



Installation and Maintenance Manual

VDW10/20 Compact direct operated 2 Port Solenoid Valve

For Air, Medium Vacuum, 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 microns.

2 Specifications

2.1 General Specifications

Valve specifications		Direct operated poppet	
		Valve construction	Withstand pressure
		2.0 MPa (Resin body type 1.5 MPa)	
		1.0 MPa	
Body material		Aluminium, Resin, Brass (C37), Stainless steel	
Seal material		NBR, 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)	DC
		Allowable voltage fluctuation	
		±10% of rated voltage	
Allowable leakage voltage		AC (With full wave rectifier)	10% or less of rated voltage
		DC	2% or less of rated voltage
Coil insulation type		Class B	

Note : Voltage in (brackets) indicates special voltage.

2.2 Coil Specifications

2.2.1 Normally Closed (N.C.)

DC Specification

Size	Power consumption (W) (Note1)	Temperature rise (C°) (Note2)
1	2.5	60
2	3	60

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: 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)

Class B

Size	Apparent Power (VA) (Note1,2)	Temperature rise (C°) (Note3)
1	2.5	60
2	3	60

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 in the AC.

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

2.3.1 For AIR/Single Unit

2.3.1.1 Normally closed (N.C.)

Aluminium Body Type

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa) Pressurised port 1	Wt (g)
				C [dm ³ /s.bar]	b	Cv		
2	M5, 1/8	1.6	VDW20	0.30	0.45	0.07	0.7	80
		2.3		0.58	0.45	0.18	0.4	
		3.2		1.10	0.38	0.30	0.2	

2 Specifications (continued)

Resin Body Type (Built-in One-touch fittings)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa) Pressurised port 1	Wt (g)
				C [dm ³ /s.bar]	b	Cv		
1	M5 Ø3.2 Ø4	1.0	VDW10	0.14	0.40	0.04	0.9	45
		1.6		0.30	0.25	0.07	0.4	
2	M5 Ø4 Ø6	1.8	VDW20	0.30	0.45	0.07	0.7	80
		2.3		0.58	0.45	0.18	0.4	
		3.2		1.10	0.38	0.30	0.2	

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 50 (Note)	-10 to 50

Note: Dew point temperature -10°C or less

2.3.2 For MEDIUM VACUUM/Single Unit

2.3.2.1 Normally closed (N.C.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa) Pressurised port 1	Wt (g)
				C [dm ³ /s.bar]	b	Cv		
1	M5	1.0	VDW14	0.14	0.40	0.04	0.9	65 (60)
		1.6		0.30	0.25	0.07	0.4	
2	M5 1/8	1.8	VDW24	0.30	0.45	0.07	0.7	115 (100)
		2.3		0.58	0.45	0.18	0.4	
		3.2		1.10	0.38	0.30	0.2	

Note 1: Operating pressure range for Vacuum is 0.1 to Atmospheric pressure (Pa-abs)

Note 2: Weight of stainless steel body is shown in (brackets).

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 50 (Note)	-10 to 50

Note: With no freezing

2.3.3 For WATER /Single Unit

2.3.3.1 Normally closed (N.C.)

Brass, Stainless Steel Body Type

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa) Pressurised port 1	Wt (g)
				AV (x 10 ⁻⁶ m ³)	Conversion Cv		
1	M5	1.0	VDW12	0.96	0.04	0.9	65 (60)
		1.6		1.70	0.07	0.4	
2	M5 1/8	1.8	VDW22	1.70	0.07	0.7	115 (100)
		2.3		4.30	0.18	0.4	
		3.2		7.20	0.30	0.2	

Note: Weight of stainless steel body is shown in (brackets).

Resin Body Type (Built-in One-touch fittings)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa) Pressurised port 1	Wt (g)
				AV (x 10 ⁻⁶ m ³)	Conversion Cv		
1	M5 Ø3.2 Ø4	1.0	VDW12	0.96	0.04	0.9	45
		1.6		1.70	0.07	0.4	
2	M5 Ø4 Ø6	1.8	VDW22	1.70	0.07	0.7	80
		2.3		4.30	0.18	0.4	
		3.2		7.20	0.30	0.2	

2 Specifications (continued)

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 50 (Note)	-10 to 50

Note: With no freezing

2.4 Pneumatic Symbol

2.4.1 Valve

Valve	Symbol
Normally closed (N.C.)	
Vacuum (N.C.)	

Table 1

3 Installation

Warning

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

3.1 VDW Valve Mounting Bracket

3.1.1 Resin body – One touch fittings

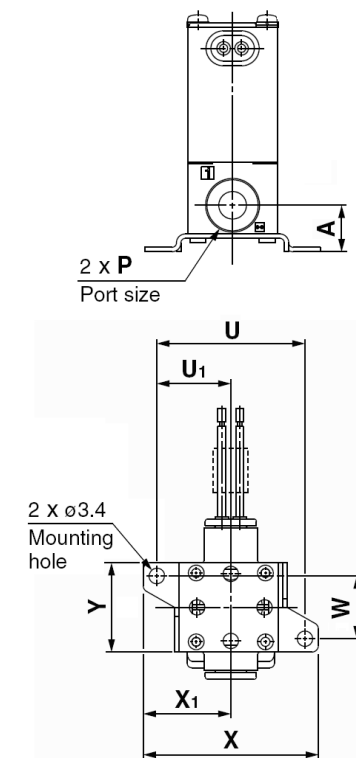


Figure 1

Size	One-touch Fitting P	A (mm)	Bracket Mounting (mm)					
			U	U ₁	W	X	X ₁	Y
1	Ø3.2, Ø4	9.5	28	14	11	34	17	17
2	Ø4, Ø6	10.5	33	16.5	14	39	19.5	20

Table 2

3 Installation (continued)

3.1.2 Resin body – Metric fitting

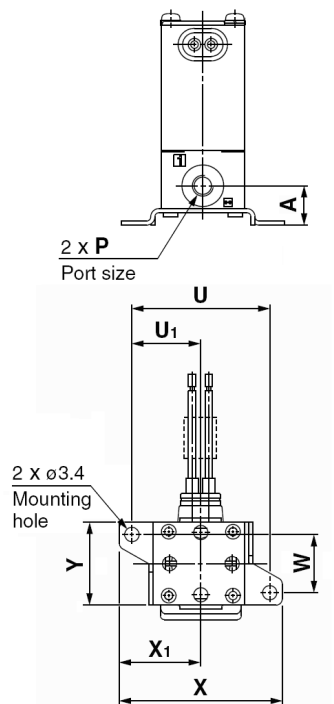


Figure 2

Size	Port size P	A (mm)	Bracket Mounting (mm)					
			U	U ₁	W	X	X ₁	Y
1	M5 (M6)	9.5	28	14	11	34	17	17
2	M5 (M6)	9.5	33	16.5	14	39	19.5	20

Table 3

3.1.3 Metal body – Aluminium, Stainless steel (Bracket optional)

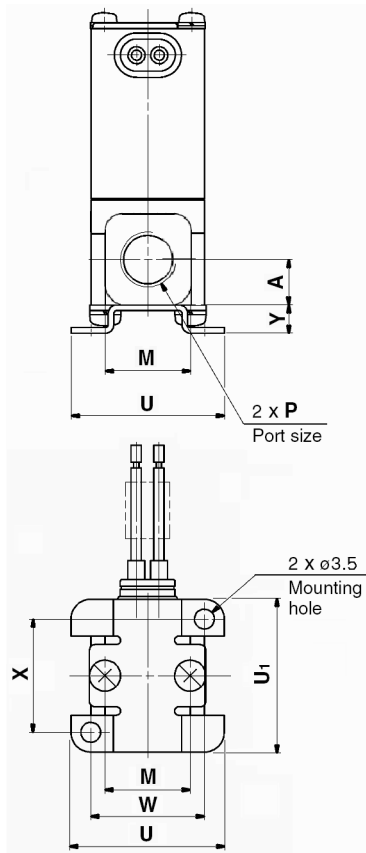


Figure 3

3 Installation (continued)

Size	Port size P	A (mm)	Bracket Mounting (mm)					
			M	U	U ₁	W	X	Y
1	M5	6	11	27	20	21	14	5
2	M5, 1/8	8	15	27	27	20	20	5

Note : Aluminium body only available for size 2.

Table 4

3.2 Environment



Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam 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 piping make sure to clean up chips, cutting oil, dust etc.
- 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.
- Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.
- Avoid connecting ground lines to piping, as this may cause electric corrosion of the system.
- In applications such as vacuum and non-leak specifications, use caution

against contamination of foreign objects and air tightness of fittings.

- Steam generated by a boiler contains a large amount of water vapour, ensure to operate with a drain trap installed.

Thread	Tightening Torque N•m
M5 ^{Note)}	1 to 1.5
M6 ^{Note)}	1 to 1.5
Rc 1/8	7 to 9

Note: For resin body type, the proper tightening torque is 0.4 to 0.5 N•m (reference value). After tightening by hand, tighten by an additional 1/6th rotation with a tool.

Table 5

3.3.1 Valve Ports

3.3.1.1 Metal body type

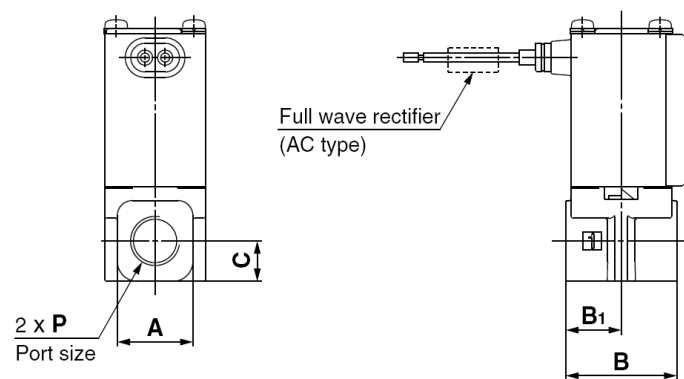


Figure 4

3 Installation (continued)

Size	Port size P (Rc)	Valve Ports (mm)			
		A	B	B1	C
1	M5	12 (15)	20	10	6
2	M5, 1/8	15 (20)	22	11	8

Dimensions in brackets () are for Brass body

Note : Aluminium body only available for size 2.

Table 6

3.3.1.2 Resin body type

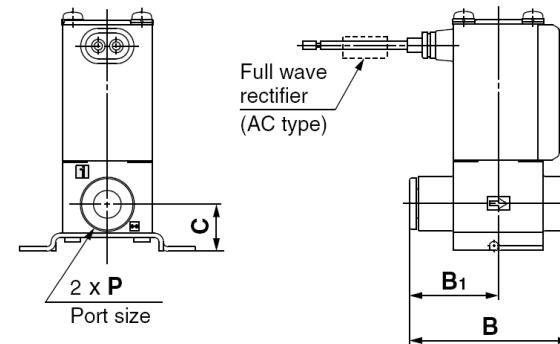


Figure 5

Size	One-touch Fitting P (mm)	Valve Ports (mm)		
		B	B1	C
1	Ø3.2, Ø4	32	17	9.5
2	Ø4, Ø6	36	20	10.5

Table 7

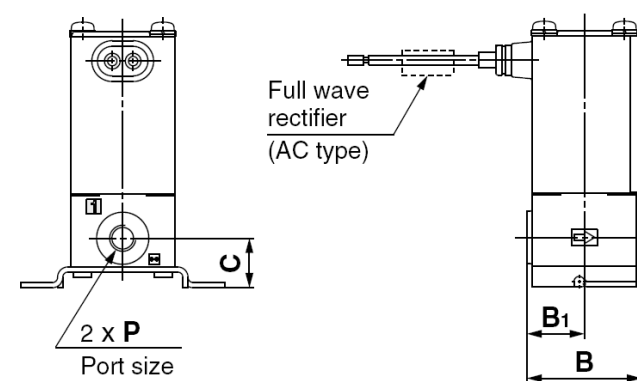


Figure 6

Size	Port size P	Valve Ports (mm)		
		B	B1	C
1	M5 (M6)	20	10	9.5
2	M5 (M6)	22	11	9.5

Table 8

3.3.2 Precautions for One-touch fittings

3.3.2.1 Attaching of tube.

- Use a tube having no flaws on its periphery and cut it off at a right angle.
- When cutting the tube use cutters TK-1, 2, or 3. Do not use pinchers, nippers or scissors, etc. If cutting is done with tools other than tube cutters, the tube may be cut diagonally or become flattened etc., making a secure installation impossible, and causing problems such as the tube pulling out after installation or air leakage. Allow some extra length in the tube.
- Grasp the tube and push it in slowly, inserting it securely all the way into the fitting.

3 Installation (continued)

- After inserting the tube, pull on it lightly to confirm that it will not come out. If it is not installed securely all the way into the fitting, this can cause problems such as air leakage or the tube pulling out.

- After connecting the tubing, care should be taken not to put excessive force (tensile force, compression, bending etc.) on the tubing.

3.3.2.2 Detaching the tube.

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

3.3.2.3 Other Tube Brands

- When tubing brands other than SMC's are used, verify the tubing O.D. satisfies the following accuracy;
 - Polyolefin tubing: Within ±0.1 mm
 - Polyurethane tubing: Within +0.15 mm, within -0.2 mm
 - Nylon tubing: Within ±0.1 mm
 - Soft nylon tubing: Within ±0.1 mm

- Do not use tubing what does not meet these outside diameter tolerances. It may not be possible to connect them or they may cause other problems such as air leakage or the tube pulling out of the connection.

3.3.2.4 Recommended piping conditions

- When connecting tubes using one-touch fittings, provide some spare tube length as shown in Figure 7

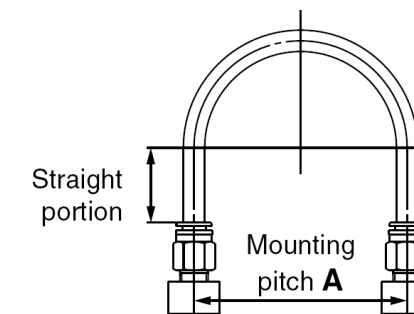


Figure 7

Tube Size	Mounting pitch A (mm)			Straight portion length (mm)
	Nylon tube	Soft nylon tube	Polyurethane tube	
Ø3.2 mm	44 or more	29 or more	25 or more	16 or more
Ø4 mm	56 or more	30 or more	26 or more	20 or more
Ø6 mm	84 or more	39 or more	39 or more	30 or more

Table 9

- Do not apply external force to the fitting when binding tubes with bands, etc. see Figure 8
- During use, deterioration of the tubing or damage to the fittings could cause the tubing to come loose from their fittings and thrash about. To prevent uncontrolled tube movement, install protective covers or fasten tubes securely in place.

3 Installation (continued)

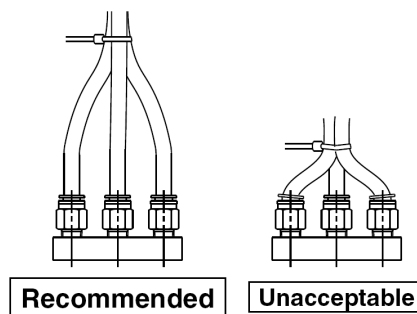


Figure 8

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 mm^2 .
- Do not bend or pull cables repeatedly.

3.4.1 Grommet

Class B coil: AWG20 Outside insulator diameter of 1.8 mm

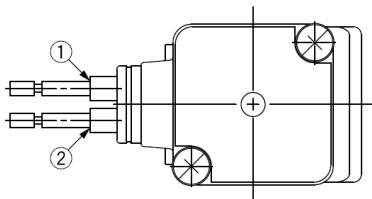


Figure 9

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

Note: There is no polarity

Table 10

3.5 Electrical circuits

3.5.1 DC circuit

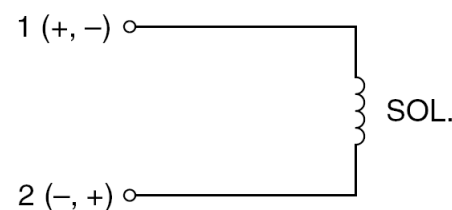


Figure 10

3 Installation (continued)

3.5.2 AC circuit

- For AC (Class B), the standard product is equipped with surge voltage suppressor.

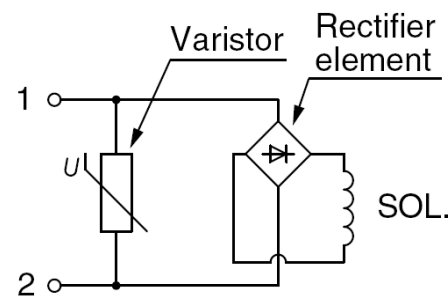


Figure 11

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.
- Install with the coil positioned upwards. 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. Especially for low leakage applications, such as with vacuum and non-leak specifications, the coil must be positioned upwards.

- 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.

6 Maintenance (continued)

- 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 drain from an air filter 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.

6.3 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 0.1 MPa .

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. Use a fluid with a dynamic viscosity of $50 \text{ mm}^2/\text{s}$ or less.
- Flammable oil, Gas; Confirm the specification for leakage in the interior and/or exterior area.
- Corrosive gas; Cannot be used since it will cause cracks by stress corrosion or result in other incidents.
- 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:

- The use of a fluid what 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.

7 Limitations of Use (continued)

- Install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 80 to 100 mesh.
- When the valve is used to supply tap water, substances such as calcium and magnesium, which generate hard scale and sludge, are present. 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.
- Depending on water quality, a brass body can incur corrosion and internal leakage may occur. If such abnormalities occur, exchange the product for a stainless steel body.
- When using water or heated water, poor operation or leaks maybe caused by dezincification, erosion, corrosion, etc.

7.4 Air quality:

- 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 of the valve.
- Install air filters; Install air filters upstream, close to the valves. A filtration of $5 \mu\text{m}$ or less should be selected.
- Install an air drier or after cooler; Compressed air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air drier or after cooler, etc.
- If excessive carbon powder is generated, eliminate it by installing mist separators upstream of the valves. If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

7.5 Vacuum:

- Please be aware there is a range of pressure that can be used.
- Do not use for applications such as holding the pressure (including vacuum) inside a pressure vessel because of air leakage in the valve.
- Vacuum piping direction:

If the system uses a vacuum pump, install the pump on the secondary side.

Also, install a filter on the primary side, ensuring no foreign material is admitted.

7.6 Leakage voltage:

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

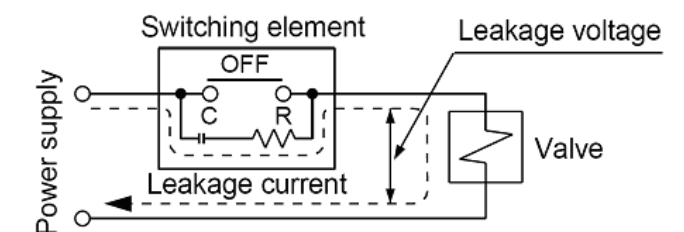


Figure 12

Ensure that the voltage leakage across the coil is as follows:
AC/Class B built-in full-wave rectifier coil: 10% or less of rated voltage.
DC coil: 2% or less of rated voltage.

7.7 Countermeasures against static electricity

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

7.8 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.

7 Limitations of Use (continued)

- 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.

7.9 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.

7.10 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.

7.11 Liquid circuits

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

7.12 Water hammer

- When problems are caused by water hammer, install water hammer relief equipment (accumulator, etc.), or use a SMC water hammer relief valve (e.g. VXR series).

7.13 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.

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
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GREECE	(30) 210 271 7265	SPAIN	(34) 945 184 100
HUNGARY	(36) 23 511 390	SWEDEN	(46) 8 603 1200
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