



Installation and Maintenance Manual
VXS Zero Pressure Differential Type
Pilot operated 2 port solenoid valve
For Steam and Heated water



1 Safety Instructions

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of “Caution”, “Warning” or “Danger”, followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

Caution	Indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.
Warning	Indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.
Danger	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.

Warning

- **The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**
Since the products specified here can be used in various operating

conditions, their compatibility with a specific system must be based on specifications or after analysis and/or tests to meet specific requirements.

- **Only trained personnel should operate pneumatically operated machinery and equipment.**

The fluid can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of the system should be performed by trained and experienced personnel.

- **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 after confirmation of safe locked-out control positions. Measures to prevent danger from the fluid should also be taken.

2) When equipment is to be removed, confirm the safety processes as mentioned above. Release the fluid pressure and be certain there is no danger from fluid leakage or fluid remaining in the system. Switch off electrical supplies.

3) Before machinery/equipment is re-started, ensure all safety measures are being implemented.

- **Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:**

- 1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.
- 2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, 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.

Caution

- Ensure that the air supply system is filtered to 5 m.

2 Specifications

2.1 General Specifications

Valve specifications	Valve construction		Zero differential pressure pilot operated 2 port piston type
	Withstand pressure (with water)		2.0 MPa
	Maximum system pressure		1.0 MPa
	Maximum operating pressure differential		1.0 MPa
	Minimum operating pressure differential		0 MPa ^{Note 1)}
	Body material		Brass (C37), Stainless steel
	Seal material ^(Note 3)		FKM
	Enclosure		Dust-tight, Water jet-proof type (IP65)
	Environment		Location without corrosive or explosive gases
Coil specifications	Rated voltage	AC	100 VAC, 200VAC, 110VAC, 230VAC, (220VAC, 240VAC, 48VAC, 24VAC) ^{Note 2)}
		DC	24 VDC
	Allowable voltage fluctuation		±10% of rated voltage
	Allowable leakage voltage	AC	5% or less of rated voltage
		DC	2% or less of rated voltage
	Coil insulation type		Class H

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the office of piping. Please contact SMC to check if the required valve size can be used in the application. Contact SMC for the compatibility of the circuit and valve size.
Note 2) Voltage in brackets () indicates special voltage.

2.2 Coil Specifications

2.2.1 Normally Closed (N.C.)

DC Specification

Model	Power consumption (W) ^{Note1)}	Temperature rise (°C) ^{Note2)}
VXS23/24	12	100
VXS25/26	15	100

Note 1: Power consumption: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%).

Note 2: The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.2.2 Normally Closed (N.C.)

AC Specification (Built-in Full-wave Rectifier Type)

Model	Apparent power (VA) ^{Note 1, 2)}	Temperature rise (°C) ^{Note 3)}
VXS23/24	12	100
VXS25/26	15	100

Note 1: Power consumption, apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)

Note 2: There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used for AC. (Built-in full-wave rectifier type).

Note 3: The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.3 Model/Valve specifications

For STEAM / Single Unit (Can be used with heated water)

Normally closed (N.C.)

C37, Stainless steel body

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Weight ^(Note) (g)
				Av (x 10 ⁻⁶ m ²)	Cv	
3	1/4	10	VXS235	58	2.4	600
	3/8			67	2.8	
4	1/2	15	VXS245	130	5.3	720
5	3/4	20	VXS255	220	9.2	1100
6	1	25	VXS265	290	12.0	1300

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal, 60g for Conduit terminal type.

Ambient and fluid temperature

Fluid	Temperature (°C)	Ambient temperature (°C)
Steam	183 or less	-20 to 60
Heated water	99 or less	

Note) With no freezing.

2 Specifications (continued)

Valve Internal Leakage Rate

Fluid	Seal Material	Leakage rate ^{Note)}
Steam	FKM	1 cm ³ /min or less
Heated water		0.1 cm ³ /min or less

Valve External Leakage Rate

Fluid	Seal Material	Leakage rate ^{Note)}
Steam	FKM	1 cm ³ /min or less
Heated water		0.1 cm ³ /min or less

Note) Leakage is the value at ambient temperature 20°C.

2.4 Pneumatic Symbol

2.4.1 Valve

Valve	Symbol
Normally closed (N.C.)	

Table 1

3 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

3.1 VXS Valve Mounting Bracket

C37, Stainless steel (Bracket optional)

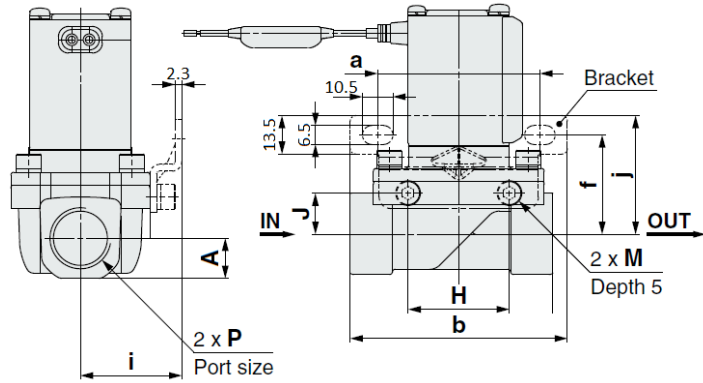


Figure 1

Model	Port size P	A (mm)	Bracket Mounting (mm)						
			a	b	f	i	j	H	J
VXS23	1/4, 3/8	10.5	56	75	30	31	37	35	10
VXS24	1/2	14	56	75	34	35	41	35	14
VXS25	3/4	17	70.5	92	39	43	46	33	15.2
VXS26	1	20	70.5	92	41	45	48	37	17.2

Table 2

3 Installation (continued)

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water, water, water vapour are present or where there is direct contact with any of these.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact. Check the product specifications.
- Do not mount in a location exposed to radiant heat.
- Employ suitable protective measures in locations where there is contact with water droplets, oil or welding splatter, etc.

3.3 Piping

Caution

- Before connecting piping, it should be thoroughly blown out with air (flushed) or washed to remove chips, cutting oil and other debris from inside the pipe.
- Avoid connecting ground lines to piping, as this may cause electrolytic corrosion of the system.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque, see Table 3.
- Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.
- When connecting piping, avoid mistakes regarding the supply port.
- Steam generated by a boiler contains a large amount of drainage; ensure to operate with a drain trap installed.
- Avoid installing piping to the valve at the lowest point of the layout. If condensate accumulates in the valve or adjacent piping, this could cause steam hammer. If steam hammer causes a problem, install a bypass to discharge condensate from the piping.

- If the effective area of the piping on the fluid supply side is restricted, the operating time may become unstable due to the differential pressure fluctuation when the valve is closed.

Thread	Tightening Torque N·m
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

Table 3

3 Installation (continued)

3.3.1 Valve Ports

C37, Stainless steel

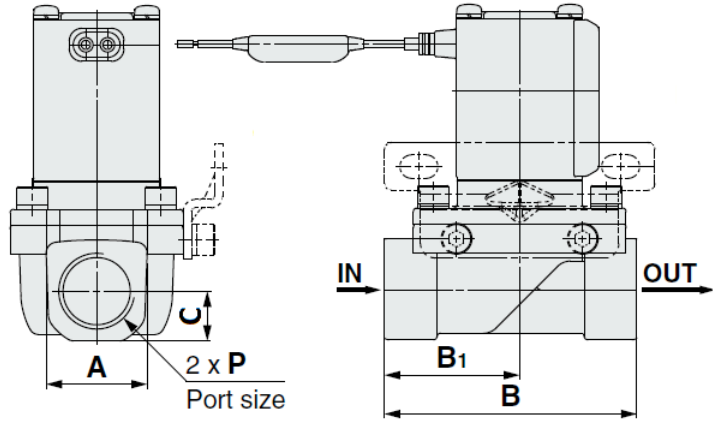


Figure 2

3 Installation (continued)

Model	Port size P (Rc)	Valve Ports (mm)			
		A	B	B1	C
VXS23	1/4, 3/8	21	57	28.5	10.5
VXS24	1/2	28	70	37.5	14
VXS25	3/4	33.5	71	38.5	17
VXS26	1	42	95	49.5	20

Table 4

3.4 Electrical connection

Caution

- Avoid mis-wiring, as this can cause malfunction, damage and fire to the product.
- To prevent noise and surge in signal lines, keep all wiring separate from power lines and high voltage lines. Otherwise this can cause malfunction.
- When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, use an option that comes with surge voltage protection circuit.
- Use electrical circuits that do not generate chattering in their contacts.
- Use voltage that is within $\pm 10\%$ of the rated voltage. In cases with a DC power supply where responsiveness is important, stay within $\pm 5\%$ of the rated value. (The voltage drop is the value in the lead wire section connecting the coil).
- Generally use electrical wire with cross sectional area 0.5 to 1.25 mm².
- Do not bend or pull cables repeatedly.
- Do not allow excessive force to be applied to the lines.
- Do not apply AC voltage to AC type unless it has a built in full-wave rectifier or it will be damaged.

3.4.1 Grommet

Class H coil: AWG18 Outside insulator diameter of 2.1 mm

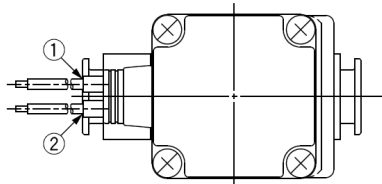


Figure 3

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

*There is no polarity

Table 5

3.4.2 DIN Terminal

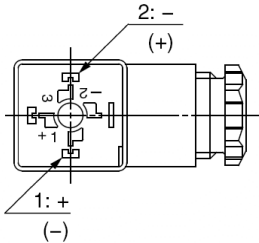


Figure 4

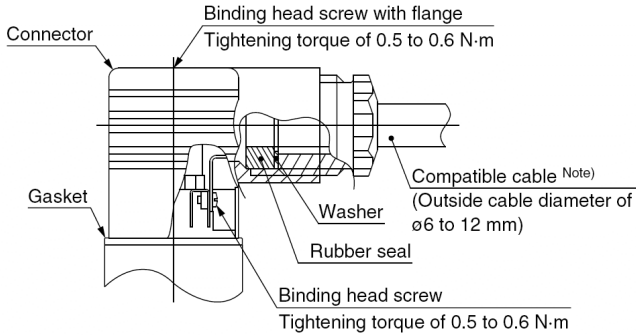
Terminal no.	1	2
Din Terminal	+(-)	-(+)

*There is no polarity

Table 6

- Use a heavy-duty cord with an outside cable diameter of $\varnothing 6$ to 12 mm.
- Tighten screws and fittings according to Figure 5.

3 Installation (continued)



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

Figure 5

Caution

- For class H coil, surge voltage suppressor and full-wave rectifier (for AC) are on DIN connector side. **A SMC DIN connector must be used.** Part numbers can be found in product catalogue.

3.4.3 Conduit Terminal

- Make connections according to the marking shown in Figure 6.
- Tighten screws and fittings according to Figure 6.
- Properly seal the terminal connection (G1/2) with special wiring conduit, etc.

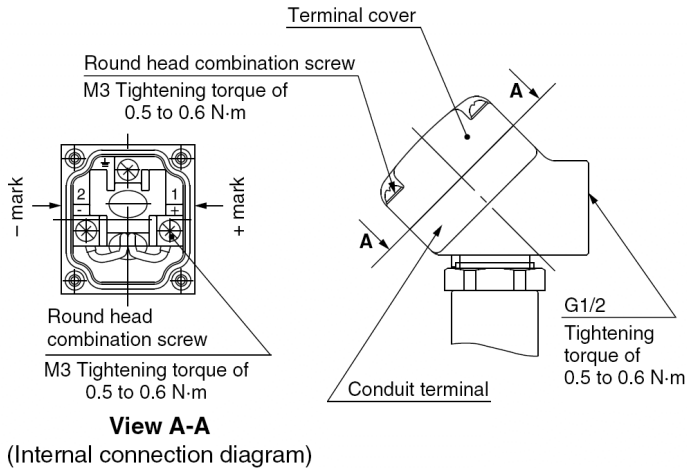


Figure 6

3 Installation (continued)

3.4.4 Conduit

- When used as an IP65 equivalent use seal (VCW20-15-6) to install the wiring conduit.
- Tighten conduit to torque shown in Figure 7.

Class H coil: AWG18 Outside insulator diameter of 2.1 mm

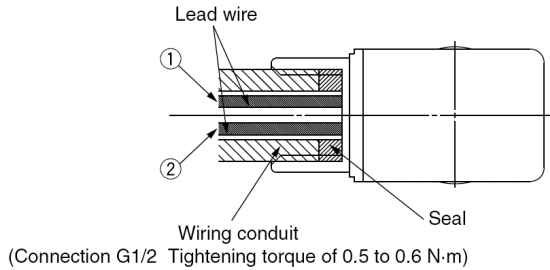


Figure 7

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

*There is no polarity

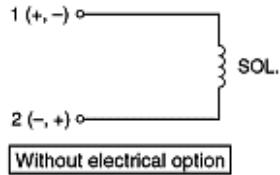
(For the power saving type, there is polarity)

Table 7

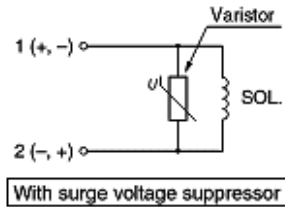
3.5 Electrical circuits

3.5.1 DC circuit

Grommet



DIN terminal



DIN terminal, Conduit terminal

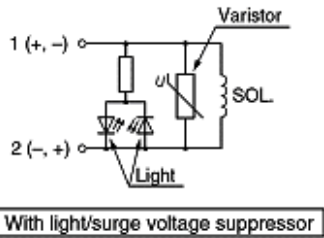
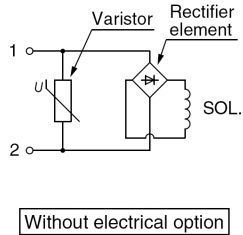


Figure 8

3.5.2 AC circuit

Grommet, DIN terminal, Conduit terminal, Conduit



DIN terminal, Conduit terminal

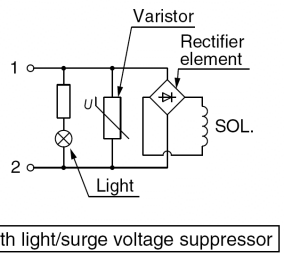


Figure 9

3 Installation (continued)

3.6 Mounting

- Secure with brackets, except in the case of steel piping and copper fittings.
- Avoid sources of vibration, or adjust the distance from the body to a minimum length so that resonance will not occur.
- 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.
- Do not apply external force to the coil section:
When tightening fittings, apply a wrench or other tool to the outside of the piping connection parts.
- Do not install with the coil downwards.
If a valve is mounted with the coil positioned downwards, foreign objects in the fluid will adhere to the iron core leading to a malfunction.
- 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.
- Painting and coating:
Warnings or specifications printed or labeled on the product should not be erased, removed or covered up.

3.7 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, use turbine oil Class 1 (no additive), ISO VG32.
- Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

4 How to Order

Refer to the catalogue for this product.

5 Outline Dimensions (mm)

Refer to the catalogue for this product.

6 Maintenance

6.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous. Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.
- Exhaust the drainage from the piping periodically.

Warning

6.2 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 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. Remove the valve, ensuring any seals are retained.

6 Maintenance (continued)

6.3 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 every 6 months.



Caution

6.4 Filters and strainers:

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

6.5 Lubrication:

- When using after lubricating, never forget to lubricate continuously.

6.6 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.

7 Limitations of Use



Warning

- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.

7.1 Confirm the specifications:

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

7.2 Fluid:

- Type of fluid;
Before using a fluid, confirm whether it is compatible with the materials for each model by referring to the fluids listed in the catalogue.
- Corrosive gas;
Cannot be used since it will cause cracks by stress corrosion or result in other incidents.
- When a brass body is used, then depending on water quality, corrosion and internal leakage may occur. If such abnormalities occur, exchange the product for stainless steel body.
- Use an oil-free specification when any oily particles must not enter the system.
- Applicable fluid in the catalogue list may not be suitable depending on the operating conditions. Give adequate consideration and then determine a suitable model, as the compatibility list is for general case.

7.3 Fluid quality: Steam, Water

- The use of a fluid that 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.
- However, the size and shape of foreign objects that occur depends on the operating environment. Check the fluid state and choose an appropriate mesh size.
- The supply water to a boiler includes materials that create a hard sediment or sludge such as calcium and magnesium. Sediment and sludge from steam can cause the valve not to operate properly. Install a water softening device which removes these materials.
- Do not use steam which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases etc., as these can cause damage or deterioration.
- As the special FKM used in this product has higher alkali resistance than general FKM, it can be used with steam containing boiler compounds. However, the resistance to other chemicals such as organic solvents is the same as general FKM. Please confirm resistance to the components of the boiler compound before use.

7 Limitations of Use (continued)

7.4 Leakage voltage:

When connecting C-R element parallel to switching element, leakage current flows through C-R element and the leakage voltage increases.

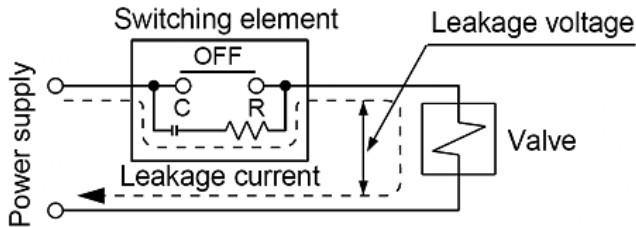


Figure 10

Ensure that the voltage leakage across the coil is as follows:

AC coil: 5% or less of rated voltage.

DC coil: 2% or less of rated voltage.

7.5 Low temperature operation:

- The valve can be used in an ambient temperature of between -10 to -20°C. However, take measures to prevent the water from freezing or solidification of impurities, etc.
- When using valves for water application in cold environments, take appropriate countermeasures to prevent water freezing in the system, after the water supply from the pump is cut off, by draining the water, etc.
- When warming by a heater, etc, be careful not to expose the coil assembly to the heater.
- For air, installation of a drier and heat retaining of the body is recommended to prevent a freezing condition in which the dew point temperature is higher than the ambient temperature.

7.6 Cannot be used as an emergency shut-off valve etc.

- This product is not designed for safety applications such as an emergency shut-off valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

7.7 Extended periods of continuous energization

- The solenoid coil will generate heat when continuously energized, so avoid installing in an enclosed space. Install in a well-ventilated area.
- Do not touch the coil while it is being energized or immediately after energization.
- Be especially careful when using three or more adjacent valves with manifolds and keeping them continuously energized for extended periods, as this may result in dramatic increases in temperature.

7.8 Liquid circuits

- In cases with flowing liquid, provide a bypass valve in the system to prevent the formation of a sealed circuit.

7.9 Steam hammer

- When problems are caused by steam hammer, install steam hammer relief equipment (accumulator, etc.).

7.10 Back pressure

- If there is a possibility of back pressure being applied to the valve, take countermeasures such as mounting a check valve on the downstream side of the valve.

7.11 Pressure holding

- Not suitable for an application such as holding pressure inside a pressure vessel, because the valve has some leakage.

7.12 Usage with low flow

- Unstable flow may occur under the following conditions;
Low flow from the pump or boiler, etc.
Use of several elbows or tees in the circuit.
Thin nozzles installed at the end of piping, etc.

7 Limitations of Use (continued)

These can cause valve opening/closing failure or oscillation and cause a valve malfunction.

- Check the pressure differential and flow to select the appropriate size of valve by referring to the flow rate characteristics. Ensure the pressure differential does not become less than 0.01MPa during ON (N.C.: Valve Open).

7.13 Rapid pressure changes

- If used in conditions in which rapid decrease in the inlet pressure and rapid increase in the outlet pressure of the valve are repeated, excessive stress will be applied to the piston, which causes damage to the piston, leading to malfunction of the valve.
Check the operating conditions before use.

7.14 Sudden inlet pressure increase

- When valve is closed and pressure is applied suddenly due to starting of fluid supply source, such as boiler, the valve may open momentarily and fluid may leak.

8 Contacts

AUSTRIA	(43) 2262 62280-0	LATVIA	(371) 781 77 00
BELGIUM	(32) 3 355 1464	LITHUANIA	(370) 5 264 8126
BULGARIA	(359) 2 974 4492	NETHERLANDS	(31) 20 531 8888
CZECH REP.	(420) 541 424 611	NORWAY	(47) 67 12 90 20
DENMARK	(45) 7025 2900	POLAND	(48) 22 211 9600
ESTONIA	(372) 651 0370	PORTUGAL	(351) 21 471 1880
FINLAND	(358) 207 513513	ROMANIA	(40) 21 320 5111
FRANCE	(33) 1 6476 1000	SLOVAKIA	(421) 2 444 56725
GERMANY	(49) 6103 4020	SLOVENIA	(386) 73 885 412
GREECE	(30) 210 271 7265	SPAIN	(34) 945 184 100
HUNGARY	(36) 23 511 390	SWEDEN	(46) 8 603 1200
IRELAND	(353) 1 403 9000	SWITZERLAND	(41) 52 396 3131
ITALY	(39) 02 92711	UNITED KINGDOM	(44) 1908 563888

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