



# Installation and Maintenance Manual

## VX3 Direct Operated 3 Port Solenoid Valve

### For Water, Oil, Steam, Air



Read this manual before using this product

- The information within this document is to be used by pneumatically trained personnel only.
- For future reference, please keep manual in a safe place.
- This manual should be read in conjunction with the current catalogue.

## 1 SAFETY

### 1.1 General recommendation

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO4414 (Note1), JIS B 8370 (Note2) and other safety practices.

Note 1:ISO 4414:Pneumatic fluid power - General rules relating to systems.  
 Note 2:JIS B 8370:Pneumatic system axiom.

- 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.

### WARNING:

- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**
  - Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
- Only trained personnel should operate pneumatically operated machinery and equipment.**
  - Compressed air can be dangerous if an operator is unfamiliar with it Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.
- Do not service machinery/equipment or attempt to remove components until safety is confirmed.**
  - Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
  - When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
  - Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Bleed air into the system gradually to create backpressure, i.e. incorporate a soft-start valve).
- Contact SMC if the product is to be used in any of the following conditions:**
  - Conditions and environments beyond the given specifications, or if product is used outdoors.
  - Installations on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
  - 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 micron.

### 1.2 Conformity to standard

This product is certified to and complies with the following standards:

EMC Directive 89/336/EEC	EN 61000-6-2, EN 55011
Low Voltage Directive 93/68/EEC	DIN VDE 0580

## 2 INTENDED CONDITIONS OF USE

### 2.1 Specifications

Standard Specifications

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

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

Single Unit VX3

Port size	Orifice size (mmØ)	Model	Max. operating pressure differential (MPa)			Flow characteristics					Max. system pressure (MPa) Water, Oil, Air	Max. system pressure (MPa) Steam	(Note) Weight (g)
			Water, Oil, Air		Water, Oil, Steam, Air	Water, Oil, Steam		Air					
			N.C.	N.O.	COM	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted	C[dm <sup>3</sup> /(s-bar)]	b	Cv converted			
1/8 (6A)	1.5	VX311*-01	1	1	0.7	1.9	0.08	0.29	0.32	0.08	2.0	1.0	380
	2.2	VX312*-01	0.7	0.5	0.4	3.8	0.16	0.60	0.25	0.15			
	3	VX313*-01	0.3	0.3	0.2	5.8	0.24	0.82	0.20	0.20			
1/4 (8A)	1.5	VX311*-02	1	1	0.7	1.9	0.08	0.29	0.32	0.08	2.0	1.0	530
	2.2	VX312*-02	0.7	0.5	0.4	3.8	0.16	0.60	0.25	0.15			
		VX322*-02	1.2	1	0.7	4.6	0.19	0.64	0.40	0.17			
3/8 (10A)	1.5	VX311*-03	1	1	0.7	1.9	0.08	0.29	0.32	0.08	2.0	1.0	730
	2.2	VX312*-03	0.7	0.5	0.4	3.8	0.16	0.60	0.25	0.15			
	3	VX313*-03	0.3	0.3	0.2	5.8	0.24	0.82	0.20	0.20			

(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.

Manifold VX3

Orifice size (mmØ)	Model	Max. operating pressure differential (MPa)			Flow characteristics					Max. system pressure (MPa)
		Oil, Air			Oil		Air			
		N.C.	N.O.	COM	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted	C[dm <sup>3</sup> /(s-bar)]	b	Cv converted	
1.5	VX311*-00	1	1	0.7	1.9	0.08	0.29	0.32	0.08	2.0
2.2	VX312*-00	0.7	0.5	0.4	3.8	0.16	0.60	0.25	0.15	
	VX322*-00	1.2	1	0.7	4.6	0.19	0.64	0.40	0.17	
3	VX313*-00	0.3	0.3	0.2	5.8	0.24	0.82	0.20	0.20	2.0
	VX323*-00	0.6	0.5	0.3	7.9	0.33	1.1	0.25	0.27	
	VX333*-00	1	0.9	0.6						
4	VX324*-00	0.3	0.25	0.2	12	0.50	1.6	0.20	0.38	2.0
	VX334*-00	0.5	0.4	0.3						

Single Unit Operating Fluid and Ambient Temperature VX3

Power Source	Operating fluid temperature (°C)						Ambient temperature (°C)
	Solenoid valve option (symbol)						
	Water		Oil		Air		
	Nil, G, H	E, P	A, H	D, N	S, Q	Nil, G	V, M
DC/AC (Class B)	1 to 40	1-	-5 (Note1) to 40	-	183	-10 (Note2) to 60	-10 (Note2) to 40
AC (Class H)	-	1 to 99	-	-5 (Note1) to 120	-	-	-

(Note1) Dynamic viscosity: 50mm<sup>2</sup>/s or less.  
 (Note2) Dew point temperature: -10°C or less.

Manifold Operating Fluid and Ambient Temperature VX3

Power Source	Operating fluid temperature (°C)				Ambient temperature (°C)
	Solenoid valve option (symbol)				
	Oil		Air		
	A	D	Nil	V	
DC/AC (Class B)	-5 (Note1) to 40	-	-10 (Note1) to 60	-10 (Note1) to 40	-20 to 40
AC (Class H)	-	-5 (Note1) to 120	-	-	-20 to 60

(Note1) Dew point temperature: -10°C or less.

Single unit VXV3

Port size	Orifice size (mmØ)		Model	Operating pressure (MPa)		Flow characteristics					Max. system pressure (MPa)	(Note) Weight (g)	
	Port 1 side	Port 3 side		Port 1 side	Port 3 side	Passage 1↔2			Passage 2↔3				
						C[dm <sup>3</sup> /(s-bar)]	b	Cv	C[dm <sup>3</sup> /(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		
	3	1.5	VXV3130-02	Low vacuum	0 to 0.5	0.82	0.20	0.20	0.29	0.32	0.08		
1/4 (8A)	1.5	3	VXV3132-02	0 to 0.5	Low vacuum	0.29	0.32	0.08	0.82	0.20	0.20	2.0	530
	4	2.2	VXV3240-02	Low vacuum	0 to 0.5	1.6	0.20	0.38	0.64	0.40	0.17		
			VXV3340-02	0 to 0.9	Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38		
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	2.0	730
			VXV3340-03	0 to 0.9	Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38		
	2.2	4	VXV3242-03	0 to 0.5	Low vacuum	0.64	0.40	0.17	1.6	0.20	0.38		

(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.

Manifold VXV3

Port 1 side	Port 3 side	Model	Operating pressure (MPa)		Flow characteristics					Max. system pressure (MPa)	
			Port 1 side	Port 3 side	Passage 1↔2			Passage 2↔3			
					C[dm <sup>3</sup> /(s-bar)]	b	Cv	C[dm <sup>3</sup> /(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	
2.2	4	VXV3242-00	0 to 0.5	Low vacuum	0.64	0.40	0.17	1.60	0.20	0.38	2.0
		VXV3342-00	0 to 0.9	Low vacuum	0.64	0.40	0.17	1.60	0.20	0.38	

Single Unit Operating Fluid and Ambient Temperature VXV3

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

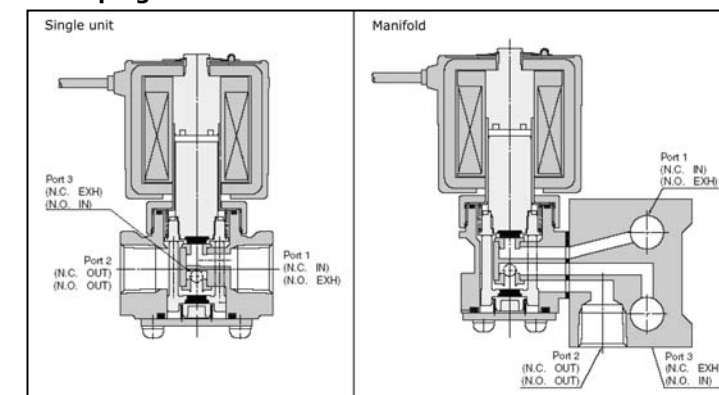
(Note 1) Dew point temperature:-10°C or less

Manifold Operating Fluid and Ambient Temperature VXV3

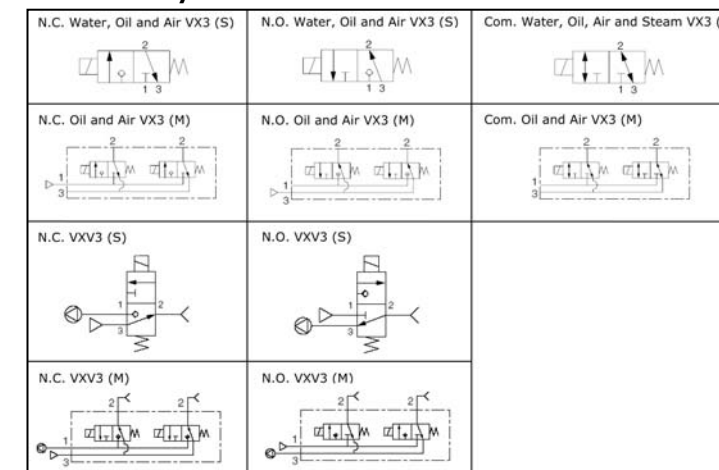
Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
AC (ClassB), DC	-10 (Note 1) to 60	-20 to 40

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

### 2.2 Piping



### 2.3 Circuit Symbols



## 3 INSTALLATION

### WARNING:

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

### 3.1 Environment

#### WARNING:

- Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.
- Do not use in an explosive atmosphere.
- The product should not be exposed to prolonged sunlight. Use a protective cover.
- Do not mount the product in a location where it is subject to strong vibrations and/or shock. Check the product specifications for above ratings.
- Do not mount the product in a location where it is exposed to radiant heat.

### 3.2 Piping

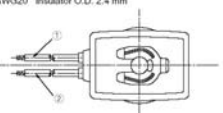
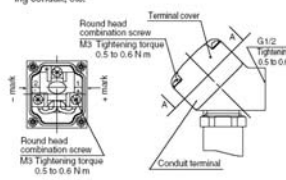
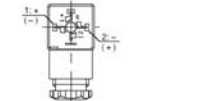
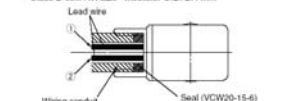
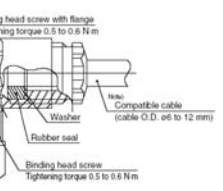
#### CAUTION:

- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fitting into a port, ensure that sealant material does not enter the port inside. When using seal tape, leave 1.5 to 2 threads exposed on the end of pipe/fitting.

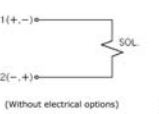
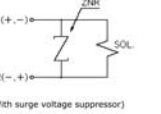
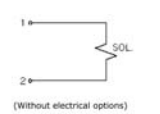
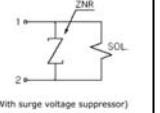
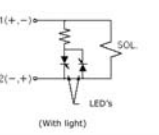
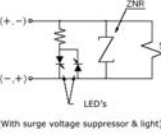
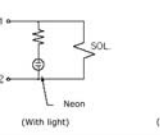
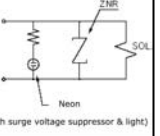
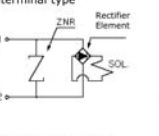
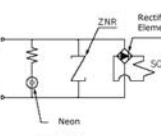

Thread	Appropriate tightening torque (Nm)
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30

### 3.3 Electrical connection

- CAUTION:**
- When DC power is connected to a solenoid valve equipped with light and/or surge voltage suppressor, check for polarity indications.
  - For polarity indications:
    - No diode to protect polarity: if polarity connection is wrong, the diode in the valve or switching device at control equipment or power supply may be damaged.
    - With diode to protect polarity: if polarity connection is wrong, the valve does not switch.
  - As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25mm<sup>2</sup> for wiring. Furthermore, do not allow excessive force to be applied to the lines.
  - Use electrical circuits which do not generate chattering in their contacts.
  - Use voltage which is within ±10% of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within ±5% of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
  - 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.)

<b>Grommet</b> Class H coil: AWG18 Insulator O.D. 2.2 mm Class B coil: AWG20 Insulator O.D. 2.4 mm 		<b>Conduit terminal</b> 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. 																												
<table border="1"> <thead> <tr> <th rowspan="2">Rated voltage</th> <th colspan="2">Lead wire color</th> </tr> <tr> <th>①</th> <th>②</th> </tr> </thead> <tbody> <tr> <td>DC (Class B only)</td> <td>Black</td> <td>Red</td> </tr> <tr> <td>100 VAC</td> <td>Blue</td> <td>Blue</td> </tr> <tr> <td>200 VAC</td> <td>Red</td> <td>Red</td> </tr> <tr> <td>Other AC</td> <td>Gray</td> <td>Gray</td> </tr> </tbody> </table> <p>* There is no polarity. (For the low power consumption type, there is polarity.)</p>		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	<p>View A-A (Internal connection diagram)</p>											
Rated voltage	Lead wire color																													
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DC (Class B only)	Black	Red																												
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200 VAC	Red	Red																												
Other AC	Gray	Gray																												
<b>Din connector (Class B only)</b> Since internal connections are as shown below for the DIN connector, make connections to the power supply accordingly. 		<b>Conduit</b> 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 																												
<table border="1"> <thead> <tr> <th>Terminal no.</th> <th>1</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>DIN terminal</td> <td>+ (-)</td> <td>- (+)</td> </tr> </tbody> </table> <p>* There is no polarity.                  • Use compatible heavy duty cords with cable O.D. of ø6 to 12.                  • Use the tightening torques below for each section.</p>		Terminal no.	1	2	DIN terminal	+ (-)	- (+)	<table border="1"> <thead> <tr> <th rowspan="2">Rated voltage</th> <th colspan="2">Lead wire color</th> </tr> <tr> <th>①</th> <th>②</th> </tr> </thead> <tbody> <tr> <td>DC</td> <td>Black</td> <td>Red</td> </tr> <tr> <td>100 VAC</td> <td>Blue</td> <td>Blue</td> </tr> <tr> <td>200 VAC</td> <td>Red</td> <td>Red</td> </tr> <tr> <td>Other AC</td> <td>Gray</td> <td>Gray</td> </tr> </tbody> </table> <p>* There is no polarity for DC. (For the low power consumption type, there is polarity.)</p> <table border="1"> <thead> <tr> <th>Description</th> <th>Part no.</th> </tr> </thead> <tbody> <tr> <td>Seal</td> <td>VCW20-15-6</td> </tr> </tbody> </table> <p>Note) Please order separately.</p>		Rated voltage	Lead wire color		①	②	DC	Black	Red	100 VAC	Blue	Blue	200 VAC	Red	Red	Other AC	Gray	Gray	Description	Part no.	Seal	VCW20-15-6
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Description	Part no.																													
Seal	VCW20-15-6																													
<b>Connector</b> Binding head screw with flange Tightening torque 0.5 to 0.6 N·m 		<table border="1"> <thead> <tr> <th rowspan="2">Rated voltage</th> <th colspan="2">Lead wire color</th> </tr> <tr> <th>①</th> <th>②</th> </tr> </thead> <tbody> <tr> <td>DC</td> <td>Black</td> <td>Red</td> </tr> <tr> <td>100 VAC</td> <td>Blue</td> <td>Blue</td> </tr> <tr> <td>200 VAC</td> <td>Red</td> <td>Red</td> </tr> <tr> <td>Other AC</td> <td>Gray</td> <td>Gray</td> </tr> </tbody> </table> <p>* There is no polarity for DC. (For the low power consumption type, there is polarity.)</p>		Rated voltage	Lead wire color		①	②	DC	Black	Red	100 VAC	Blue	Blue	200 VAC	Red	Red	Other AC	Gray	Gray										
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100 VAC	Blue	Blue																												
200 VAC	Red	Red																												
Other AC	Gray	Gray																												

### 3.4 Electrical Circuits

<b>DC Circuit</b> Grommet, Conduit, Conduit terminal, DIN terminal type  		<b>AC Circuit / Class H</b> Grommet, Conduit, Conduit terminal  	
Conduit terminal, DIN terminal type  		Conduit terminal  	
<b>AC Circuit / Class B</b> *AC/class B is standard product with surge voltage suppressor Grommet, Conduit, Conduit terminal, DIN terminal type  		Conduit terminal, DIN terminal type 	

### 3.5 Mounting

- 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 is performed, apply a wrench or other tool to the outside of the piping connection parts.
- 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.
- 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.
- Secure with brackets, except in the case of steel piping and copper fittings.**
- Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.**
- Painting and coating.**  
Warnings or specifications printed or labelled on the product should not be erased, removed or covered up.

### 3.6 Lubrication

- CAUTION:**
- SMC products have been lubricated for life at manufacturer, and do not require lubrication in service.  
This solenoid valve can be operated without lubrication
  - 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 MAINTENANCE

- WARNING:**
- Not following proper procedures could cause the product to malfunction and could lead to damage to the equipment or machine.
  - If handled improperly, compressed air can be dangerous. Assembly, handling and repair of pneumatic system should be performed by qualified personnel only.
  - Drain: remove condensate from the filter bowl on a regular basis.
  - Shut-down before maintenance: before attempting any kind of maintenance make sure the supply pressure is shut off and all residual air pressure is released from the system to be worked on.
  - Start-up after maintenance: apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, please verify product set-up parameters.
  - Do not make any modification to the product.
  - Do not disassemble the product, unless required by installation or maintenance instructions.

- 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.
  - Shut off the fluid supply and release the fluid pressure in the system.
  - Shut off the power supply.
  - Disconnect the product.

- 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.

- 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.

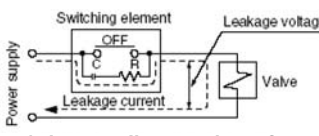
- Lubrication**  
When using after lubricating, never forget to lubricate continuously.

- 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.

- Exhaust the drain from an air filter periodically.**

## 5 LIMITATIONS OF USE

- WARNING:**
- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.
  - 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 ~**  
**DC coil: 2% or less of rated voltage**

- Low temperature operation**
  - 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.
  - 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

## 6 EUROPEAN CONTACT LIST

### 6.1 SMC Corporation

Country	Telephone	Country	Telephone
<b>Austria</b>	(43) 2262-62 280	<b>Italy</b>	(39) 02-92711
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<b>Czech Republic</b>	(420) 5-414 24611	<b>Norway</b>	(47) 67 12 90 20
<b>Denmark</b>	(45) 70 25 29 00	<b>Poland</b>	(48) 22-548 50 85
<b>Finland</b>	(358) 9-859 580	<b>Portugal</b>	(351) 22 610 89 22
<b>France</b>	(33) 1-64 76 1000	<b>Spain</b>	(34) 945-18 4100
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### 6.2 Websites

<b>SMC Corporation</b>	www.smcworld.com
<b>SMC Europe</b>	www.smc.eu.com