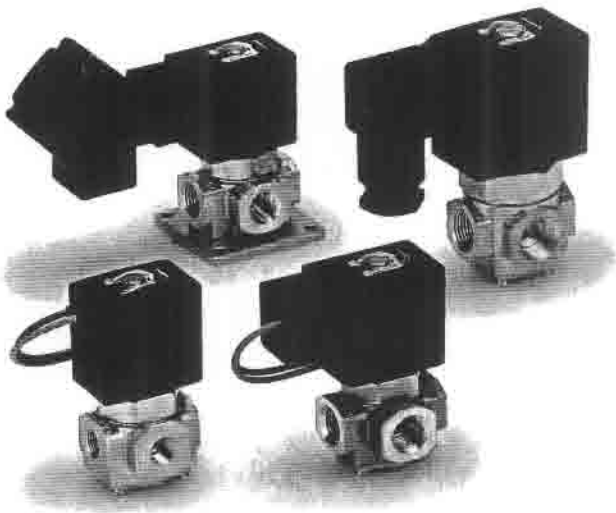


Pilot 3-port Solenoid Valve

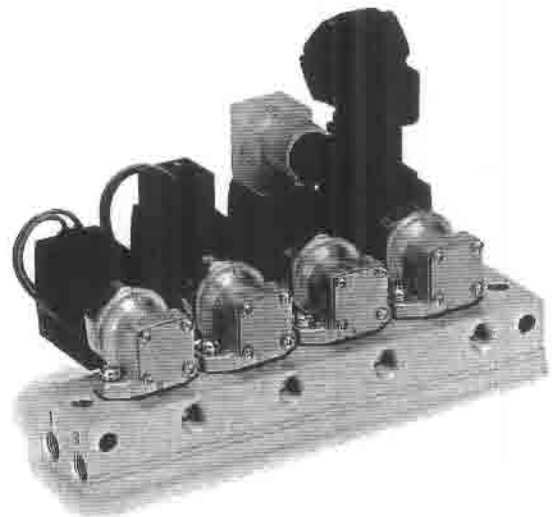
Series VX31/32/33

Operation Manual



Single unit

Manifold



Registration No.		VX31N** - OMJ0002		
Symb	Part	Revision	Data	YMO

Contents

○ Contents	_____	P.1
○ Safety Instructions	_____	P.3
○ Flow characteristics	_____	P.9
○ Specifications	_____	P.17
○ Model Selection	_____	P.24
○ Troubleshooting	_____	P.36

Direct Operated 3 Port Solenoid Valve

Series VX31/32/33

For Water, Oil, Steam, Air



Single Unit

Valve

Normally closed (N.C.)
Normally open (N.O.)
Common (COM.)

Solenoid Coil

Coil: Class B, Class H

Rated Voltage

100 VAC, 200 VAC, 110 VAC,
220 VAC, 240 VAC, 230 VAC,
48 VAC, 24 VDC, 12 VDC

Material

Body — Brass (C37), Stainless steel
Seal — NBR, FKM, EPDM, PTFE, FFKM

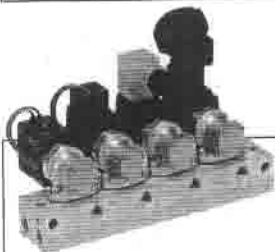
Electrical Entry

- Grommet
- Conduit
- DIN terminal
- Conduit terminal



Normally Closed (N.C.) / Normally Open (N.O.) / Common (COM.)

Model	VX31	VX32	VX33
Orifice size			
1.5 mmø	●	—	—
2.2 mmø	●	●	●
3 mmø	●	●	●
4 mmø	—	●	●
Port size	1/8, 1/4	1/4, 3/8	1/4, 3/8



Manifold

Valve

Normally closed (N.C.)
Normally open (N.O.)
Common (COM.)

Base

Common SUP/EXH type

Solenoid Coil

Coil: Class B, Class H

Rated Voltage

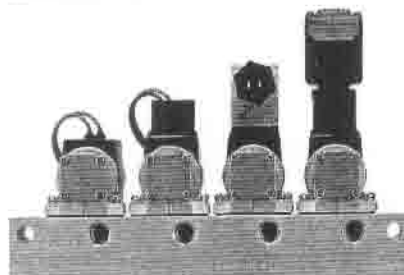
100 VAC, 200 VAC, 110 VAC,
220 VAC, 240 VAC, 230 VAC,
48 VAC, 24 VDC, 12 VDC

Material

Body — Brass (C37)
Base — Aluminum
Seal — NBR, FKM, EPDM

Electrical Entry

- Grommet
- Conduit
- DIN terminal
- Conduit terminal



Normally Closed (N.C.) / Normally Open (N.O.) / Common (COM.)


Model	VX31	VX32	VX33
Orifice size			
1.5 mmø	●	—	—
2.2 mmø	●	●	●
3 mmø	●	●	●
4 mmø	—	●	●
(Common SUP/EXH type) Port size	IN port	1/4	
	OUT port	1/8, 1/4	
	EXH port	1/4	




Series VX

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 the 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 post analysis and/or tests to meet your specific requirements. The expected performance and safety assurance are 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 handled incorrectly. 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 driven objects have been confirmed.
2. When equipment is removed, confirm that safety process as mentioned above. Turn off 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 quick extension of a cylinder piston rod, etc.

4. Contact SMC if the product will 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.



3 Port Solenoid Valve for Fluid Control/Precautions 1

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

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

The solenoid coil will generate heat when continuously energized. Avoid using in a tightly shut container. Install it in a well-ventilated area. Furthermore, do not touch it while it is being energized or right after it is energized.

3. This solenoid valve cannot be used for explosion proof applications.

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 bypass valve in the system to prevent the liquid from entering the liquid seal circuit.

6. Actuator drive

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. Pressure (including vacuum) holding

It is not usable for an application such as holding the pressure (including vacuum) inside of a pressure vessel because air leakage is entailed in a valve.

8. When the conduit type is used as equivalent to an IP65 enclosure, install a wiring conduit, etc.

9. When an impact, such as water hammer, etc., caused by the rapid pressure fluctuation is applied, the solenoid valve may be damaged. Give an attention to it.

Selection

⚠ Warning

1. Confirm the specifications.

Give careful consideration to the operating conditions such as the application, fluid and environment, and use within the operating ranges specified in this catalog.

2. Fluid

1) Type of fluid

Before using a fluid, confirm whether it is compatible with the materials from each model by referring to the fluids listed in this catalog. Use a fluid with a dynamic viscosity of 50 mm²/s or less. If there is something you do not know, please contact us.

2) Inflammable oil, Gas,

Confirm the specification for leakage in the interior and/or exterior area.

Selection

⚠ Warning

3) Corrosive gas

Cannot be used since it will lead to cracks by stress corrosion or result in other incidents.

4) Use an oil-free specification when any oily particle must not enter the passage.

5) Applicable fluid on the list may not be used depending on the operating condition. Give adequate confirmation, and then determine a model, just because the compatibility list shows the general case.

3. Fluid quality

The use of a fluid which contains foreign matter can cause problems such as malfunction and seal failure by promoting wear of the valve seat and armature, 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 the valve to malfunction, install water softening equipment, and a filter (strainer) directly upstream from the valve to remove these substances.

4. Air quality

1) Use clean air.

Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

2) Install air filters.

Install air filters close to valves at their upstream side. A filtration degree of 5µm or less should be selected.

3) Install an air dryer or 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 generated, eliminate it by installing mist separators at the upstream side of valves.

If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

Refer to SMC's Best Pneumatics catalog vol. 14 for further details on compressed air quality.

5. Ambient environment

Use within the operable ambient temperature range. Confirm the compatibility between the product's composition materials and the ambient atmosphere. Be sure that the fluid used does not touch the external surface of the product.

6. Countermeasures against static electricity

Take measures to prevent static electricity since some fluids can cause static electricity.

7. For the low particle generation specification, confirm us separately.



3 Port Solenoid Valve for Fluid Control/Precautions 2

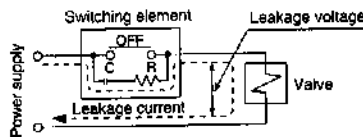
Be sure to read this before handling.
For detailed precautions on each series, refer to the main text.

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, C-R element, etc., creating a possible danger that the valve may not turn off.



AC/Class B coil: 5% or less of rated voltage
AC/Class H coil: 20% or less of rated voltage
DC coil: 2% or less of rated voltage

2. Low temperature operation

1. The valve can be used in an ambient temperature of between -10 to -20°C , however take measures to prevent freezing or solidification of impurities, etc.
2. When using valves for water application in cold climates, take appropriate countermeasures to prevent the water from freezing in tubing after cutting the water supply from the pump, by draining 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 is recommended to prevent a freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.

Mounting

⚠ Warning

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

After mounting is completed, confirm that it has been done correctly by performing a suitable function test.

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

When tightening is performed, apply a wrench or other tool to the outside of the piping connection parts.

3. Be sure not to position the coil downwards.

When mounting a valve with its coil positioned downwards, foreign objects in the fluid will adhere to the iron core leading to a malfunction.

4. Do not warm the coil assembly with a heat insulator, etc.

Use tape, heaters, etc., for freeze prevention on the piping and body only. They can cause the coil to burn out.

5. Secure with brackets, except in the case of steel piping and copper fittings.

6. Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.

7. Painting and coating

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

Piping

⚠ Caution

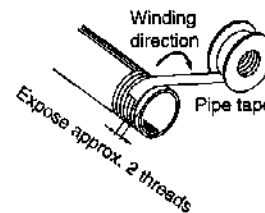
1. Preparation before piping

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 connecting pipes, fittings, etc., be sure that chips from the pipe threads and sealing material do not enter the valve.

Furthermore, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



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

4. Always tighten threads with the proper tightening torque.

When attaching fittings to valves, tighten with the proper tightening torque shown below.

Tightening Torque for Piping

Connection threads	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

5. Connection of piping to products

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

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

Be sure to operate it 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.



3 Port Solenoid Valve for Fluid Control/Precautions 3

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

Wiring

⚠ Caution

1. As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25mm² for wiring. Furthermore, 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 $\pm 10\%$ of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within $\pm 5\%$ of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
4. When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, adopt an option that comes with the surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with us.)

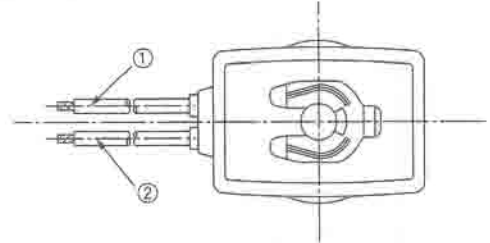
Electrical Connections

⚠ Caution

Grommet

Class H coil: AWG18 Insulator O.D. 2.2 mm

Class B coil: AWG20 Insulator O.D. 2.4 mm

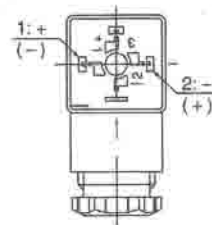


Rated voltage	Lead wire color	
	①	②
DC (Class B only)	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

* There is no polarity.

DIN connector (Class B only)

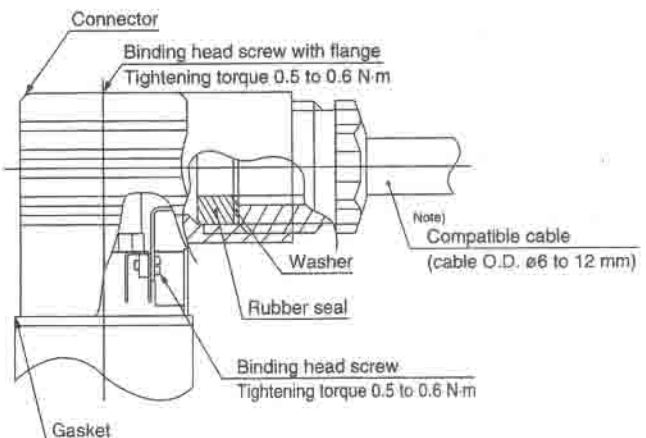
Since internal connections are as shown below for the DIN connector, make connections to the power supply accordingly.



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

* There is no polarity.

- Use compatible heavy duty cords with cable O.D. of $\phi 6$ to 12.
- Use the tightening torques below for each section.



Note) For an outside cable diameter of $\phi 9$ to 12 mm, remove the internal parts of the rubber seal before using.



3 Port Solenoid Valve for Fluid Control/Precautions 4

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

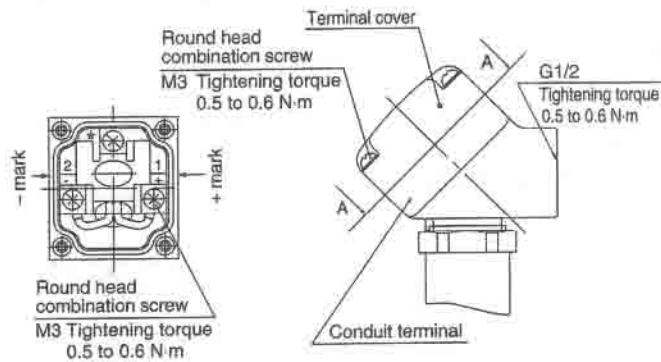
Electrical Connections

Caution

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 (G1/2) with the special wiring conduit, etc.

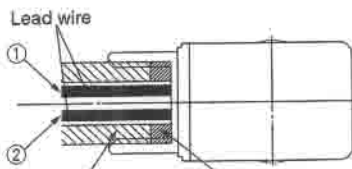


View A-A
(Internal connection diagram)

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 Insulator O.D. 2.2 mm
Class B coil: AWG20 Insulator O.D. 2.4 mm



Wiring conduit Bore size G1/2 Tightening torque 0.5 to 0.6 N·m

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 for DC.

Description	Part no.
Seal	VCW20-15-6

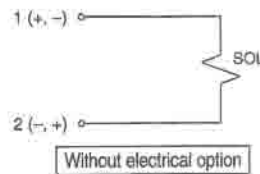
Note) Please order separately.

Electrical Circuits

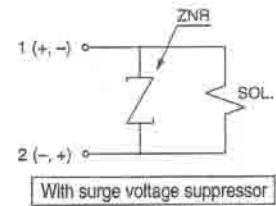
Caution

DC circuit

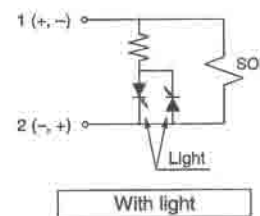
Grommet, Conduit, Conduit terminal, DIN connector



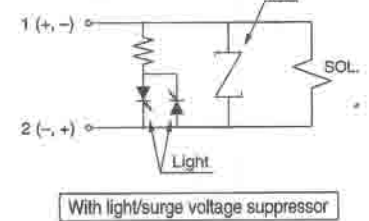
Grommet, Conduit terminal, DIN connector



Conduit terminal, DIN connector

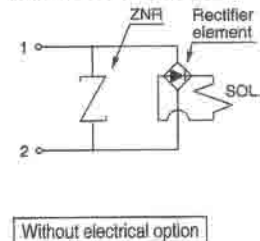


Conduit terminal, DIN connector



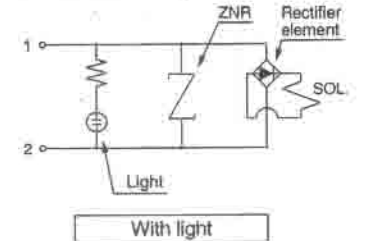
AC/Class B coil circuit

Grommet, Conduit, Conduit terminal, DIN connector



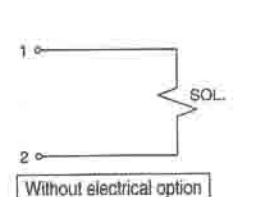
* Surge voltage suppressor is attached to the AC/Class B coil, as a standard.

Conduit terminal, DIN connector

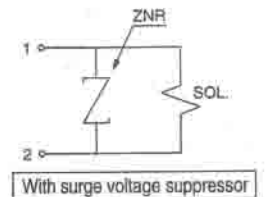


AC/Class H coil circuit

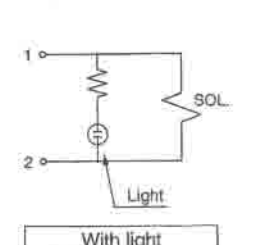
Grommet, Conduit, Conduit terminal



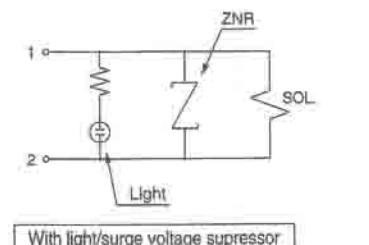
Grommet, Conduit terminal



Conduit terminal



Conduit terminal





3 Port Solenoid Valve for Fluid Control/Precautions 5

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

Operating Environment

⚠ Warning

1. Do not use the valves in an atmosphere having corrosive gases, chemicals, salt water, water, steam, or where there is direct contact with any of these.
2. Do not use in explosive atmospheres.
3. Do not use in locations subject to vibration or impact.
4. Do not use in locations where radiated heat will be received from nearby heat sources.
5. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

Lubrication

⚠ Caution

1. This solenoid valve can be operated without lubrication.

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

Refer to the table of brand name of lubricants compliant with Class 1 turbine oil (with no 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 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 Corp.	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

⚠ Warning

1 Removing the product

The valve will reach a high temperature when used with high temperature fluids. Confirm that the valve temperature has dropped 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. Shut off the power supply.
3. Demount the product.

2. Low frequency operation

Switch valves at least once every 30 days to prevent malfunction. Also, in order to use it under the optimum state, conduct a regular inspection once a half year.

Maintenance

⚠ Caution

1. Filters and strainers

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

2. Lubrication

When using after lubricating, never forget to lubricate continuously.

3. Storage

In case of long term storage after use with heated water, thoroughly remove all moisture to prevent rust and deterioration of rubber materials, etc.

4. Exhaust the drain from an air filter periodically.

Operating Precautions

⚠ 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.

Solenoid Valves Flow Characteristics

(How to indicate flow characteristics)

1. Indication of flow characteristics

Indication of the flow characteristics in specifications for equipment such as solenoid valve, etc. is depending on "Table (1)".

Table (1) Indication of Flow Characteristics

Corresponding equipment	Indication by international standard	Other indications	Standards conforming to
Equipment for pneumatics	C, b	—	ISO 6358: 1989 JIS B 8390: 2000
	—	S	JIS B 8390: 2000 Equipment: JIS B 8373, 8374, 8375, 8379, 8381
		C_v	ANSI/(NFPA)T3.21.3: 1990
Equipment for controlling process fluids	A_v	—	IEC60534-2-3: 1997 JIS B 2005: 1995
	—	C_v	Equipment: JIS B 8471, 8472, 8473

2. Equipment for pneumatics

2.1 Indication according to the international standards

(1) Standards conforming to

ISO 6358: 1989 : Pneumatic fluid power—Components using compressible fluids—
Determination of flow-rate characteristics

JIS B 8390: 2000 : Pneumatic fluid power—Components using compressible fluids—
How to test flow-rate characteristics

(2) Definition of flow characteristics

Flow rate characteristics are indicated as a result of a comparison between sonic conductance C and critical pressure ratio b .

Sonic conductance C : Values which divide the passing mass flow rate of an equipment in a choked flow condition by the product of the upstream absolute pressure and the density in the standard condition.

Critical pressure ratio b : It is the pressure ratio which will turn to the choke flow (downstream pressure/upstream pressure) when it is smaller than this values. (critical pressure ratio)

Choked flow : It is the flow in which the upstream pressure is higher than the downstream pressure and where sonic speed in a certain part of an equipment is reached.
Gaseous mass flow rate is in proportion to the upstream pressure and not dependent on the downstream pressure. (choked flow)

Subsonic flow : Flow greater than the critical pressure ratio

Standard condition : Air in a temperature state of 20°C, absolute pressure 0.1 MPa (= 100 kPa = 1 bar), relative humidity 65%.

It is stipulated by adding the abbreviation (ANR) after the unit depicting air volume.
(standard reference atmosphere)

Standard conforming to: ISO 8778: 1990 Pneumatic fluid power—Standard reference atmosphere, JIS B 8393: 2000: Pneumatic fluid power—Standard reference atmosphere

(3) Formula of flow rate

It can be indicated by the practical unit as following.

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} \leq b, \text{ choked flow}$$

$$Q = 600 \times C (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \dots\dots\dots(1)$$

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} > b, \text{ subsonic flow}$$

$$Q = 600 \times C (P_1 + 0.1) \sqrt{1 - \left[\frac{\frac{P_2 + 0.1}{P_1 + 0.1} - b}{1 - b} \right]^2} \sqrt{\frac{293}{273 + t}} \dots\dots\dots(2)$$

Q : Air flow rate [dm³/min (ANR)], dm³ (Cubic decimeter) of SI unit are also allowed to described by ℓ (liter). 1 dm³ = 1 ℓ.

Solenoid Valves Flow Characteristics

C : Sonic conductance [dm³/(s·bar)]

b : Critical pressure ratio [—]

P_1 : Upstream pressure [MPa]

P_2 : Downstream pressure [MPa]

t : Temperature [°C]

Note) Formula of subsonic flow is the elliptic analogous curve.

Flow characteristics curve is indicated in the Graph (1) For details, please use SMC's "Energy Saving Program".

Example)

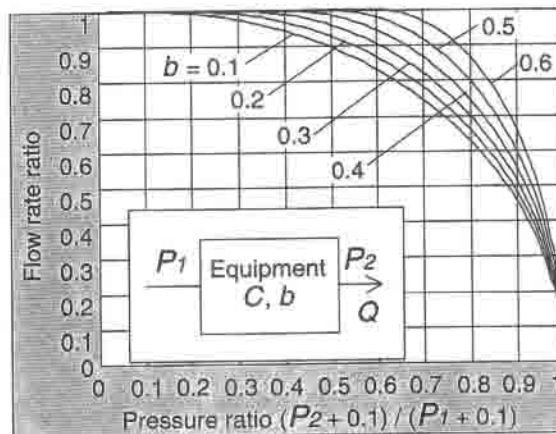
Obtain the air flow rate for $P_1 = 0.4$ [MPa], $P_2 = 0.3$ [MPa], $t = 20$ [°C] when a solenoid valve is performed in $C = 2$ [dm³/(s·bar)] and $b = 0.3$.

According to formula 1, the maximum flow rate = $600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}} = 600$ [dm³/min (ANR)]

$$\text{Pressure ratio} = \frac{0.3 + 0.1}{0.4 + 0.1} = 0.8$$

Based on the Graph (1), it is going to be 0.7 if it is read by the pressure ratio as 0.8 and the flow ratio to be $b = 0.3$.

Hence, flow rate = Max. flow \times flow ratio = $600 \times 0.7 = 420$ [dm³/min (ANR)]



Graph (1) Flow characteristics line

(4) Test method

By attaching a test equipment with the test circuit indicated in Fig. (1) while maintaining to a certain amount which does not let the upstream pressure go down below 0.3 MPa, measure the maximum flow to be saturated in the first place. Next, measure this flow rate at 80%, 60%, 40%, 20% and the upstream and downstream pressure. And then, obtain the sonic conductance C from this maximum flow rate. Besides that, substitute each data of others for the formula of subsonic flow in order to find b , then obtain the critical pressure ratio b from that average.

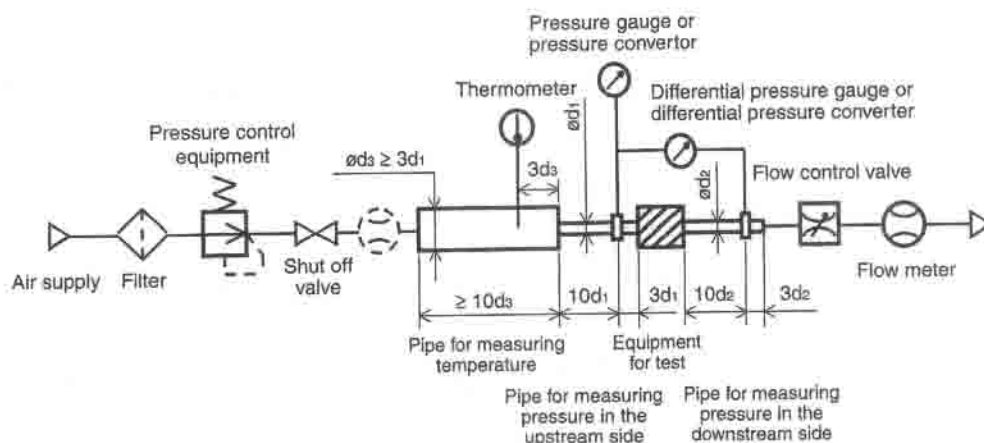


Fig. (1) Test circuit based on ISO 6358, JIS B 8390

Solenoid Valves Flow Characteristics

2.2 Effective area S

(1) Standards conforming to

**JIS B 8390: 2000: Pneumatic fluid power—Components using compressible fluids—
Determination of flow rate characteristics**

Equipment standards: JIS B 8373: 2 port solenoid valve for pneumatics

JIS B 8374: 3 port solenoid valve for pneumatics

JIS B 8375: 4 port, 5 port solenoid valve for pneumatics

JIS B 8379: Silencer for pneumatics

JIS B 8381: Fittings of flexible joint for pneumatics

(2) Definition of flow characteristics

Effective area S : is the cross-sectional area having an ideal throttle without friction deduced from the calculation of the pressure changes inside an air tank or without reduced flow when discharging the compressed air in a choked flow, from an equipment attached to the air tank. This is the same concept representing the "easy to run through" as sonic conductance C (effective area).

(3) Formula of flow rate

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} \leq 0.5, \text{ choked flow}$$

$$Q = 120 \times S (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \dots\dots\dots(3)$$

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} > 0.5, \text{ subsonic flow}$$

$$Q = 240 \times S \sqrt{(P_2 + 0.1)(P_1 - P_2)} \sqrt{\frac{293}{273 + t}} \dots\dots\dots(4)$$

Conversion with sonic conductance C :

$$S = 5.0 \times C \dots\dots\dots(5)$$

Q : Air flow rate[dm³/min(ANR)], dm³ (cubic decimeter) of SI unit is good to be described by ℓ (liter), too. 1 dm³ = 1 ℓ

S : Effective area [mm²]

P_1 : Upstream pressure [MPa]

P_2 : Downstream pressure [MPa]

t : Temperature [°C]

Note) Formula for subsonic flow (4) is only applicable when the critical pressure ratio b is the unknown equipment. In the formula by sonic conductance C (2), it is the same formula when $b = 0.5$.

(4) Test method

By attaching the equipment for testing with the test circuit shown in Fig. (2), discharge air into the atmosphere until the pressure inside the air tank goes down to 0.25 MPa (0.2 MPa) from an air tank filled with compressed air of a certain pressure (0.5 MPa) which does not go down below 0.6 MPa. At this time, measure the discharging time and the residual pressure inside the air tank which had been left until it turned to be the normal values, and then determine the effective area S by using the following formula. The volume of air tank should be selected within the specified range by corresponding to the effective area of the equipment being tested. In the case of JIS B 8373, 8374, 8375, 8379, 8381, the pressure values are in parentheses and the coefficient of formula is 12.9.

$$S = 12.1 \frac{V}{t} \log_{10} \left(\frac{P_s + 0.1}{P + 0.1} \right) \frac{293}{T} \dots\dots\dots(6)$$

S : Effective area [mm²]

V : Air tank capacity [dm³]

t : Discharging time [s]

P_s : Pressure inside air tank before discharging [MPa]

P : Residual pressure inside air tank after discharging [MPa]

T : Temperature inside air tank before discharging [K]

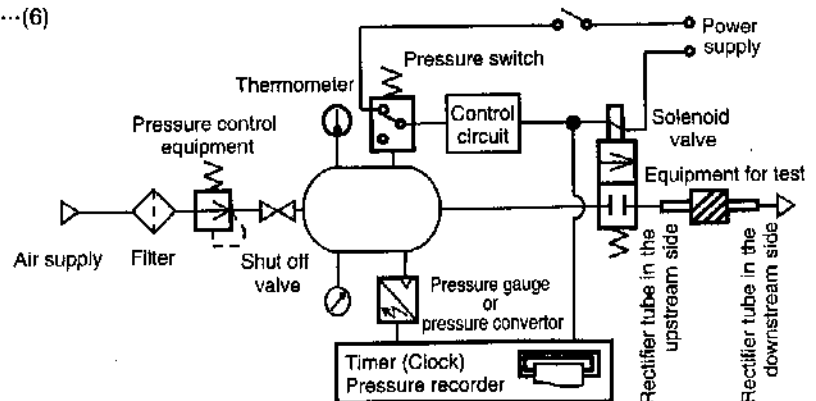


Fig. (2) Test circuit based on JIS B 8390

Solenoid Valves Flow Characteristics

2.3 Flow coefficient C_v factor

The United States Standard ANSI/(NFPA)T3.21.3:1990: Pneumatic fluid power—Flow rating test procedure and reporting method for fixed orifice components

defines the C_v factor of flow coefficient by the following formula which is based on the test conducted by the test circuit analogous to ISO 6358.

$$C_v = \frac{Q}{114.5 \sqrt{\frac{\Delta P (P_2 + P_a)}{T_1}}} \dots\dots\dots(7)$$

ΔP : Pressure drop between the static pressure tapping ports [bar]

P_1 : Pressure of the upstream tapping port [bar gauge]

P_2 : Pressure of the downstream tapping port [bar gauge]; $P_2 = P_1 - \Delta P$

Q : Flow rate [dm³/s standard condition]

P_a : Atmospheric pressure [bar absolute]

T_1 : Test conditions of the upstream absolute temperature [K]

is $< P_1 + P_a = 6.5 \pm 0.2$ bar absolute, $T_1 = 297 \pm 5$ K, $0.07 \text{ bar} \leq \Delta P \leq 0.14$ bar.

This is the same concept as effective area A which ISO6358 stipulates as being applicable only when the pressure drop is smaller than the upstream pressure and the compression of air does not become a problem.

3. Equipment for process fluids

(1) Standards conforming to

IEC60534-2-3: 1997: Industrial process control valves. Part 2: Flow capacity, Section Three-Test procedures

JIS B 2005: 1995: Test method for the flow coefficient of a valve

Equipment standards: JIS B 8471: Regulator for water

JIS B 8472: Solenoid valve for steam

JIS B 8473: Solenoid valve for fuel oil

(2) Definition of flow characteristics

Av factor: Value of the clean water flow rate represented by m³/s which runs through a valve (equipment for test) when the pressure difference is 1 Pa. It is calculated using the following formula.

$$Av = Q \sqrt{\frac{\rho}{\Delta P}} \dots\dots\dots(8)$$

Av : Flow coefficient [m²]

Q : Flow rate [m³/s]

ΔP : Pressure difference [Pa]

ρ : Density of fluid [kg/m³]

(3) Formula of flow rate

It is described by the known unit. Also, the flow characteristics line shown in the Graph (2).

In the case of liquid:

$$Q = 1.9 \times 10^6 Av \sqrt{\frac{\Delta P}{G}} \dots\dots\dots(9)$$

Q : Flow rate [ℓ/min]

Av : Flow coefficient [m²]

ΔP : Pressure difference [MPa]

G : Relative density [water = 1]

In the case of saturated aqueous vapor:

$$Q = 8.3 \times 10^6 Av \sqrt{\Delta P (P_2 + 0.1)} \dots\dots\dots(10)$$

Q : Flow rate [m³/s]

Av : Flow coefficient [m²]

ΔP : Pressure difference [Pa]

P_1 : Relative density [MPa]; $\Delta P = P_1 - P_2$

P_2 : Relative density [MPa]

Solenoid Valves Flow Characteristics

Conversion of flow coefficient:

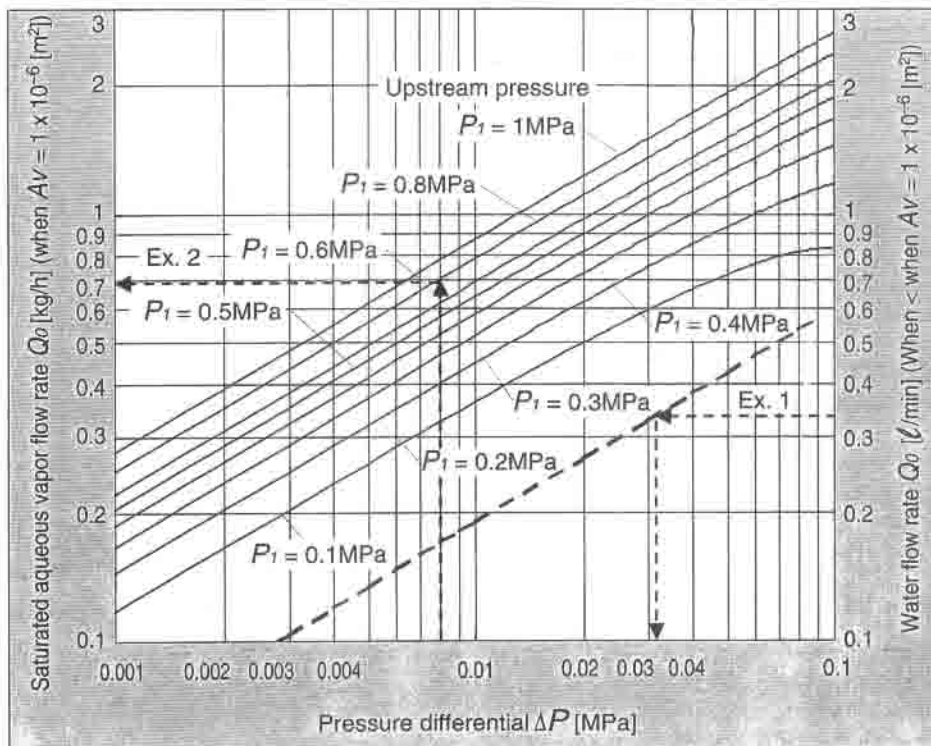
$$Av = 28 \times 10^{-6} Kv = 24 \times 10^{-6} Cv \dots\dots\dots (11)$$

Here,

Kv factor: Value of the clean water flow rate represented by the m³/h which runs through the valve at 5 to 40°C, when the pressure difference is 1 bar.

Cv factor (Reference values): It is the figures representing the flow rate of clean water by US gal/min which runs through the valve at 60°F, when the pressure difference is 1 lbf/in² (psi).

Values of pneumatic *Kv* are different from *Cv* because the testing method is different from each other.



Graph (2) Flow characteristics line

Example 1)

Obtain the pressure difference when water 15 [l/min] runs through the solenoid valve with an $Av = 45 \times 10^{-6} [m^2]$. Since $Q_0 = 15/45 = 0.33 [l/min]$, according to the Graph (2), if reading ΔP when Q_0 is 0.33, it will be 0.031 [MPa].

Example 2)

Obtain the flow rate of saturated aqueous vapor when $P_1 = 0.8 [MPa]$, $\Delta P = 0.008 [MPa]$ with a solenoid valve with an $Av = 1.5 \times 10^{-6} [m^2]$.

According to the Graph (2), if reading Q_0 when P_1 is 0.8 and ΔP is 0.008, it is 0.7 [kg/h]. Hence, the flow rate $Q = 0.7 \times 1.5 = 1.05 [kg/h]$.

Solenoid Valves Flow Characteristics

(4) Test method

By attaching the equipment for testing with the test circuit shown in Fig. (3) and running water at 5 to 40°C, measure the flow rate with a pressure difference of 0.075 MPa. However, the pressure difference needs to be set with a large enough difference so that the Reynolds number does not go below a range of 4×10^4 .

By substituting the measurement results for formula (8) to figure out A_v .

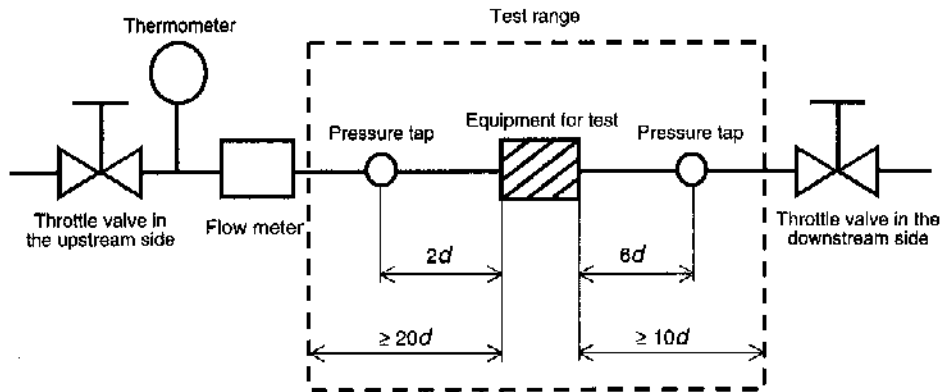
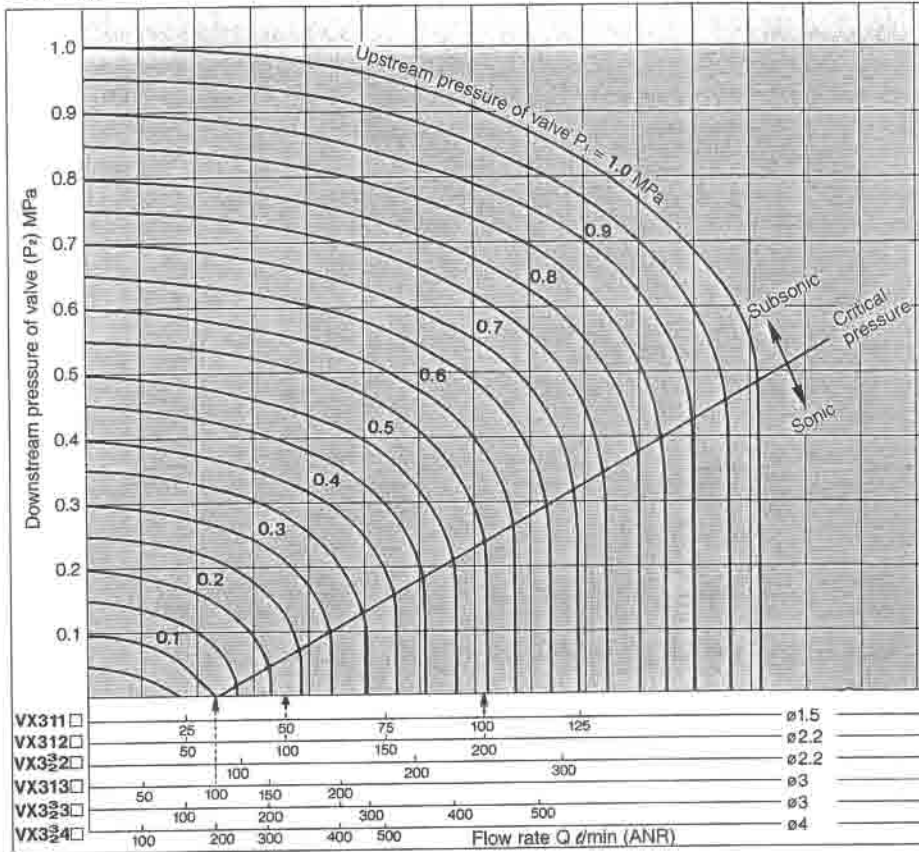


Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005

Flow Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to front matter pages 1 to 6.

For Air



How to read the graph

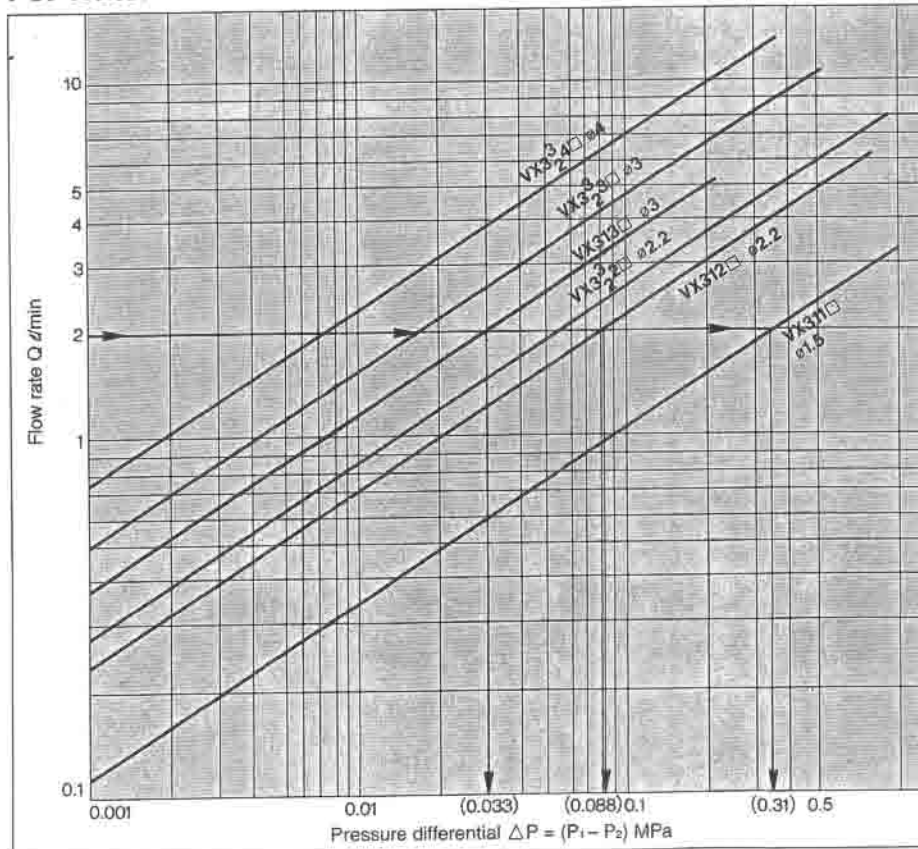
The sonic range pressure to generate a flow rate of 100 l/min (ANR) is

$P_1 = 0.1$ MPa for a $\phi 3$ orifice (VX313□),

$P_1 = 0.23$ MPa for a $\phi 2.2$ orifice (VX312□), and

$P_1 = 0.55$ MPa for a $\phi 1.5$ orifice (VX311□).

For Water



How to read the graph

When a water flow of 2 l/min is generated,

$\Delta P = 0.033$ MPa for a $\phi 3$ orifice (VX313□),

$\Delta P = 0.088$ MPa for a $\phi 2.2$ orifice (VX312□), and

$\Delta P = 0.31$ MPa for a $\phi 1.5$ orifice (VX311□).

Series VX31/32/33

Standard Specifications

Valve specifications	Valve construction		Direct operated poppet
	Valve construction (MPa)		3.0
	Body material		Brass (C37), Stainless steel
	Seal material		NBR, FKM, EPDM, PTFE, FFKM
	Enclosure		Dusttight, Low jetproof (equivalent to IP65)*
	Environment		Location without corrosive or explosive gases
Coil specifications	Rated voltage	AC (Class B coil, with full-wave rectifier)	100 VAC, 200 VAC, 110 VAC, 220 VAC, 230 VAC, 240 VAC, 48 VAC
		AC (Class H coil)	
		DC	
	Allowable voltage fluctuation		24 VDC, 12 VDC
			±10% of rated voltage
	Allowable leakage voltage	AC (Class B coil, with full-wave rectifier)	±5% or less of rated voltage
		AC (Class H coil)	±20% or less of rated voltage
DC		±2% or less of rated voltage	
Coil insulation type		Class B, Class H	

* Electrical entry, Grommet with surge voltage suppressor (GS) has a rating of IP40.

Solenoid Coil Specifications

DC Specification

Model	Power consumption (W)	Temperature rise (C°) (Note)
VX31	4.5	45
VX32	7	45
VX33	10.5	60

Note) The values are for an ambient temperature of 20°C and at the rated voltage.

AC Specification (Class B coil, with full-wave rectifier)

Model	Apparent power (VA)*	Temperature rise (C°) (Note)
VX31	7	55
VX32	9.5	60
VX33	12	65

* There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used in the AC (Class B).

Note) The values are for an ambient temperature of 20°C and at the rated voltage.

AC Specification (Class H coil)

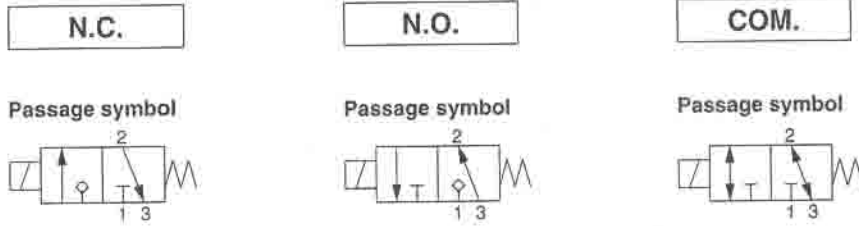
Model	Frequency (Hz)	Apparent power (VA)		Temperature rise (C°) (Note)
		Inrush	Energized	
VX31	50	33	14	65
	60	28	12	60
VX32	50	65	33	100
	60	55	27	95
VX33	50	94	50	120
	60	79	41	115

Note) The values are for an ambient temperature of 20°C and at the rated voltage.

Series VX31/32/33

For Water / Single Unit

Model/Valve Specifications



Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)			Flow characteristics		Max. system pressure (MPa)	Weight (g) ^{Note)}	
			N.C.	N.O.	COM.	Av x 10 ⁻⁶ m ²	Cv converted			
1/8 (6A)	1.5	VX311□-01	1	1	0.7	1.9	0.08	2.0	380	
	2.2	VX312□-01	0.7	0.5	0.4	3.8	0.16			
	3	VX313□-01	0.3	0.3	0.2	5.8	0.24			
1/4 (8A)	1.5	VX311□-02	1	1	0.7	1.9	0.08		530	
	2.2	VX312□-02	0.7	0.5	0.4	3.8	0.16			
		VX322□-02	1.2	1	0.7	4.6	0.19			
		VX332□-02	1.6	1.6	1	4.6	0.19			
	3	VX313□-02	0.3	0.3	0.2	5.8	0.24			730
		VX323□-02	0.6	0.5	0.3	7.9	0.33			
		VX333□-02	1	0.9	0.6					
	4	VX324□-02	0.3	0.25	0.2	12	0.50			530
		VX334□-02	0.5	0.4	0.3					
VX322□-03		1.2	1	0.7	4.6			0.19		
VX332□-03	1.6	1.6	1							
3/8 (10A)	2.2	VX323□-03	0.6	0.5		0.3	7.9		0.33	730
		VX333□-03	1	0.9	0.6					
		VX324□-03	0.3	0.25	0.2					
	3	VX334□-03	0.5	0.4	0.3	12	0.50			
		VX322□-03	1.2	1	0.7					

Note) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for terminal type respectively.
 Also, add 60 g for VX31□□, 80 g for VX32□□ and VX33□□ respectively for bracket option.
 * Refer to "Glossary of Terms" on front matter 10, for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)		Ambient temperature (°C)
	Solenoid valve option (symbol)		
	NII, G, H	E, P	
AC	1 to 40	1 to 99	-20 to 60
DC	1 to 40	—	-20 to 40

Note) With no freezing

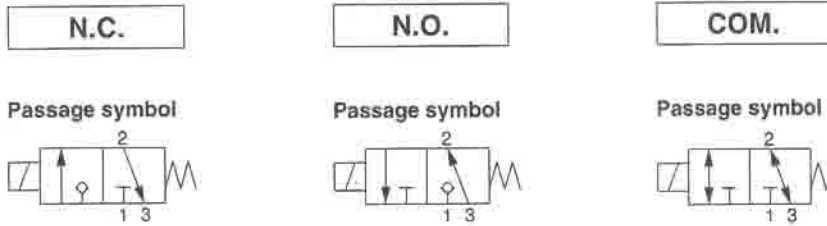
Tightness of Valve (Leakage Rate)

Seal material	Max. operating pressure differential	Leakage rate (With water pressure)
NBR, FKM, EPDM	From 0 to less than 1 MPa	0.1 cm ³ /min or less
	1 MPa or more	0.2 cm ³ /min or less

Series VX31/32/33

For Oil /Single Unit

Model/Valve Specifications



Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)			Flow characteristics		Max. system pressure (MPa)	Weight (g) ^{Note)}
			N.C.	N.O.	COM.	Av. x 10 ⁻⁶ m ²	Cv. converted		
1/8 (6A)	1.5	VX311□-01	1	1	0.7	1.9	0.08	2.0	380
	2.2	VX312□-01	0.7	0.5	0.4	3.8	0.16		
	3	VX313□-01	0.3	0.3	0.2	5.8	0.24		
1/4 (8A)	1.5	VX311□-02	1	1	0.7	1.9	0.08		
	2.2	VX312□-02	0.7	0.5	0.4	3.8	0.16		
		VX322□-02	1.2	1	0.7	4.6	0.19		
		VX332□-02	1.6	1.6	1				
	3	VX313□-02	0.3	0.3	0.2	5.8	0.24		
		VX323□-02	0.6	0.5	0.3	7.9	0.33		
		VX333□-02	1	0.9	0.6				
		VX324□-02	0.3	0.25	0.2	12	0.50		
4	VX334□-02	0.5	0.4	0.3					
3/8 (10A)	2.2	VX322□-03	1.2	1	0.7	4.6	0.19		
		VX332□-03	1.6	1.6	1				
	3	VX323□-03	0.6	0.5	0.3	7.9	0.33		
		VX333□-03	1	0.9	0.6				
		VX324□-03	0.3	0.25	0.2			12	0.50
	4	VX334□-03	0.5	0.4	0.3				

Note) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for terminal type respectively.
 Also, add 60 g for VX31□□, 80 g for VX32□□ and VX33□□ respectively for bracket option.
 • Refer to "Glossary of Terms" on front matter 10, for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)		Ambient temperature (°C)
	Solenoid valve option (symbol)		
	A, H	D, N	
AC	-5 ^{Note)} to 40	-5 ^{Note)} to 120	-20 to 60
DC	-5 ^{Note)} to 40	—	-20 to 40

Note) Dynamic viscosity: 50 mm²/s or less

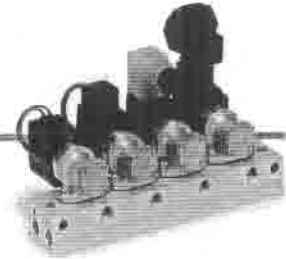
Tightness of Valve (Leakage Rate)

Seal material	Max. operating pressure differential	Leakage rate (With oil pressure)
FKM	From 0 to less than 1 MPa	0.1 cm ³ /min or less
	1 MPa or more	0.2 cm ³ /min or less

Series VVX31/32/33

For Oil /Manifold

Solenoid Valve for Manifold/Valve Specifications

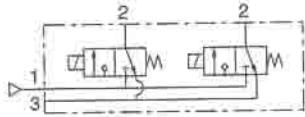


N.C.

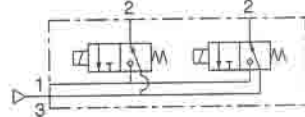
N.O.

COM.

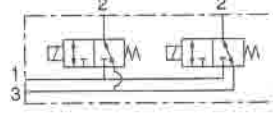
Passage symbol



Passage symbol



Passage symbol



Orifice size (mmø)	Model	Max. operating pressure differential (MPa)			Flow characteristics		Max. system pressure (MPa)
		N.C.	N.O.	COM.	Av x 10 ⁻⁶ m ²	Cv converted	
1.5	VX311□-00	1	1	0.7	1.9	0.08	2.0
	VX312□-00	0.7	0.5	0.4	3.8	0.16	
2.2	VX322□-00	1.2	1	0.7	4.6	0.19	
	VX332□-00	1.6	1.6	1			
3	VX313□-00	0.3	0.3	0.2	5.8	0.24	
	VX323□-00	0.6	0.5	0.3	7.9	0.33	
	VX333□-00	1	0.9	0.6			
4	VX324□-00	0.3	0.25	0.2	12	0.50	
	VX334□-00	0.5	0.4	0.3			

Refer to "Glossary of Terms" on front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)		Ambient temperature (°C)
	Solenoid valve option (symbol)		
	A	D	
AC	-5 <small>Note)</small> to 40	-5 <small>Note)</small> to 120	-20 to 60
DC	-5 <small>Note)</small> to 40	—	-20 to 40

Note) Dynamic viscosity: 50 mm²/s or less

Tightness of Valve (Leakage Rate)

Seal material	Max. operating pressure differential	Leakage rate (With oil pressure)
FKM	From 0 to less than 1 MPa	0.1 cm ³ /min or less
	1 MPa or more	0.2 cm ³ /min or less

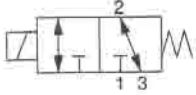
Series VX31/32/33

For Steam /Single Unit

Model/Valve Specifications

COM.

Passage symbol



Port size	Orifice size (mm \varnothing)	Model	Max. operating pressure differential (MPa)	Flow characteristics		Max. system pressure (MPa)	Weight (g) ^{Note)}
			COM	Av x 10 ⁻⁶ m ²	Cv converted		
1/8 (6A)	1.5	VX3114-01	0.7	1.9	0.08	1.0	380
	2.2	VX3124-01	0.4	3.8	0.16		
	3	VX3134-01	0.2	5.8	0.24		
1/4 (8A)	1.5	VX3114-02	0.7	1.9	0.08		
		VX3124-02	0.4	3.8	0.16		
		VX3224-02	0.7	4.6	0.19		
	2.2	VX3324-02	1	4.6	0.19		
		VX3134-02	0.2	5.8	0.24		
		VX3234-02	0.3	7.9	0.33		
	3	VX3334-02	0.6	7.9	0.33		
		VX3244-02	0.2	12	0.50		
		VX3344-02	0.3	12	0.50		
3/8 (10A)	2.2	VX3224-03	0.7	4.6	0.19		
		VX3324-03	1	4.6	0.19		
	3	VX3234-03	0.3	7.9	0.33		
		VX3334-03	0.6	7.9	0.33		
		VX3244-03	0.2	12	0.50		
	4	VX3344-03	0.3	12	0.50		

Note) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for terminal type respectively. Also, add 60 g for VX31□□, 80 g for VX32□□ and VX33□□ respectively for bracket option.
* Refer to "Glossary of Terms" on front matter 10, for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
	Solenoid valve option (symbol)	
AC	S, Q	-20 to 60
	183	

Tightness of Valve (Leakage Rate)

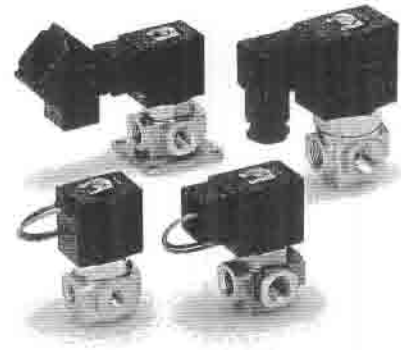
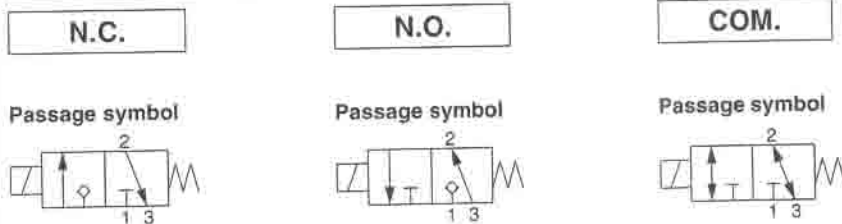
Seal material		Leakage rate (With air pressure)
Main valve poppet	Fixed sealant	
FFKM	PTFE	150 cm ³ /min or less

Series VX31/32/33

For Air /Single Unit

(Inert gas, Non-leak, Medium vacuum)

Model/Valve Specifications



Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)			Flow characteristics			Max. system pressure (MPa)	Weight (g) ^{Note)}
			N.C.	N.O.	COM.	C _v [dm ³ /(s·bar)]	b	C _v		
1/8 (6A)	1.5	VX311□-01	1	1	0.7	0.29	0.32	0.08	2.0	380
	2.2	VX312□-01	0.7	0.5	0.4	0.60	0.25	0.15		
	3	VX313□-01	0.3	0.3	0.2	0.82	0.20	0.20		
1/4 (8A)	1.5	VX311□-02	1	1	0.7	0.29	0.32	0.08		
		VX312□-02	0.7	0.5	0.4	0.60	0.25	0.15		
		VX322□-02	1.2	1	0.7	0.64	0.40	0.17		
	VX332□-02	1.6	1.6	1						
	3	VX313□-02	0.3	0.3	0.2	1.1	0.25	0.27		
		VX323□-02	0.6	0.5	0.3					
		VX333□-02	1	0.9	0.6					
	4	VX324□-02	0.3	0.25	0.2	1.6	0.20	0.38		
VX334□-02		0.5	0.4	0.3						
3/8 (10A)	2.2	VX322□-03	1.2	1	0.7	0.64	0.40	0.17		
		VX332□-03	1.6	1.6	1					
		VX323□-03	0.6	0.5	0.3					
	3	VX333□-03	1	0.9	0.6	1.1	0.25	0.27		
		VX324□-03	0.3	0.25	0.2					
		VX334□-03	0.5	0.4	0.3					
	4	VX324□-03	0.3	0.25	0.2	1.6	0.20	0.38		
		VX334□-03	0.5	0.4	0.3					

Note) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for terminal type respectively.
 Also, add 60 g for VX31□□, 80 g for VX32□□ and VX33□□ respectively for bracket option.
 • Refer to "Glossary of Terms" on front matter 10, for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)		Ambient temperature (°C)
	Solenoid valve option (symbol)		
	NII, G	V, M	
AC	-10 ^{Note)} to 60	-10 ^{Note)} to 40	-20 to 60
DC	-10 ^{Note)} to 60	-10 ^{Note)} to 40	-20 to 40

Note) Dew point temperature: -10°C or less

Tightness of Valve (Leakage Rate)

Seal material	Max. operating pressure differential	Leakage rate	
		Air	Note) Non-leak, Medium vacuum
NBR, FKM	From 0 to less than 1 MPa	1 cm ³ /min or less	10 ⁻⁶ Pa·m ³ /sec or less
	1 MPa or more	2 cm ³ /min or less	

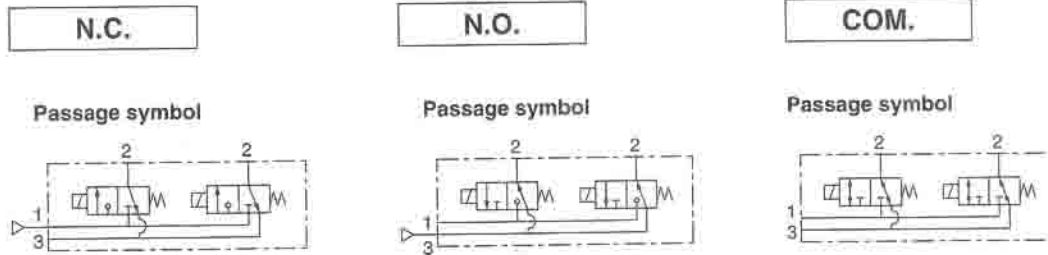
Note) The leakage amount (10⁻⁶ Pa·m³/sec) for the "V" and "M" option are values when the differential pressure is 0.1 MPa.

Series VVX31/32/33

For Air /Manifold

(Inert gas, Non-leak, Medium vacuum)

Solenoid Valve for Manifold/Valve Specifications



Orifice size (mmø)	Model	Max. operating pressure differential (MPa)			Flow characteristics			Max. system pressure (MPa)
		N.C.	N.O.	COM.	C[dm ³ /(s·bar)]	b	Cv	
1.5	VX311□-00	1	1	0.7	0.29	0.32	0.08	2.0
	VX312□-00	0.7	0.5	0.4	0.60	0.25	0.15	
2.2	VX322□-00	1.2	1	0.7	0.64	0.40	0.17	
	VX332□-00	1.6	1.6	1				
3	VX313□-00	0.3	0.3	0.2	1.1	0.25	0.20	
	VX323□-00	0.6	0.5	0.3				
	VX333□-00	1	0.9	0.6				
4	VX324□-00	0.3	0.25	0.2	1.6	0.20	0.38	
	VX334□-00	0.5	0.4	0.3				

* Refer to "Glossary of Terms" on front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)		Ambient temperature (°C)
	Solenoid valve option (symbol)		
	NII	V	
AC	-10 ^{Note)} to 60	-10 ^{Note)} to 40	-20 to 60
DC	-10 ^{Note)} to 60	-10 ^{Note)} to 40	-20 to 40

Note) Dew point temperature: -10°C or less

Tightness of Valve (Leakage Rate)

Seal material	Max. operating pressure differential	Leakage rate	
		Air	^{Note)} Non-leak, Medium vacuum
NBR, FKM	From 0 to less than 1 MPa	1 cm ³ /min or less	10 ⁻⁶ Pa·m ³ /sec or less
	1 MPa or more	2 cm ³ /min or less	

Note) The leakage amount (10⁻⁶ Pa·m³/sec) for the "V" option is a value when the differential pressure is 0.1 MPa.

How to Order (Single Unit)

DC, AC/Class H coil VX 31 1 4 [] [] - 01 [] - 1 G 1 - []

AC/Class B coil (with full-wave rectifier) VX 31 1 4 [] [] - 01 [] - 1 GR1 - []

Model
Refer to Table (1) shown below for availability.

Orifice size
Refer to Table (1) shown below for availability.

Valve/Body configuration

0	N.C. / Single unit
2	N.O. / Single unit
4	COM. / Single unit

Solenoid valve option
Refer to Table (2) shown below for availability.

Port size
Refer to Table (1) shown below for availability.

Thread type

NII	Rc
T	NPTF
F	G
N	NPT

Suffix

NII	—
Z	Oil free

Bracket

NII	None
B	With bracket

※ Bracket can not be installed and not removed.

With full-wave rectifier, surge voltage suppressor

Electrical entry

G - Grommet GS - With grommet surge voltage suppressor	C - Conduit
T - With conduit terminal TS - With conduit terminal and surge voltage suppressor TL - With conduit terminal and light TZ - With conduit terminal, surge voltage suppressor and light	D - DIN DS - DIN with surge voltage suppressor DL - DIN with light DZ - DIN with surge voltage suppressor and light DO - For DIN (without connector)

Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.

Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

For Water
For Oil
For Steam
For Air

Table (1) Port/Orifice Size

Model	Solenoid valve			Orifice symbol (diameter)			
	VX31	VX32	VX33	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
Port no. (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material/ Shading coil material	Guide pin material	Coil insulation type	Note
	Main valve poppet	Fixed sealant				
NII	NBR	NBR	Brass (C37)	PPS	B	—
G	—	—	Stainless steel	—	—	—
E	EPDM	EPDM	Brass (C37)/Cu	Stainless steel	H	Heated water
P	—	—	Stainless steel/Ag	—	—	—
H	FKM	FKM	Stainless steel	PPS	B	—

Table (3) Rated Voltage – Electrical Option

Rated voltage	Class B					
	AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	100 V	●	●	—
	2	200 V	200 V	●	●	—
	3	110 V	110 V	●	●	—
	4	220 V	220 V	●	●	—
	7	240 V	240 V	●	—	—
	8	48 V	48 V	●	—	—
DC	J	230 V	230 V	●	—	—
	5	24 V	24 V	●	●	●
	6	12 V	12 V	●	—	—

Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Rated voltage	Class H					
	AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	100 V	●	●	●
	2	200 V	200 V	●	●	●
	3	110 V	110 V	●	●	●
	4	220 V	220 V	●	●	●
	7	240 V	240 V	●	—	—
	8	48 V	48 V	●	—	—
DC	J	230 V	230 V	●	—	—
	5	24 V	24 V	—	—	—
	6	12 V	12 V	—	—	—

How to Order (Single Unit)

DC, AC/Class H coil VX 31 1 4 A 01 1 G 1

AC/Class B coil (with full-wave rectifier) VX 31 1 4 A 01 1 G R1 1

Bracket

Nll	None
B	With bracket

※ Bracket can not be installed and not removed.

Model Refer to Table (1) shown below for availability.

Orifice size Refer to Table (1) shown below for availability.

Valve/Body configuration

0	N.C. / Single unit
2	N.O. / Single unit
4	COM. / Single unit

Solenoid valve option Refer to Table (2) shown below for availability.

Port size Refer to Table (1) shown below for availability.

Thread type

Nll	Rc
T	NPTF
F	G
N	NPT

Suffix

Nll	—
Z	Oil free

Rated voltage

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

※ Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Electrical entry

<p>G - Grommet</p> <p>GS - With grommet surge voltage suppressor</p>	<p>C - Conduit</p>
<p>T - With conduit terminal</p> <p>TS - With conduit terminal and surge voltage suppressor</p> <p>TL - With conduit terminal and light</p> <p>TZ - With conduit terminal, surge voltage suppressor and light</p>	<p>D - DIN</p> <p>DS - DIN with surge voltage suppressor</p> <p>DL - DIN with light</p> <p>DZ - DIN with surge voltage suppressor and light</p> <p>DO - For DIN (without connector)</p> <p>※ DIN type is available with class B insulation only.</p>

※ Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.

※ Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

For Water

For Oil

For Steam

For Air

Table (1) Port/Orifice Size

Solenoid valve			Orifice symbol (diameter)				
Model	VX31	VX32	VX33	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
Port no. (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material/ Shading coil material	Guide pin material	Coil insulation type
	Main valve poppet	Fixed sealant			
A	FKM	FKM	Brass (C37)	PPS	B
H			Stainless steel		
D			Brass (C37)/Cu	Stainless steel	H
N			Stainless steel/Ag		

※ The additives contained in oil are different depending on the type and manufacturers, so the durability of the seal materials will vary. For details, please consult with SMC.

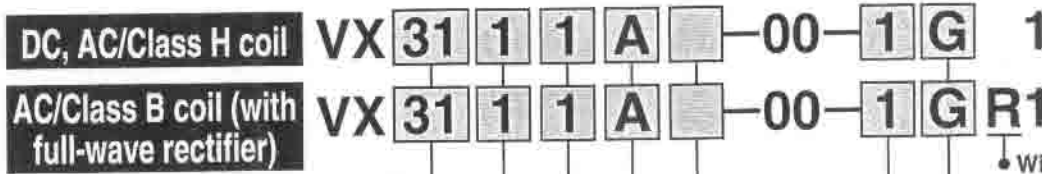
Table (3) Rated Voltage – Electrical Option

Rated voltage			Class B		
AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	Note 1)	●	Note 1)
	2	200 V		●	
	3	110 V		●	
	4	220 V		●	
	7	240 V		—	
	8	48 V		—	
DC	J	230 V	—	—	—
	5	24 V	●	●	●
	6	12 V	●	—	—

Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Rated voltage			Class H		
AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	●	●	●
	2	200 V	●	●	●
	3	110 V	●	●	●
	4	220 V	●	●	●
	7	240 V	●	—	—
	8	48 V	●	—	—
DC	J	230 V	●	—	—
	5	24 V	DC specification is not available.		
	6	12 V	DC specification is not available.		

How to Order (Solenoid Valve for Manifold)



Model • Refer to Table (1) shown below for availability.

Orifice size • Refer to Table (1) shown below for availability.

Valve/Body configuration

1	N.C. / Manifold
3	N.O. / Manifold
5	COM. / Manifold

Solenoid valve option • Refer to Table (2) shown below for availability.

Rated voltage

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

Suffix

Nil	—
Z	Oil free

* Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Electrical entry

G - Grommet
GS - With grommet surge voltage suppressor

C - Conduit

D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light

* DIN type is available with class B insulation only.

For Water
For Oil
For Steam
For Air

How to Order Manifold Bases

VVX31
VVX32
VVX33

Manifold base

Suffix

Nil	—
Z	Oil free

Number of manifolds

02	2 stations
•	•
•	•
•	•
10	10 stations

Port size (Individual port)

1	Rc1/8
2	Rc1/4

* Common port sizes are all Rc1/4.
 * Indicating numbers shown below are for common ports.

Type	SUP port	EXH port
N.C.	1	3
N.O.	3	1

• Blanking plate part no.

For VX31: VVX31-4A-F
 For VX32/33: VVX32-4A-F

• Seal material: FKM

How to Order Manifold Assemblies (Example)

Enter the valve and blanking plate to be mounted under the manifold base part number.

Example
 VVX311-05-1 1 set
 * VVX311A-00-1GR1.. 4 sets
 * VVX31-4A-F..... 1 set

"*" is the symbol for mounting.
 Add an "*" in front of the part numbers for solenoid valves, etc. to be mounted.

Enter the product's part number in order, counting the 1st station from the left in the manifold arrangement, when viewing the individual port in front.
 The common port on the right side is plugged.

Table (1) Port/Orifice Size

Solenoid valve	Orifice symbol (diameter)			
	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
VX31	●	●	●	—
VX32	—	●	●	●
VX33	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material/ Shading coil material	Guide pin material	Coil insulation type
	Main valve poppet	Fixed sealant			
A	FKM	FKM	Brass (C37)	PPS	B
D	FKM	FKM	Brass (C37)/Cu	Stainless steel	H

* Aluminum is only available as a material for the manifold base.

The additives contained in oil are different depending on the type and manufacturers, so the durability of the seal materials will vary.
 For details, please consult with SMC.

Table (3) Rated Voltage – Electrical Entry – Electrical Option

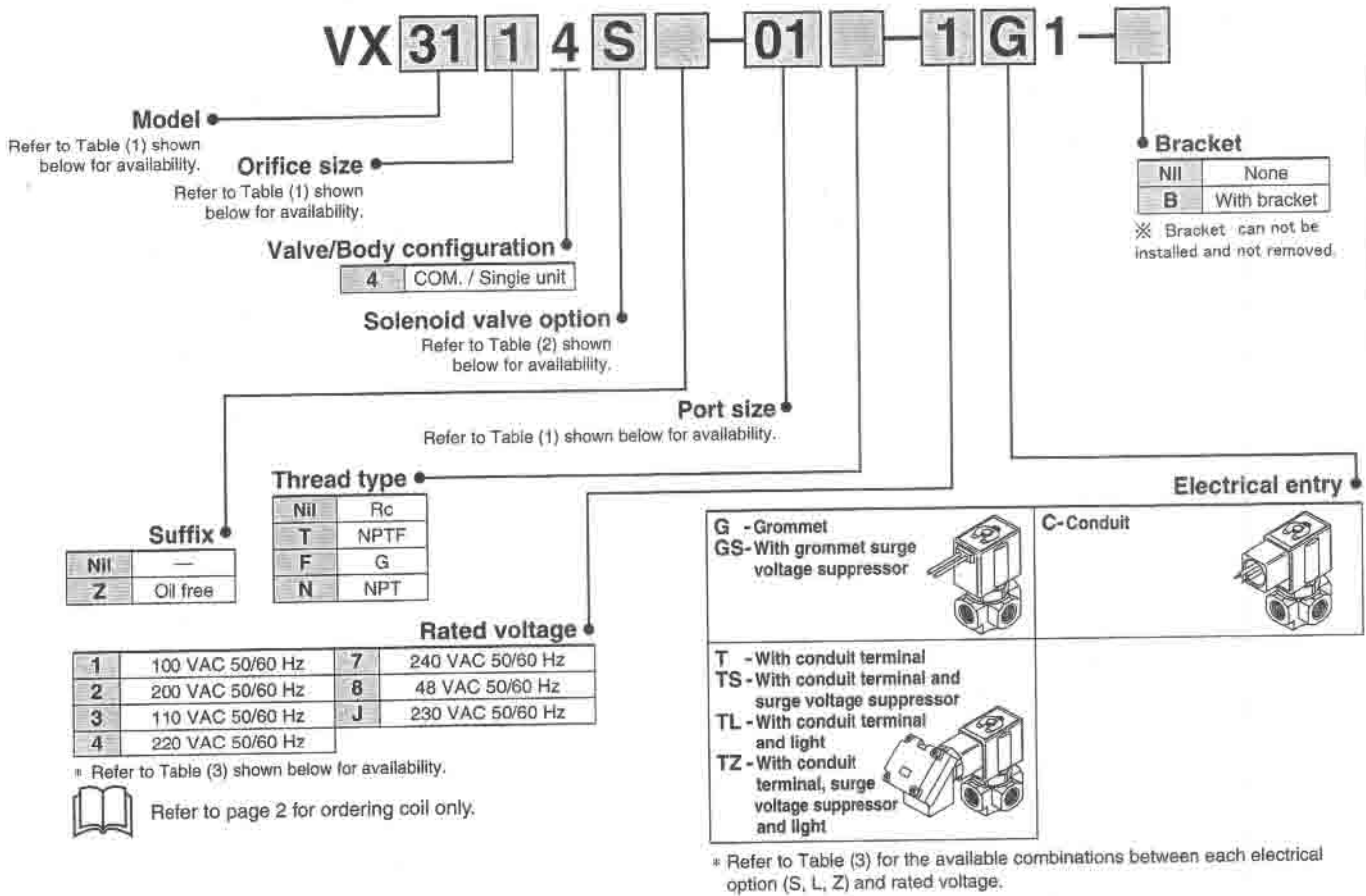
Rated voltage		Class B			Class H		
		S	L	Z	S	L	Z
AC/DC	Voltage symbol	With surge voltage suppressor	With light	With light and surge voltage suppressor	With surge voltage suppressor	With light	With light and surge voltage suppressor
	100 V	1	●	●	●	●	●
		2	●	●	●	●	●
		3	●	●	●	●	●
		4	●	●	●	●	●
		7	●	●	●	●	●
		8	●	●	●	●	●
200 V	J	●	●	●	●	●	
	230 V	●	●	●	●	●	
	24 V	●	●	●	●	●	
DC	12 V	●	●	●	●	●	

Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Direct Operated 3 Port Solenoid Valve Series **VX31/32/33**

For Steam/Single Unit

How to Order (Single Unit)



For Water

For Oil

For Steam

For Air

Table (1) Port/Orifice Size

Model	Solenoid valve			Orifice symbol (diameter)			
	VX31	VX32	VX33	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
Port no. (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (3) Rated Voltage – Electrical Option

AC/DC	Rated voltage		Class H		
	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	●	●	●
	2	200 V	●	●	●
	3	110 V	●	●	●
	4	220 V	●	●	●
	7	240 V	●	—	—
	8	48 V	●	—	—
DC	J	230 V	●	—	—
	5	24 V	DC specification is not available.		
	6	12 V	DC specification is not available.		

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material/ Shading coil material	Guide pin material	Coil insulation type
	Main valve poppet	Fixed sealant			
S	FFKM	PTFE	Brass (C37)/Cu	Stainless steel	H
Q			Stainless steel/Ag		

Solenoid coil: AC/Class H only

Direct Operated 3 Port Solenoid Valve Series VX31/32/33

For Air/Single Unit

How to Order (Single Unit)

DC

AC/Class B coil (with full-wave rectifier)

Model
Refer to Table (1) shown below for availability.

Orifice size
Refer to Table (1) shown below for availability.

Valve/Body configuration

0	N.C. / Single unit
2	N.O. / Single unit
4	COM. / Single unit

Solenoid valve option
Refer to Table (2) shown below for availability.

Port size
Refer to Table (1) shown below for availability.

Suffix

Nil	—
Z	Oil free

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

Rated voltage

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

* Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Bracket

Nil	None
B	With bracket

※ Bracket can not be installed and not removed.

• With full-wave rectifier, surge voltage suppressor

Electrical entry (AC/DC)

<p>G - Grommet</p> <p>GS - With grommet surge voltage suppressor</p>	<p>C - Conduit</p>
<p>T - With conduit terminal</p> <p>TS - With conduit terminal and surge voltage suppressor</p> <p>TL - With conduit terminal and light</p> <p>TZ - With conduit terminal, surge voltage suppressor and light</p>	<p>D - DIN</p> <p>DS - DIN with surge voltage suppressor</p> <p>DL - DIN with light</p> <p>DZ - DIN with surge voltage suppressor and light</p> <p>DO - For DIN (without connector)</p> <p>* DIN type is available with class B insulation only.</p>

• Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.

• Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Table (1) Port/Orifice Size

Solenoid valve			Orifice symbol (diameter)				
Model	VX31	VX32	VX33	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
Port no.	01 (1/8)	—	—	●	●	●	—
(Port size)	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (3) Rated Voltage – Electrical Option

Rated voltage	Class B		
	S	L	Z
AC/DC	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	1 100 V	●	—
	2 200 V	●	—
	3 110 V	●	—
	4 220 V	Note 1)	Note 1)
	7 240 V	—	—
	8 48 V	—	—
DC	J 230 V	—	—
	5 24 V	●	●
	6 12 V	●	—

Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

* Class H coil is not available.

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material/ Shading coil material	Guide pin material	Coil insulation type	Note (Note)
	Main valve poppet	Fixed sealant				
Nil			Brass (C37)	PPS	B	—
G	NBR	NBR	Stainless steel			
V	FKM	FKM	Brass (C37)			
M			Stainless steel			

Note) The leakage amount (10⁻⁶ Pa·m³/sec) for the "V" and "M" option are values when the differential pressure is 0.1 MPa.

For Water

For Oil

For Steam

For Air

Direct Operated 3 Port Solenoid Valve Series VVX31/32/33

For Air/Manifold

How to Order (Solenoid Valve for Manifold)

DC
AC/Class B coil (with full-wave rectifier)

Model: **VX 31 1 1** — Orifice size: **00** — Suffix: **5 G** — **1**
 AC/Class B coil (with full-wave rectifier): **VX 31 1 1** — Orifice size: **00** — Suffix: **1 G R1**

• With full-wave rectifier, surge voltage suppressor

Refer to Table (1) shown below for availability.

Refer to Table (1) shown below for availability.

Valve/Body configuration

1	N.C. / Manifold
3	N.O. / Manifold
5	COM. / Manifold

Solenoid valve option

Refer to Table (2) shown below for availability.

Rated voltage

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

* Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Suffix

Nil	—
Z	Oil free

Electrical entry (AC/DC)

G - Grommet
 GS - With grommet surge voltage suppressor

C - Conduit

T - With conduit terminal
 TS - With conduit terminal and surge voltage suppressor
 TL - With conduit terminal and light
 TZ - With conduit terminal, surge voltage suppressor and light

D - DIN
 DS - DIN with surge voltage suppressor
 DL - DIN with light
 DZ - DIN with surge voltage suppressor and light
 DO - For DIN (without connector)

* DIN type is available with class B insulation only.

For Water
 For Oil
 For Steam
 For Air

How to Order Manifold Bases

VVX31
VVX32 **1** **07** **1**
VVX33

Number of manifolds

02	2 stations
10	10 stations

Port size (Individual port)

1	Rc1/8
2	Rc1/4

* Common port sizes are all Rc1/4.
 * Indicating numbers shown below are for common

Type	SUP port	EXH port
N.C.	1	3
N.O.	3	1

Manifold base

Blanking plate part no.

For VX31: **VVX31-4A-**
 For VX32/33: **VVX32-4A-**

Seal material

Nil	NBR
F	FKM

Suffix

Nil	—
Z	Oil free

* Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.
 * Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Table (1) Port/Orifice Size

Solenoid valve	Orifice symbol (diameter)			
	1 (1.5 mmø)	2 (2.2 mmø)	3 (3 mmø)	4 (4 mmø)
VX31	●	●	●	—
VX32	—	●	●	●
VX33	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material	Guide pin material	Coil insulation type	Note (Note)
	Main valve poppet	Fixed sealant				
Nil	NBR	NBR	Brass (C37)	PPS	B	Non-leak (10 ⁻⁶ Pa·m ³ /sec), Medium vacuum (0.1 Pa.abs)
V	FKM	FKM				

* Aluminum is only available as a material for the manifold base.
 Note) The leakage amount (10⁻⁶ Pa·m³/sec) for the "V" and "M" option are values when the differential pressure is 0.1 MPa.

Table (3) Rated Voltage - Electrical Option

Rated voltage	Class B	Class B			
		S	L	Z	
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor
			1	100 V	●
	2	200 V	●	—	
	3	110 V	●	—	
	4	220 V	—	●	—
	7	240 V	—	—	—
8	48 V	—	—	—	
J	230 V	—	—	—	
DC	5	24 V	●	●	●
	6	12 V	●	—	—

* Class H coil is not available.
 Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

How to Order Manifold Assemblies (Example)

Enter the valve and blanking plate to be mounted under the manifold base part number.

Example
 VVX311-05-1 1 set
 * VX3111-00-1GR1 ... 4 sets
 * VVX31-4A 1 set

*" is the symbol for mounting.
 Add an "*" in front of the part numbers for solenoid valves, etc. to be mounted.

Enter the product's part number in order, counting the 1st station from the left in the manifold arrangement, when viewing the individual port in front.
 The common port on the right side is plugged.

For Vacuum Pad Series VXV31/32/33

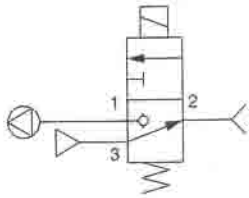
- Vacuum circuit side is suited for a large orifice. Supply pressure side is suited for high pressure and a vacuum pad.
- Construction and dimensions are the same as the VX3 series.

Model/Valve Specifications

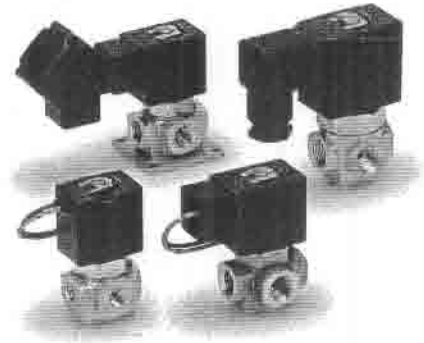
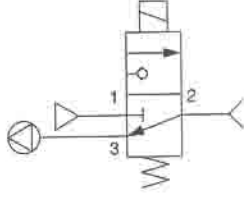
N.C.

N.O.

Passage symbol (example)



Passage symbol (example)



Port size	Orifice size (mm)		Model	Operating pressure (MPa)		Flow characteristics						Max. system pressure (MPa)	Weight (g) <small>Note)</small>
	Port 1 side	Port 3 side		Port 1 side	Port 3 side	Passage: 1↔2			Passage: 2↔3				
						C[dm ³ /(s·bar)]	b	Cv	C[dm ³ /(s·bar)]	b	Cv		
1/8 (6A)	3	1.5	VXV3130-01	※Low vacuum	0 to 0.5	0.82	0.20	0.20	0.29	0.32	0.08	2.0	380
	1.5	3	VXV3132-01	0 to 0.5	※Low vacuum	0.29	0.32	0.08	0.82	0.20	0.20		
1/4 (8A)	3	1.5	VXV3130-02	※Low vacuum	0 to 0.5	0.82	0.20	0.20	0.29	0.32	0.08		530
	1.5	3	VXV3132-02	0 to 0.5	※Low vacuum	0.29	0.32	0.08	0.82	0.20	0.20		
	4	2.2	VXV3240-02	※ Low vacuum	0 to 0.5	1.6	0.20	0.38	0.64	0.40	0.17		
	2.2	4	VXV3340-02	0 to 0.9	※ Low vacuum								
	2.2	4	VXV3242-02	0 to 0.5	※ Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38		
	4	2.2	VXV3342-02	0 to 0.9	※ Low vacuum								
3/8 (10A)	4	2.2	VXV3240-03	※ Low vacuum	0 to 0.5	1.6	0.20	0.38	0.64	0.40	0.17		530
	2.2	4	VXV3340-03	0 to 0.5	※ Low vacuum								
	2.2	4	VXV3242-03	0 to 0.5	※ Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38		
	4	2.2	VXV3342-03	0 to 0.9	※ Low vacuum								



Note) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for terminal type respectively.

Also, add 60 g for VX31□□, 80 g for VX32□□ and VX33□□ respectively for bracket option.

• Refer to "Glossary of Terms" on front matter 10, for details on the max. operating pressure differential and the max. system pressure.

※ Low vacuum : To 1.3×10^2 Pa

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
AC	-10 <small>Note 1)</small> to 60	-20 to 60
DC	-10 <small>Note 1)</small> to 60	-20 to 40



Note 1) Dew point temperature: -10°C or less

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate <small>Note)</small>
	Air
NBR, FKM	1 cm ³ /min or less



Note) Value when air pressure is applied.

For Vacuum Pad/Manifold Series VVXV31/32/33

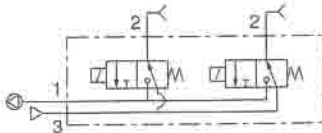
- Construction and dimensions are the same as those of the VXX3 series.

Model/Valve Specifications

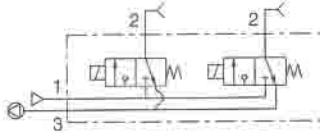
N.C.

N.O.

Passage symbol (example)



Passage symbol (example)



Orifice size (mmø)		Model	Operating pressure (MPa)		Flow characteristics						Max. system pressure (MPa)
Port 1 side	Port 3 side		Port 1 side	Port 3 side	Passage: 1↔2			Passage: 2↔3			
					C[dm ³ /(s-bar)]	b	Cv	C[dm ³ /(s-bar)]	b	Cv	
3	1.5	VXV3130-00	※Low vacuum	0 to 0.5	0.82	0.20	0.20	0.29	0.32	0.08	2.0
1.5	3	VXV3132-00	0 to 0.5	※Low vacuum	0.29	0.32	0.08	0.82	0.20	0.20	
4	2.2	VXV3240-00	※ Low vacuum	0 to 0.5	1.6	0.20	0.38	0.64	0.40	0.17	
		VXV3340-00		0 to 0.9							
2.2	4	VXV3242-00	0 to 0.5	※ Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38	
		VXV3342-00	0 to 0.9								



• Refer to "Glossary of Terms" on front matter 10 for details on the max. operating pressure differential and the max. system pressure.

※ Low vacuum : To 1.3×10^2 Pa

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
AC	-10 ^{Note 1)} to 60	-20 to 60
DC	-10 ^{Note 1)} to 60	-20 to 40



Note 1) Dew point temperature: -10°C or less

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate ^{Note)}
	Air
NBR, FKM	1 cm ³ /min or less



Note) Value when air pressure is applied.

Series VXV31/32/33

For Vacuum Pad/Single Unit

How to Order (Single Unit)

DC VXV 31 3 0 [] [] 01 [] 5 G 1 []

AC/Class B coil (with full-wave rectifier) VXV 31 3 0 [] [] 01 [] 1 G R1 []

Model Refer to Table (1) shown below for availability.

Orifice size Refer to Table (1) shown below for availability.

Valve/Body configuration

0	N.C. / Single unit
2	N.O. / Single unit

Solenoid valve option Refer to Table (2) shown below for availability.

Port size Refer to Table (1) shown below for availability.

Suffix

NII	—
Z	Oil free

Thread type

NII	Rc
T	NPTF
F	G
N	NPT

Rated voltage

1	100 VAC 50/60 Hz	5	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

* Refer to Table (3) shown below for availability.

Refer to page 2 for ordering coil only.

Bracket

NII	None
B	With bracket

※ Bracket can not be installed and not removed.

With full-wave rectifier, surge voltage suppressor

Electrical entry (AC/DC)

G - Grommet
GS - With grommet surge voltage suppressor

C - Conduit

T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor

TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light

D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

* DIN type is available with class B insulation only.

* Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.

* Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Table (1) Port/Orifice Size

Model	Solenoid valve			Orifice symbol (diameter) ^{Note)}	
	VXV31	VXV32	VXV33	3 (1.5/3 mmø)	4 (2.2/4 mmø)
Port no. (Port size)	01 (1/8)	—	—	●	—
	02 (1/4)	—	—	●	—
	—	02 (1/4)	02 (1/4)	—	●
	—	03 (3/8)	03 (3/8)	—	●

Note) The orifice diameter shown above are for the supply pressure side/ vacuum side port.

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material	Guide pin material	Coil insulation type
	Main valve poppet	Fixed sealant			
NII	NBR	NBR	Brass (C37)	PPS	B
A	FKM	FKM			
G	NBR	NBR	Stainless steel		
H	FKM	FKM			

Table (3) Rated Voltage – Electrical Option

Rated voltage	Class B				
	S	L	Z		
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	1	100 V	●	●	●
	2	200 V	●	●	●
	3	110 V	Note 1)	●	Note 1)
	4	220 V	●	●	●
	7	240 V	—	—	—
	8	48 V	—	—	—
DC	J	230 V	—	—	—
	5	24 V	●	●	●
	6	12 V	●	—	—

Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

* Class H coil is not available.

Series VVXV31/32/33

For Vacuum Pad/Manifold

How to Order (Solenoid Valve for Manifold)

DC
AC/Class B coil (with full-wave rectifier)

Model
Refer to Table (1) shown below for availability.

Orifice size
Refer to Table (1) shown below for availability.

Suffix

Nil	—
Z	Oil free

Valve/Body configuration

1	N.C. / Manifold
3	N.O. / Manifold

Solenoid valve option
Refer to Table (2) shown below for availability.

With full-wave rectifier, surge voltage suppressor

Electrical entry (AC/DC)

Rated voltage

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

* Refer to Table (3) shown below for availability.
Refer to page 2 for ordering coil only.

G - Grommet
GS - With grommet surge voltage suppressor

C-Conduit

T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light

D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

* DIN type is available with class B insulation only.

* Refer to Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.
* Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

How to Order Manifold Bases

VVX31
VVX32
VVX33

Number of manifolds

02	2 stations
10	10 stations

Port size (Individual port)

1	Rc1/8
2	Rc1/4

* Common port sizes are all Rc1/4.
* Indicating numbers shown below are for common ports.

Type	Vacuum side port	SUP side port
N.C.	1	3
N.O.	3	1

Manifold base

Table (1) Port/Orifice Size

Solenoid valve	Orifice symbol (diameter) ^{Note)}	
	3 (1.5/3 mmø)	4 (2.2/4 mmø)
VVX31	●	—
VVX32	—	●
VVX33	—	●

Note) The orifice diameter shows the supply pressure side/vacuum side.

Blanking plate part no.

For VVX31: VVX31-4A-
For VVX32/33: VVX32-4A-

Seal material

Nil	NBR
F	FKM

Table (2) Solenoid Valve Option

Option symbol	Seal material		Body material	Guide pin material	Coil insulation type
	Main valve poppet	Fixed sealant			
Nil	NBR	NBR	Brass (C37)	PPS	B
A	FKM	FKM			

* Aluminum is only available as a material for the manifold base.

How to Order Manifold Assemblies (Example)

Enter the valve and blanking plate to be mounted under the manifold base part number.

Example
VVX311-05-1 1 set * is the symbol for mounting.
* VVX3131-00-1GR1.. 4 sets Add an "*" in front of the part numbers
* VVX31-4A 1 set for solenoid valves, etc. to be mounted.

Enter the product's part number in order, counting the 1st station from the left in the manifold arrangement, when viewing the individual port in front. The common port on the right side is plugged.

Table (3) Rated Voltage - Electrical Option

Rated voltage			Class B		
			S	L	Z
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor
			●	●	●
AC	1	100 V	●	—	—
	2	200 V	●	—	—
	3	110 V	—	●	—
	4	220 V	—	●	—
	7	240 V	—	—	—
	8	48 V	—	—	—
	J	230 V	—	—	—
DC	5	24 V	●	●	●
	6	12 V	●	—	—

* Class H coil is not available.
Note 1) Option S, Z are not available as surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

Applicable Fluid Check List

Single Unit Series VX31/32/33



All Options (Single Unit)

Option symbol	Seal material		Body, Shading coil material	Guide pin material	Coil insulation type	Note
	Main valve poppet	Fixed sealant				
Nil	NBR	NBR	Brass (C37)	PPS	B	—
A	FKM	FKM				
B	EPDM	EPDM				
C	FFKM	PTFE				
D	FKM	FKM	Brass (C37)/Cu	Stainless steel	H	
E	EPDM	EPDM				
G	NBR	NBR	Stainless steel	PPS	B	
H	FKM	FKM				
J	EPDM	EPDM		Stainless steel		PPS
K	FFKM	PTFE				
M	FKM	FKM		Stainless steel		PPS
N	FKM	FKM	Stainless steel/Ag	Stainless steel	H	—
P	EPDM	EPDM				
Q	FFKM	PTFE				
S	FFKM	PTFE	Brass (C37)/Cu	Stainless steel	H	Steam (Max. 183°C)
V	FKM	FKM				

* "K", "M", "V" options are for non-lube treatment.

Fluid Name and Option (Single Unit)

Fluid (Application)	Option symbol and body material	
	Brass (C37)	Stainless steel
Caustic soda (25% ≥)	—	J
Gas oil	A	H
Silicon oil	A	H
Steam system (Steam) (Max. 183°C)	S	Q
Steam system (Condensation) (Max. 99°C)	E	P
Vacuum system (for pad)	Standard	—
Medium vacuum (up to 0.1 Pa.abs)	V	M
Perchloroethylene	A	H
Helium	V	M
Non-leak (10^{-6} Pa·m ³ /s)	V	M
Heated water (Max. 99°C)	E	P

Note 1) The leakage amount (10^{-6} Pa·m³/s) of "V", "M" options are values when differential pressure is 0.1 MPa.

Note 2) If using for other fluids, contact SMC.

Manifold Series VVX31/32/33



All Options (Manifold)

Option symbol	Seal material		Body, Shading coil material	Guide pin material	Coil insulation type	Note
	Main valve poppet	Fixed sealant				
Nil	NBR	NBR	Brass (C37)	PPS	B	—
A	FKM	FKM				
B	EPDM	EPDM				
D	FKM	FKM	Brass (C37)/Cu	Stainless steel	H	
E	EPDM	EPDM				
V	FKM	FKM	Brass (C37)	PPS	B	

* Aluminum is only available with the material for a manifold base.

Fluid Name and Option (Manifold)

Fluid (Application)	Option symbol
Gas oil	A
Silicon oil	A
Vacuum system (for pad)	Standard
Medium vacuum (up to 0.1 Pa.abs)	V
Perchloroethylene	A
Helium	V
Non-leak (10^{-6} Pa·m ³ /s)	V

Note 1) The leakage amount (10^{-6} Pa·m³/s) of "V" options are values when differential pressure is 0.1 MPa.

Note 2) If using for other fluids, contact SMC.

How to Order Solenoid Coil Assembly

DC

VX02 1 N - 5 G

Series

1	VX31□□
2	VX32□□
3	VX33□□

Rated voltage Note 1)

5	24 VDC
6	12 VDC

Note 1) Refer to Table (1) for the available combinations.

Electrical entry

G - Grommet GS - With grommet surge voltage suppressor	C - Conduit
T - With conduit terminal TS - With conduit terminal and surge voltage suppressor TL - With conduit terminal and light TZ - With conduit terminal, surge voltage suppressor and light	D - DIN DS - DIN with surge voltage suppressor DL - DIN with light DZ - DIN with surge voltage suppressor and light DO - For DIN (without connector)

* Refer to Table (1) for the available combinations between each electrical option and rated voltage.

AC/Class B coil (with full-wave rectifier)

VX02 1 N - 1 GR

Series

1	VX31□□
2	VX32□□
3	VX33□□

Rated voltage Note 1)

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	110 VAC 50/60 Hz
4	220 VAC 50/60 Hz
7	240 VAC 50/60 Hz
8	48 VAC 50/60 Hz
J	230 VAC 50/60 Hz

Note 1) Refer to Table (1) for the available combinations.

Electrical entry

G - Grommet	C - Conduit
T - With conduit terminal TL - With conduit terminal and light	D - DIN DL - DIN with light DO - For DIN (without connector)

* Refer to Table (1) for the available combinations between each electrical option and rated voltage.
 * Surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

AC/Class H coil

VX02 1 N - 1 G - H - 2 - Z

Series

1	VX31□□
2	VX32□□
3	VX33□□

Rated voltage Note 1)

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	110 VAC 50/60 Hz
4	220 VAC 50/60 Hz
7	240 VAC 50/60 Hz
8	48 VAC 50/60 Hz
J	230 VAC 50/60 Hz

Note 1) Refer to Table (1) for the available combinations.

Electrical entry

G - Grommet GS - With grommet surge voltage suppressor	C - Conduit
T - With conduit terminal TS - With conduit terminal and surge voltage suppressor TL - With conduit terminal and light TZ - With conduit terminal, surge voltage suppressor and light	

* Refer to Table (1) for the available combinations between each electrical option and rated voltage.

Table (1) Rated Voltage - Electrical Option

Rated voltage	Class B			Class H		
	S	L	Z	S	L	Z
AC/DC	With surge voltage suppressor	With light	With light and surge voltage suppressor	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	1 100 V	●	●	●	●	●
	2 200 V	●	●	●	●	●
	3 110 V	●	●	●	●	●
	4 220 V	●	●	●	●	●
	7 240 V	—	—	—	—	—
	8 48 V	—	—	—	—	—
J 230 V	—	—	—	—	—	—
DC	5 24 V	●	●	●	DC specification is not available.	
	6 12 V	●	—	—	DC specification is not available.	

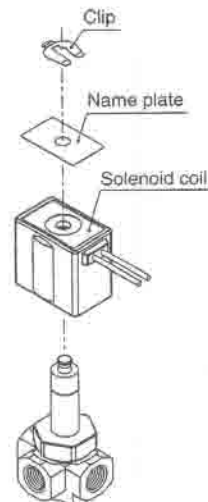
Note 1) Option S, Z are not available since a surge voltage suppressor is integrated into the AC/Class B coil, as a standard.

* When changing coils, AC/DC are not interchangeable with each other, and Class B and H coils are also not interchangeable with each other.

• Name plate part no.

AZ-T-VX **Valve model**

↑ Enter by referring to "How to Order".



• Clip part no.

For VX31: VX021N-10

For VX32: VX022N-10

For VX33: VX023N-10

Troubleshooting

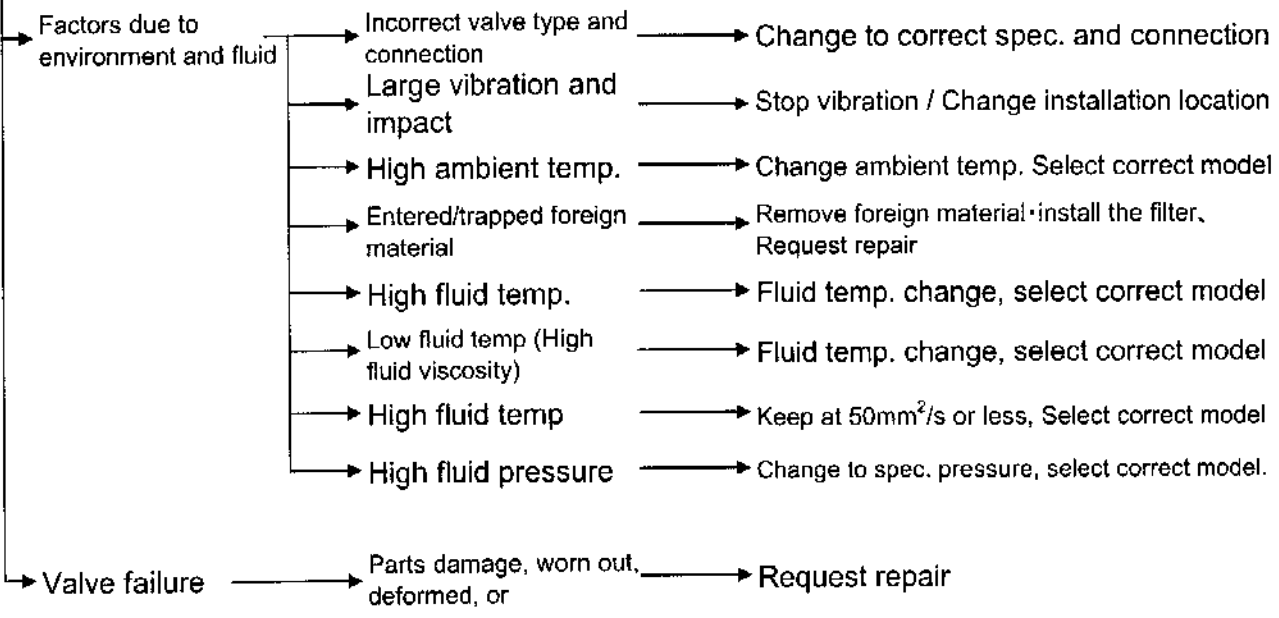
Follow procedures below in case of trouble during operation

Non-conforman	Causes	Remedies	
<p>Not turn on (See "Air tightness failure" for leakage)</p>	Electrical factor	<ul style="list-style-type: none"> → Incorrect valve type and connection → Change to correct spec. and connection → Power supply is not turned on → Check the power supply and circuit → Wiring failure or incorrect wiring → Check the power supply and circuit → Low voltage → Voltage adjustment → Frequency difference → Change to correct valve 	
	Factors due to environment and fluid	<ul style="list-style-type: none"> → Incorrect valve type and connection → Change to correct spec. and connection → Large vibration and impact → Stop vibration / Change installation location → High ambient temp. → Change ambient temp., Select correct model → Entered/trapped foreign material → Remove foreign material • install the filter → High fluid temp. → Fluid temp. change, select correct model → Low fluid temp.(High fluid viscosity) → Fluid temp. change, select correct model → High fluid temp → Keep at 50mm²/s or less, Select correct model → High fluid pressure → Change to spec. pressure, select correct model. 	
	Valve failure	<ul style="list-style-type: none"> → Lead wire disconnected → Request repair → Parts damage, worn out, deformed, or deteriorated → Request repair → Coil / substrate burnout(See below for causes) → Request repair <ul style="list-style-type: none"> • High voltage, surge voltage etc. generated → Check the power supply and circuit • Constantly exposed to water drops → Take measure to be resisting against water 	
	<p>Not turn off (See "Air tightness failure" for leakage)</p>	Electrical factor	<ul style="list-style-type: none"> → Incorrect valve type and connection → Change to correct spec. and connection → Power supply is turned on → Check the power supply and circuit → wiring system failure → Check the power supply and circuit → Frequency difference → Change to correct valve → Incorrect valve type and connection → Change to correct spec. and connection → High leak voltage → Adjust the voltage to be at spec. value or lower → Frequency difference → Change to correct valve

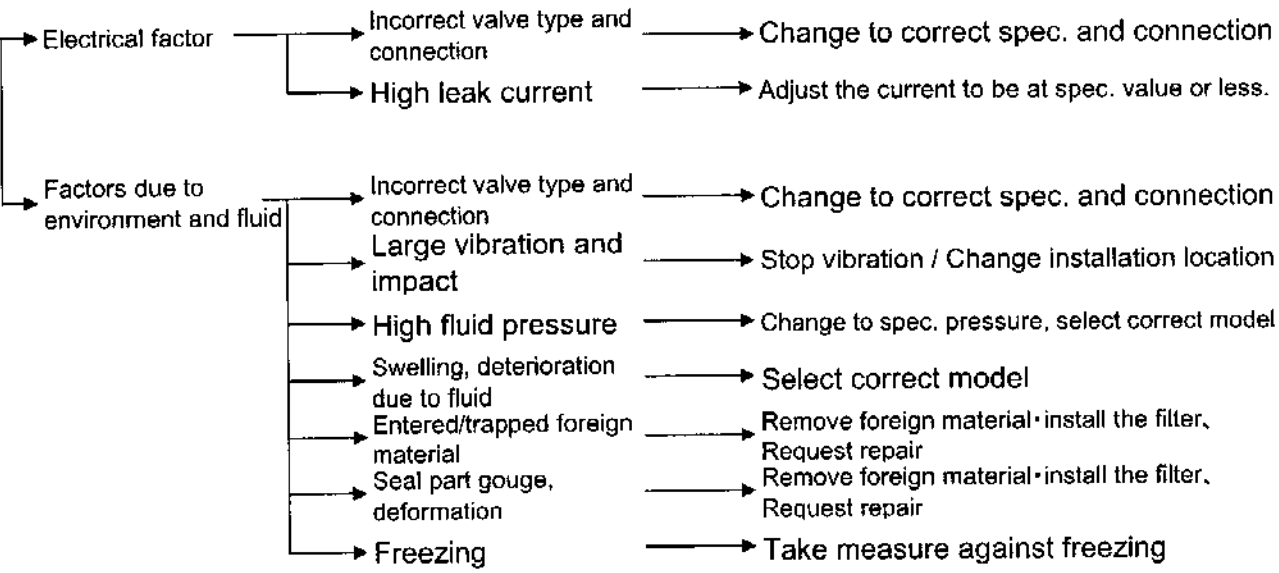
Non-conforman

Causes

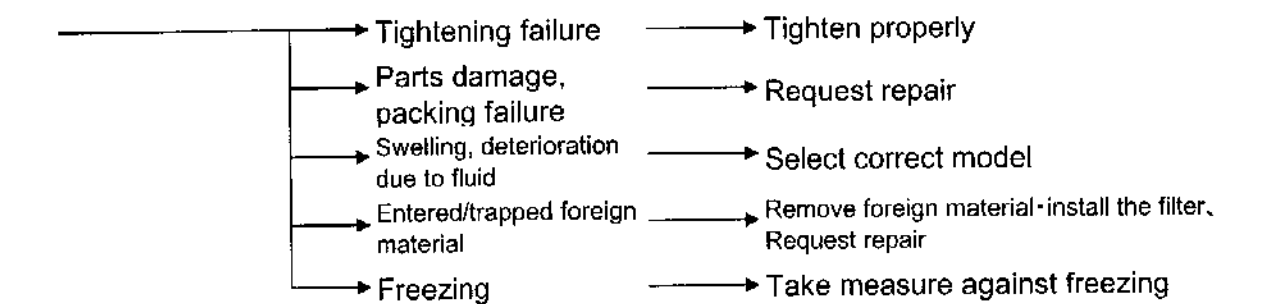
Remedies



Air tightness failure (Internal leak)



Air tightness failure (External leakage)



Valve growling

