With indicator light

Series VC (Class H coil)

Grommet, Conduit, Conduit terminal

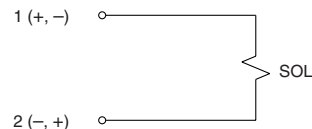
AC circuit



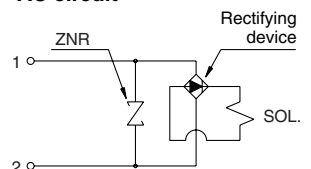
Without indicator light

Series VDW

DC circuit



AC circuit





2/3 Port Process Valve Precautions 6

Be sure to read before handling.

For detailed precautions on every series, refer to main text.

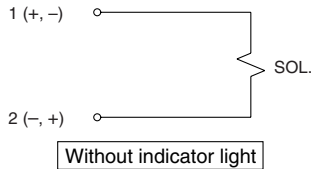
Electrical Circuit

Caution

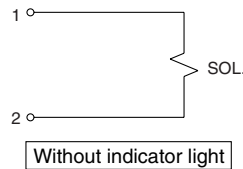
Series VX

Grommet, Conduit, Conduit terminal, DIN connector

DC circuit

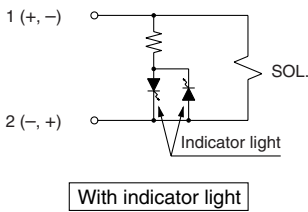


AC circuit

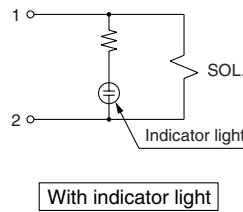


Conduit terminal, DIN terminal

DC circuit



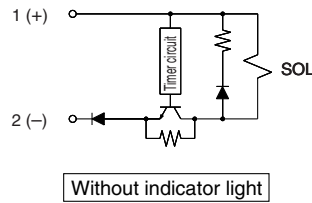
AC circuit



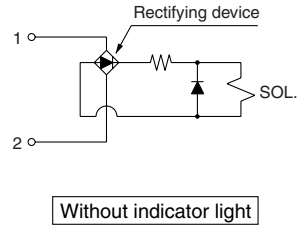
Series VQ20/30

Grommet, DIN terminal

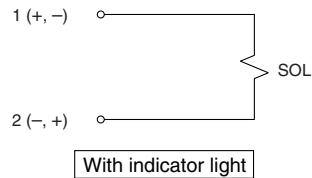
DC voltage
(With energy-saving circuit)



AC circuit

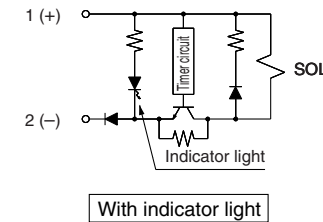


DC circuit

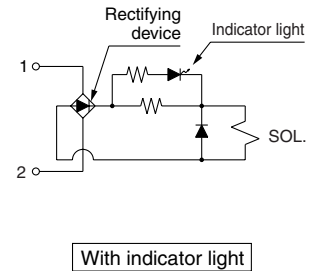


Grommet

DC voltage
(With energy-saving circuit)

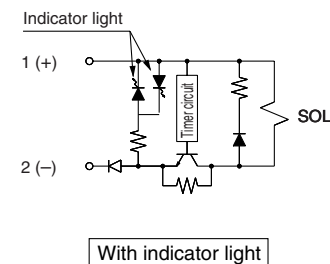


AC circuit

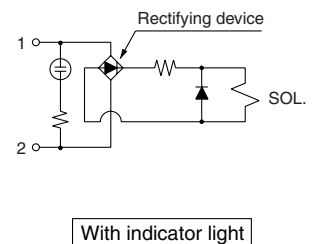


DIN terminal

DC voltage
(With energy-saving circuit)



AC circuit





2/3 Port Process Valve Precautions 7

Be sure to read before handling.
For detailed precautions on every series, refer to main text.

Operating Environment

⚠ Warning

1. Do not use valves in atmospheres of corrosive gases, chemicals, salt water, water or steam, or where there is direct contact with same.
2. Do not use in explosive atmospheres.
3. Do not use in locations where vibration or impact occurs.
4. Do not use in locations subject to emissive heat.
5. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

Lubrication

⚠ Caution

1. The valve has been lubricated for life at manufacture, and does not require lubrication in service.

If a lubricant is used in the system, use turbine oil Class 1, ISO VG32 (no additive). But do not lubricate the valve with EPB seal.

Refer to the below brand name table of lubricants compliant to Class 1 turbine oil (without additive), ISO VG32.

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

Classification of viscosity (cst) (40°C)	Viscosity according to ISO Grade	32
Idemitsu Kosan Co.,Ltd.	Turbine oil P-32	
Nippon Mitsubishi Oil Corp.	Turbine oil 32	
Cosmo Oil Co.,Ltd.	Cosmo turbine 32	
Japan Energy Corp.	Kyodo turbine 32	
Kygnus Oil Co.	Turbine oil 32	
Kyushu Oil Co.	Stork turbine 32	
NIPPON OIL CORPORATION	Mitsubishi turbine 32	
Showa Shell Sekiyu K.K.	Turbine 32	
Tonen General Sekiyu K.K.	General R turbine 32	
Fuji Kosan Co.,Ltd.	Fucoal turbine 32	

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

Maintenance and Inspection

⚠ Warning

1. Removing the product

The valve will reach high temperatures from high temperature fluids such as steam. Confirm that the valve has cooled sufficiently before performing work. If touched inadvertently, there is a danger of being burned.

- 1) Shut off the fluid supply and release the fluid pressure in the system.
- 2) In the case of air pilot or air-operated type, shut off the supply air source and discharge the compressed air inside a pilot piping.
- 3) Shut off the power supply.
- 4) Remove the product.

2. Remove any remaining chemicals and carefully replace them with pure water or air, etc., before beginning work activities. (Series LV)

3. Low frequency operation

In order to prevent malfunction, conduct a switching operation of a valve every 30 days. Also, in order to use it under the optimum state, conduct a regular inspection once a half year.

4. Manual override

When the manual override is operated, connected equipment will be actuated.

Operate after safety is confirmed.

5. Do not disassemble the product. Products which have been disassembled cannot be guaranteed.

If disassembly is necessary, please contact SMC.

Maintenance and Inspection

⚠ Caution

1. Filters and strainers

- 1) Be careful regarding clogging of filters and strainers.
- 2) Replace filters after one year of use, or earlier if the amount of pressure drop reaches 0.1 MPa.
- 3) Clean the strainer when pressure drop exceeds 0.1 MPa.

2. Lubrication

If operated with lubrication, be sure to continue the lubrication.

3. How to store for a long period of time

Remove water completely from valves before storing for a long period of time to avoid the dust generation and damage to the rubber material.

4. Flush drainage from filters regularly.

Precautions on Handling

⚠ Warning

1. Valves will reach high temperatures from high temperature fluids. Use caution, as there is a danger of being burned if a valve is touched directly.

⚠ Caution

Series LV

1. When the diaphragm is made of PTFE

Please note that when the product is shipped from the factory, gases such as N₂ and air may leak from the valve at a rate of 1 cm³/min (when pressurized).

2. When operated at a very low flow rate, the series LV□ with flow rate adjustment may vibrate, etc. depending on the operating conditions. Therefore, operate it after careful examination of the flow rate, pressure and piping conditions.

3. In the series LV□, water hammering may occur depending on the fluid pressure conditions. In most cases, improvement is possible by adjusting the pilot pressure with a speed controller, etc., but the flow rate, pressure and piping conditions should be reviewed.

4. To adjust the flow rate for the series LV□ with flow rate adjustment, open gradually starting from the fully closed condition.

Opening is accomplished by turning the adjustment knob counterclockwise. It is in the fully closed condition when the product is shipped from the factory.

5. After a long period of nonuse, perform a test run before beginning regular operation.

6. Since the LVC is packaged in a clean room use sufficient care in handling when opened.