VFS6000-TF2Z527EN

ORIGINAL INSTRUCTIONS

Instruction Manual

5 Port Pilot Operated Solenoid Valve Metal Seal, Plug-in / Non Plug-in

VFS6000 Series

The intended use of this valve is to control the movement of an actuator.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger."
They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) [*1)], and other safety regulations.

[*1)] ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

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

⚠ Warning

- **Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

⚠ Caution

- The product is provided for use in manufacturing industries only. Do not use in residential premises.

2 Specifications

2.1 Valve specifications

Fluid		Air
Operating pressure range [MPa]	For internal pilot	0.1 to 1
	For external pilot	0 to 1
Internal / External pilot operating pressure range [MPa]		0.1 to 1
Ambient and fluid temperature [°C] Note 1)		–10 to 60 (No freezing)
Flow characteristics		Refer to catalogue
Response time [ms]		Refer to catalogue
Duty cycle		Contact SMC
Min. operating frequency		1 cycle / 30 days
Max. operating frequency [cycles/min]		180
Manual override		Non-locking push type (Flush)
Lubrication		Normally not required

2 Specification - continued

Impact / Vibration resistance [m/s²] Note 2)			150 / 50
Enclosure Note 3) (based on JIS C 0920)	Without light/surge voltage suppressor	Type E	Equivalent to IP50
		Type F	Equivalent to IP52
		Type D	Equivalent to IP54
	With light/surge voltage suppressor	Type E	Equivalent to IP50
		Type F	
		Type D	
Mounting orientation Note 3)			Unrestricted
Weight			Refer to catalogue

Table 1.

Note 1) Use dry air at low temperatures.
Note 2) 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 and armature; in both energized and de-energised states and for every time in each condition. (Values quoted are for a new valve)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Tests are performed at both energized and de-energized states in the axial direction and at right angles to the main valve and armature. (Values quoted are for a new valve).
Note 3) In the case of double solenoid, mount the valve so that the spool is horizontal.

2.2 Solenoid specifications

Pilot valve part number			SF4-#F-22
Coil rated voltage [V]	DC		12, 24, 100
	AC (50/60 Hz)		100, 110 to 120, 200, 220, 240
Electrical entry	Plug-in type		Conduit terminal
	Non plug-in type		Grommet terminal, DIN, DIN terminal
Coil insulation class			Class B or equivalent
Allowable voltage fluctuation			–15 to +10% of rated voltage
Apparent power [VA]	Inrush	50 Hz	5.6
		60 Hz	5.0
	Holding	50 Hz	3.4 (2.1 W)
		60 Hz	2.3 (1.5 W)
Power consumption [W]			1.8 (2.04 with light/surge voltage suppressor)
Surge voltage suppressor			Varistor
Indicator light	24 VDC or less		LED
	100 VAC/DC or more		Neon bulb

Table 2.

2.3 Indicator light

Figure 1. Indicator lights position

Note: Plug-in type shown in figure 1, but indicator light position is the same regardless of electrical entry.

2 Specification - continued

2.4 Special products

⚠ Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

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 in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- Products compliant with IP50, IP52 and IP54 have limited protection against dust.
- Products compliant with IP52 are protected against water drips and products compliant with IP54 are protected water splashes. However, these products cannot be used in water.
- Products compliant with IP50, IP52 and IP54 enclosures satisfy the specifications by mounting each product properly. Be sure to read the Specific Product Precautions for each product.

3.3 Piping

⚠ Caution

- Before connecting 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 to the tightening torque specified in table 3.

Port	Thread (R, NPT, NPTF, G)	Correct tightening torque [N·m]
Pilot EXH	1/8	3 to 5
External pilot		
1 (P), 2 (B), 3 (R2), 4 (A), 5 (R1)	3/4	28 to 30
	1	36 to 38

Table 3.

3.4 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, refer to catalogue for details.

3.5 Air supply

⚠ Warning

- Use clean air. If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas etc., it can lead to damage or malfunction.

⚠ Caution

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

3.6 Manual override

⚠ Warning

- Regardless of an electric signal for the valve, the manual override is used for switching the main valve. Since connected equipment will operate when the manual override is activated, confirm that conditions are safe prior to activation.
- Refer to the catalogue for manual override location.
- To operate the manual override, push the manual override until it stops.

3 Installation - continued

3.7 Mounting

⚠ Caution

- Ensure gaskets are in good condition, not deformed and are dust and debris free.
- When mounting valves ensure gaskets are present, aligned and securely in place and tighten the M8 mounting screws to a torque of 11.0～15.0 N·m.
- Refer specific product precautions for how to exchange solenoid valve.

Figure 2. Mounting of valve on subplate

- Attach/remove solenoid valve vertically, parallel to sub-plate, otherwise it may cause damage to the solenoid valve. Never remove a valve at an angle.

3.8 Electrical circuits

⚠ Caution

- Surge suppression should be specified by using the appropriate part number. If a valve type without suppression is used, suppression must be provided by the host controller as close as possible to the valve.

3.8.1 Plug-in (conduit terminal)/Grommet terminal

⚠ Caution

Figure 3. Plug-in circuit diagrams

3.8.2 DIN/DIN terminal

⚠ Caution

Figure 4. DIN circuit diagrams (100 VAC/DC or more)

3 Installation - continued

Figure 5. DIN circuit diagrams (24 VDC or less)

3.9 Electrical connections

Caution

3.9.1 DIN terminal

Caution

1	A side
2	B side
3	COM
⏚	Ground

Note: there is no polarity.

Figure 6. DIN terminal pin diagram

- Applicable cable: heavy-duty cord O. D.: ø8 to ø10.
- The following three crimped terminals are applicable to the terminal block: 1.25Y-3L, 1.25-3.5S, 1.25-4M.
- Connector /Clamping torque: set screw 0.6 N·m, terminal screw 0.6 N·m.
- Incorrect common (DIN terminal no. 3) causes damage on power side circuit.

3.9.2 Grommet terminal

Figure 7. Grommet terminal electrical connection

- Refer to figure 7, remove cover (1), terminal block (2) is attached to the inside of the body.
- For a valve with indicator light and surge voltage suppressor, pull out the light and surge voltage suppressor substrate (3) in a straight direction before connecting wiring.
- Connect with the corresponding power side.
- There is no polarity.
- Applicable terminal: 1.25-3.5M, 1.25Y-3L, 1.25Y-3M.
- Tightening torque for terminal: 0.6 N·m.
- Tightening torque for cover mounting screws: 0.8~1.0 N·m.

3 Installation - continued

3.9.3 Plug-in type (conduit terminal)

Caution

Figure 8. Plug-in (conduit terminal) electrical connection

- Refer to figure 8: Removing junction cover (1) allows access to plug-in terminal block (2). Connect with power side corresponding to markings.

	Solenoid A side	Solenoid B side
Terminal block marking	A + -	B + -

Table 4.

- Applicable terminal: 1.25-3.5M, 1.25Y-3L, 1.25-3M.
- There is no polarity.
- Tightening torque for terminal: 0.6 N·m.

3.10 Residual voltage

Caution

- If a varistor voltage suppressor is used, the suppressor arrests the back EMF voltage from the coil to a level in proportion to the rated voltage.
- Ensure the transient voltage is within the specification of the host controller.
- Contact SMC for the varistor residual voltage.
- Valve response time is dependent on surge suppression method selected.

3.11 Countermeasure for surge voltage

Caution

- At times of sudden interruption of the power supply, the energy stored in a large inductive device may cause non-polar type valves in a de-energised state to switch.
- When installing a breaker circuit to isolate the power, consider a valve with polarity (with polarity protection diode), or install a surge absorption diode across the output of the breaker.

3.12 Extended period of continuous energization

Warning

- If a valve will be continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil assembly. This will likely adversely affect the performance of the valve and any nearby peripheral equipment. Therefore, if the valve is to be energized for periods of longer than 30 minutes at a time or if during the hours of operation the energized period per day is longer than the de-energized period, we advise using a valve with specifications of 0.4 W or lower valve, such as the SY series, or a valve with a power-saving circuit.

4 How to Order

Refer to catalogue for 'How to order' or to product drawing for special products.

5 Outline Dimensions

Refer to catalogue for outline dimensions.

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.

6 Maintenance - continued

- 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.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

6.2 Mounting

Caution

- Refer to 3.7 Mounting for information on mounting valves to sub-plate.

6.3 Maintainable parts

Caution

- Refer to specific product precautions in catalogue for how to order and exchange pilot valve.

Figure 9. Changing pilot valve

- Refer to catalogue for how to order light/surge voltage suppressor substrate, sub-plate assembly and mounting bolt and gasket.
- Refer to Figure 7 for accessing/removing light/surge voltage suppressor substrate.

Warning

- When changing rated voltage and electrical entry etc., pilot valve assembly can be changed. However, when changing the rated voltage of a valve with indictor light/surge voltage suppressor, it is required to change both the pilot valve and indictor light/surge voltage suppressor substrate.

7 Limitations of Use

7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

7.2 Intermediate stopping

Warning

Refer to Handling Precautions for 3/4/5 port Solenoid Valves.

7.3 Holding of pressure

Warning

Since valves are subject to air leakage, they cannot be used for applications such as holding pressure (including vacuum) in a system.

7.4 Cannot be used as an emergency shut-off valve

Warning

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 be adopted.

7 Limitations of Use - continued

7.5 Effect of energy loss on valve switching

Caution

	Single solenoid	Double solenoid
Air supply present, electrical supply cut	Valve spool returns to the OFF position by air and spring force.	Valve spool holds position.
Electrical supply present, air supply cut	Valve spool returns to the OFF position by spring force.	Valve spool holds position.

Table 5.

7.6 Leakage voltage

Caution

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes ≤3% (for DC coils) or ≤20% (for AC coils) of the rated voltage across the valve.

7.7 Low temperature operation

Caution

Unless otherwise indicated in the specifications for each valve, operation is possible to -10˚C, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7.8 Momentary energization

Caution

If a double solenoid valve is operated with momentary energization, it should be energized for at least 0.1 second. However, depending on the secondary load conditions, it should be energized until the cylinder reaches the stroke end position, as there is a possibility of malfunction otherwise.

8 Product Disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

9 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor/importer.

SMC Corporation

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