No. VF1000(V200)-TFM121**

Installation and Maintenance Manual
5 port solenoid valve
Series VF1000/3000/5000

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 pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications. Since the products specified here can be used in various operating conditions, their compatibility with the specific pneumatic 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.**
  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 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.
  2) 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.
  3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Supply air into the system gradually to create back pressure, i.e. incorporate a soft-start valve).
- **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

Refer to the operation manual for this product.

2.1 Specifications

Valve specifications

Fluid			Air		
Operating pressure range	Standard	2 position single/3 position	0.15 to 0.7 MPa		
		2 position double	0.1 to 0.7 MPa		
	High pressure	2 position single/3 position	0.15 to 1.0 MPa		
		2 position double	0.1 to 1.0 MPa 0.2		
Ambient and fluid temperature			-10 ~ 50 °C (No freezing)		
Maximum operating frequency		Series	VF1000	VF3000	VF5000
		2 position single / 2 position double	10 Hz	10 Hz	5 Hz
		3 position	-	3 Hz	3 Hz
Manual override			Non-locking push type, Push turn locking slotted type, Push turn locking lever type		
Pilot exhaust method			Individual exhaust. Common exhaust for main valve and pilot valve (except VF1000 series)		
Lubrication			Not required		
Mounting position			Unrestricted		
Impact / Vibration resistance			300/50 m/s² (1)		
Protection structure			Dust proof (G,H,L,M : IP40) (D,Y,T : IP65*)		

Table 1

Note)

Impact resistance: No malfunction occurred when it was tested with a drop tester in the axial direction and at right angles to the main valve & armature; in both energised & de-energised states and for every time in each condition (Values at the initial period.)

Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Tests are performed at both energised and de-energised states in the axial direction and at right angles to the main valve & armature. (Valves at the initial period.)

*Based on IEC60529. Compliance to IP65 is limited to the common exhaust option.

Solenoid Specifications

			Grommet (G),(H), L plug connector (L), M plug connector (M)	DIN terminal (D), DIN (EN175301-803) terminal (Y), Conduit terminal (T)
Electrical entry			G,H,L,M	D,Y,T
Coil rated voltage	DC		24,12 V	
	AC (50/60 Hz)			100,110,200,220,240
Allowable voltage fluctuation			±10% rated voltage[1,2,3]	
Power Consumption	DC	Standard	1.5 W (With indicator light: 1.55 W)	1.5 W (With indicator light: 1.75 W)
		Power saving type	0.55 W (With indicator light only)	0.75 W (With indicator light only)
	AC	100V		1.55 VA (With indicator light: 1.7 VA)
		110V [115 V]		
		200V		
		220V [230 V]		
		240V		
Surge voltage suppressor			Diode (Non-polar type is varistor)	
Indicator light			LED	LED (Neon bulb when AC)

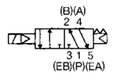
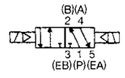
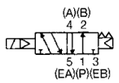
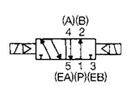
Table 2

1) In common between 110 VAC and 115 VAC, and between 220 VAC and 230 VAC.
2) For 115 VAC and 230 VAC, the allowable voltage is -15% ~ +5% of rated voltage.
3) S, Z and T type (with power saving circuit), should be used with the following allowable voltage fluctuation range due to a voltage drop caused by the internal circuit.
24 VDC: -7% to +10%
12 VDC: -4% to +10%

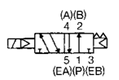
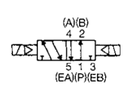
2 Specifications (continued)

2.2 Symbol

Body ported

	Single	Double
VF1000		
VF3000 VF5000		

Base mounted

	Single	Double
VF3000 VF5000		

Body ported / Base mounted

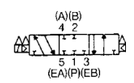
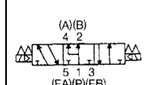
	Closed centre	Exhaust centre	Pressure centre
VF3000 VF5000			

Figure 1

3 Installation

3.1 Installation

⚠ Warning

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

3.2 Environment

⚠ Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- 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.
- If it is used in an atmosphere where there is possible contact with water droplets, oil, weld spatter, etc., exercise preventative measures.
- When the solenoid valve is mounted in a control panel or its energised for a long time, make sure that the ambient temperature is within the specification of the valve.

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 thread exposed on the end of the pipe/fitting.
- Tighten fittings according to appropriate tightening torque.

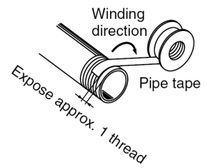


Figure 2

3 Installation (Continued)

3.4 Connection of fittings

When screwing fittings into valves, tighten as follows:
(1) Follow the procedures below when installing an SMC fitting, etc.
1) M5
After tightening the fitting by hand, use a wrench to tighten the fitting an additional approximately 1/6 turn. However, if miniature fittings are used, tighten an additional 1/4 turn with a tightening tool after tightening by hand.
Note) If tightened excessively, the thread of the product may break or the gasket may deform. If tightened insufficiently, the thread of the product may become loose. In either case, air leakage can occur.

(2) When fittings other than SMC fittings are used, follow the instructions of the respective fitting manufacturer.

2) Threads
Fasten with the proper tightening torques shown below.

Connection thread	Tightening torque (N·m)
1/8	7 to 9
1/4	12 to 14
3/8	22 to 24
1/2	28 to 30

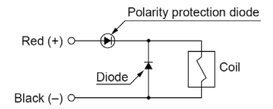
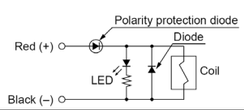
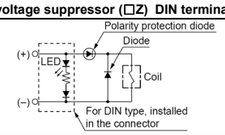
Table 3

3.5 Connection of piping to products

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

3.6 Precautions on Design <DC>

・Polar type

With surge voltage suppressor (□S)	With light/surge voltage suppressor (□Z) Grommet/L,M plug connecter
	
With light/surge voltage suppressor (□Z) DIN terminal/Conduit terminal	
	

・Non-polar type

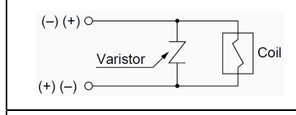
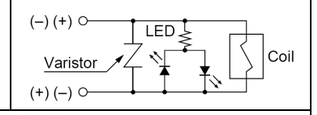
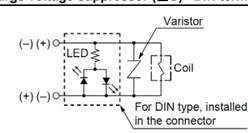
With surge voltage suppressor (□R)	With light/surge voltage suppressor (□U) Grommet/L,M plug connecter
	
With light/surge voltage suppressor (□U) DIN terminal/Conduit terminal	
	

Table 4

- Please connect in accordance with the +,- polarity indication. (The non-polar type can be used with the connections made either way.)
- Please use caution regarding the allowable voltage fluctuation because there is approximately a 1 V drop for a valve with polarity protection (For details, refer to the solenoid specifications for the valve.)
- When wiring is done at the factory, positive (+) is red and negative (-) is black.

3 Installation (Continued)

Power saving circuit <DC type only>

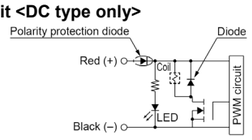


Figure 3

Please use caution regarding the allowable voltage fluctuation because there is approximately a 0.5 V drop for a transistor. (For details, refer to the solenoid specifications to the each valve.)

<AC>

There is no “S” option, It is already built-in to the rectifier circuit.

Light/surge voltage suppressor (□Z) DIN terminal/Conduit terminal

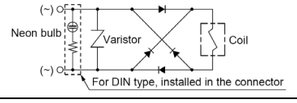


Figure 4

3.7 Residual voltage in the surge protection circuit.

Caution

- **Confirm the specifications**

When the surge protection circuit contains non-ordinary diodes, a residual voltage that is in proportion to the protective elements and the rated voltage will remain. Therefore, give consideration to surge voltage protection of the controller. The following table lists the approximate valves for the different types surge suppressor available.

In addition to this, the type of surge suppressor affects the response time of the valve. Please see catalogue specifications for further details.

Residual voltage

Surge voltage suppressor	DC		AC
	24	12	
S,Z	Approx. 1 V		Approx. 1V
R,U	Approx. 47 V	Approx. 32 V	-

Table 5

3.8 Leakage voltage

Caution

- **Voltage leakage.**

When a C-R device (surge suppressor) is used for the protection of switching device, note that voltage leakage will be increased by passing voltage leakage through C-R device. Therefore, select circuit or device which can limit residual voltage leakage to following value. And for recovery failure due to voltage leakage, bleeder resistance should be placed. For further information of bleeder resistance, contact SMC.

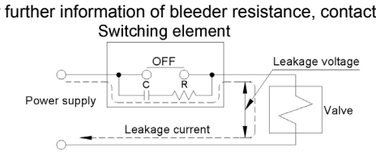


Figure 5

AC coil: 8% or less of rated voltage

DC coil: 3% or less of rated voltage

3.9 Extended periods of continuous energisation

Caution

- Continuous energisation of the valve for extended periods of time may have an adverse effect on the solenoid valve performance and the peripheral equipment due to temperature rises caused by the heat generation of the coil. Consult with SMC if valves will be continuously energised for extended periods of time, or if the energised period per day will be longer than the de-energised period. Use either DC specification or power saving type.
- When solenoid valves are mounted in a control panel, take measures against radiation in order to keep the valve temperature within the specified range. Use special caution when three or more stations sequentially aligned on the manifold are continuously energised since this will cause a drastic temperature rise.

3 Installation (Continued)

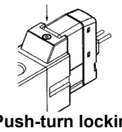
3.10 Manual override operation

Warning

Without an electric signal for the solenoid valve the manual override is used for switching the main valve.

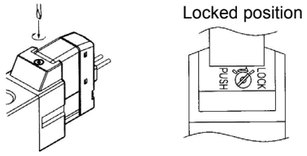
When the manual override is operated, connected equipment will be actuated. Confirm safety before operating.

■ Non-locking push type



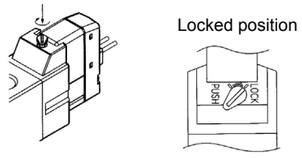
Push down on the manual override button with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

■Push-turn locking slotted type [D type]



While pressing, turn in the direction of the arrow (90° clockwise). If it is not turned, it can be operated the same way as the non-locking type.

■Push-turn lever locking type [E type]



While pressing, turn it the direction of the arrow. If it is not turned, it can be operated the same way as the non-locking type.

Figure 6

Caution

When locking the manual override on the push-turn locking types (D or E type), be sure to push it down before turning. Turning without first pushing it down can cause damage to the manual override and other trouble such as air leakage, etc. [Torque : Less than 0.1N･m]

3.11 How to Use Plug Connector

Caution

1. Attaching and detaching connectors

- To attach a connector, hold the lever and connector unit between your fingers and insert straight onto the pins of the solenoid valve so that the lever’s pawl is pushed into the groove and locks.
- To detach a connector, remove the pawl from the groove by pushing the lever downward with your thumb, and pull the connector straight out.

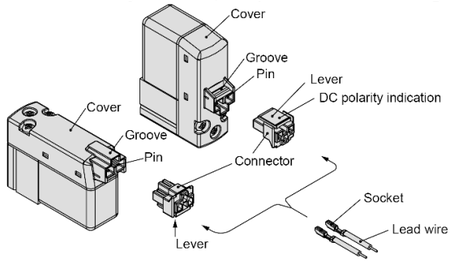


Figure 7

2. Crimping connection of lead wire and socket.

Strip 3.2 to 3.7 mm at the end of lead wires, insert the ends of the core wires evenly into the sockets, and then crimp with a crimping tool. When this in done, take care that the coverings of the lead wires do not enter the core wire crimping area.

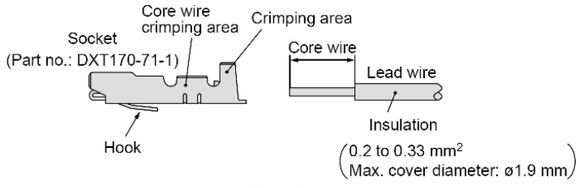


Figure 8

3 Installation (Continued)

3. Attaching and detaching lead wires with sockets

- **Attaching**

Insert the sockets into the square holes of the connector (+,- indication), and continue to push the sockets all the way in until they lock by hooking into the seats in the connector. (When they are pushed in, their hooks open and they are locked automatically.) Then, confirm that they are locked by pulling lightly on the lead wires.

- **Detaching**

To detach a socket from a connector, pull out the lead wire while pressing the socket’s hook with a stick with a thin tip (approx. 1 mm).
If the socket needs to used again, first spread the hook outward.

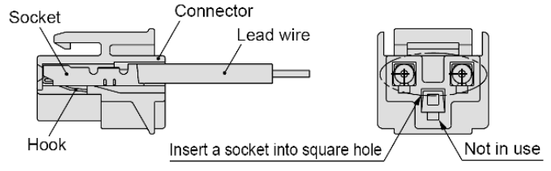


Figure 9

4 Settings and Programming

4.1 How to Use DIN terminal

Products with IP65 enclosures (based on IEC60529) are protected against dust and water, however, these products cannot be used in water.

Caution

Connection

1. Loosen the set screw and pull the connector out of the solenoid valve terminal block.
2. After removing the set screw, insert a flat head screwdriver, etc. into the notch on the bottom of the terminal block and pry it open, separating the terminal block and the housing.
3. Loosen the terminal screws on the terminal block, insert the core of the lead wire to the terminal, and attach securely with the terminal screws. In case of a DC surge voltage suppressor attached type (polar: S and Z types), connect wires corresponding to the polarity (+ or -) that is printed on the terminal block.
4. Tighten the ground nut and fix the wire.
   In the case of connecting wires, select cabtyre cords carefully because if those out of the specified range (Ø4.5 to Ø7) are used, it will not be able to satisfy IP65 (enclosure). Tighten the ground nut and set screw within the specified range of torque.

Changing the entry direction

After separating the terminal block and housing, the cord entry direction can be changed by attaching the housing in the opposite direction.

* Be careful not to damage elements, etc. with the cord’s lead wires.

Caution

Plug in and pull out the connector vertically without tilting to one side.

Compatible cable

Cord O.D.: Ø4.5 to Ø7

(Reference) 0.5 to 1.5 mm^2, 2-core or 3-core, equivalent to JIS C 3306.

Applicable crimped terminals

O-terminal: R1.25-4M that is specified in JIS C 2805.

Y-terminal: 1.25-3L, which is released by JST Mfg. Co., Ltd.

Bar terminal: Size 1.5 or shorter.

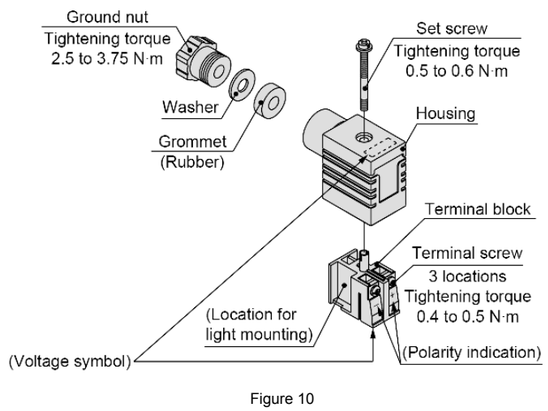


Figure 10

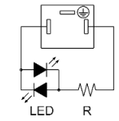
4 Settings and Programming (Continued)

4.2 Circuit Diagram with Light/Surge Voltage Suppressor

Caution

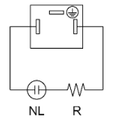
Circuit with indicator light (Built-in connector)

DC (□U) circuit



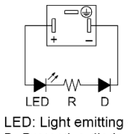
LED: Light emitting diode, R: Resistor

AC (□Z) circuit



NL: Neon bulb R: Resistor

DC (□Z) circuit



LED: Light emitting diode
D: Protective diode
R: Resistor

Figure 11

4.3 DIN (EN175301-803) terminal

Y type DIN type terminal corresponds to the DIN connector with terminal pitch 10 mm, which complies with EN175301-803B. Since the terminal pitch is different from the D type DIN connector, these two types are not interchangeable.

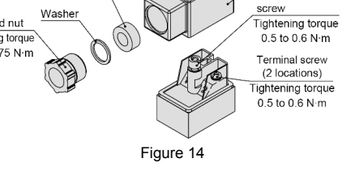


Figure 12

4.4 How to Use Conduit Terminal

Caution

Connection

1. Loosen the set screw and remove the terminal block cover from the terminal block.
2. Loosen the terminal screws of the terminal block, insert the core of the lead wire to the terminal, and attach securely with the terminal screws.
   In case of a DC surge voltage suppressor attached type (S and Z type with limited polarity), care must be taken that the positive and negative wires are connected according to the figure on the right.
3. Tighten the ground nut and fix the cable.

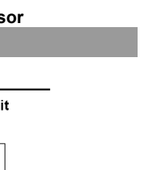


Figure 13

In the case of connecting wires, select cabtyre cords carefully because if those out of the specified range (Ø4.5 to Ø7) are used, it will not be able to satisfy IP65 (enclosure). Tighten the ground nut and set screw within the specified range of torque.

Compatible cable

Cord O.D. : Ø4.5 to Ø7

(Reference) 0.5 to 1.5 mm^2, 2-core or 3-core, equivalent to JIS C 3306.

Applicable crimped terminals

O-terminal : Equivalent to R1.25-3 that is specified in JIS C 2805.

Y-terminal : Equivalent to 1.25-3, which is released by JST Mfg. Co., Ltd.

* Use O terminal when a ground terminal is used.

Figure 14

4 Settings and Programming (continued)

4.5 One-touch fittings

Caution

When using fittings, check their dimensions in the catalogue to avoid possible interference between fittings of different types or sizes.
The following table shows the fittings which have been confirmed to be applicable to the VF series. The fittings selected from this table will not interfere with each other.

Series	Type	Piping port	Port size	Applicable tubing O.D. ø3.2	ø4	ø6	ø8	ø10	ø12	ø16
VF1000	**VF1□20-□□-M5**	4 (A), 2 (B)	M5	●	●					
		5 (EA), 3 (EB)	M5	●	●	●				
	VF1□20-□□-01	4 (A), 2 (B)	1/8	●	●	●	●			
		5 (EA), 3 (EB)	M5	●	●	●				
	VF1□3□-□□-M5	4 (A), 2 (B)	M5	●	●					
	VF1□3□-□□-01	4 (A), 2 (B)	1/8	●	●	●	●			
	VV5F3-30Manifold base	1 (P), 5/3 (R)	1/8	●	●	●	●	●	●	
	VV5F3-31 Manifold base	1 (P)	1/8	●	●	●				
		5 (EA), 3 (EB)	M5	●	●					

Series	Type	Piping port	Port size	Applicable tubing O.D. ø3.2	ø4	ø6	ø8	ø10	ø12	ø16
VF3000	**VF3□3□-□□-01**	4 (A), 2 (B)	1/8	●	●	●	●	●		
		1 (P), 5 (EA), 3 (EB)	1/8	●	●	●	●			
	VF3□3□-□□-02	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	P: 1/4, EA, EB: 1/8	●	●	●	●			
	VF3□4□-□□-02	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	1/4	●	●	●	●	●	●	
	VF3□4□-□□-03	4 (A), 2 (B)	3/8			●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	3/8			●	●	●	●	
	VV5F3-30Manifold base	1 (P), 5 (R), 3 (R)	1/4	●	●	●	●	●	●	
	VV5F3-40 Manifold base	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (R), 3 (R)	1/4	●	●	●	●	●	●	

Series	Type	Piping port	Port size	Applicable tubing O.D. ø3.2	ø4	ø6	ø8	ø10	ø12	ø16
VF5000	**VF5□2□-□□-02**	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	1/4	●	●	●	●	●	●	
	VF5□2□-□□-03	4 (A), 2 (B)	3/8			●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	3/8			●	●	●	●	
	VF5□44-□□-02	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (EA), 3 (EB)	1/4	●	●	●	●	●	●	
	VF5□44-□□-03	4 (A), 2 (B)	3/8			●	●	●	●	●
		1 (P), 5 (EA), 3 (EB)	3/8			●	●	●	●	●
	VF5□44-□□-04	4 (A), 2 (B)	1/2					●	●	●
		1 (P), 5 (EA), 3 (EB)	1/2					●	●	●
	VV5F5-20Manifold base	1 (P), 5 (R), 3 (R)	3/8			●	●	●	●	
	VV5F5-21Manifold base	1 (P), 5 (R), 3 (R)	1/2					●	●	●
	VV5F5-40 Manifold base	4 (A), 2 (B)	1/4	●	●	●	●	●	●	
		1 (P), 5 (R), 3 (R)	3/8			●	●	●	●	

Table 6

5 Maintenance

5.1 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.

Warning

1.Perform maintenance procedures as shown in the instruction manual.
If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Removal of equipment, and supply/exhaust of compressed air
When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and power, and exhaust all compressed air from the system using the residual pressure release function.
When the equipment is operated after remounting or replacement, first confirm that measures are in place to prevent lurching of actuators, etc. Then, confirm that the equipment is operating normally.

3. Low frequency operation
Valves should be operated at least once every 30 days to prevent malfunction. (Use caution regarding the air supply.)

5 Maintenance (Continued)

5.2 Supply air

Warning

Use clean air
Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases etc., as it can cause damage or malfunction.

Caution

Install an air filter
Install an air filter upstream near the valve. Select an air filter with a filtration of 5 µm or smaller.

6 Limitations of Use

Caution

- **Leakage voltage**
  The suppressor residual voltage should be 3 % or less of the rated voltage.
- **Surge voltage suppressor**
  If a surge protection circuit contains non-ordinary diodes such as zener diodes or varistor, a residual voltage will remain that is in proportion to the protective elements & the rated voltage. Therefore, give consideration to surge voltage protection of the controller. In the case of diodes, the residual voltage is approximately 1 V.
- **Low temperature operation**
  Unless otherwise indicated in the specifications for each valve, operation is possible to -10℃, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.
- **Mounting orientation**
  Mounting orientation is universal.

7 Contacts

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