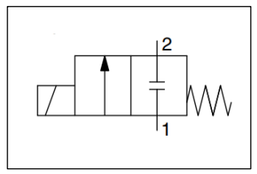
ORIGINAL INSTRUCTIONS

Instruction Manual
Energy Saving Type 2 Port Solenoid Valve
Series VXE



The intended use of this product is for the control of the downstream fluid supply.

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. This product must not be used in residential areas.

2 Specifications

2.1 Valve specifications

Model		VXE21	VXE22	VXE23
Valve construction		Direct operated poppet type		
Valve type		Normally closed (N.C.)		
Fluid Note1)		Air, Medium vacuum (0.1 Pa.abs), Water, Oil		
Withstand pressure [MPa]		5		
Max system pressure [MPa]		Refer to catalogue		
Maximum operating pressure differential [MPa]				
Orifice Ø [mm]		2, 3, 4.5, 6, 8, 10		
Port size [ᴿ]		1/8, 1/4	1/4, 3/8, 1/2	
Ambient temperature [°C]		-20 to 60 (no freezing)		
Fluid temperature [°C]	Air	-10 to 60 (no freezing) (Dew point temperature -10°C or less)		
	Water	1 to 60 (no freezing)		
	Oil	-5 to 60 (no freezing) (Kinematic viscosity: 50 mm²/s or less)		

2 Specifications – continued

Flow characteristics			Refer to catalogue
Response time [ms]			Contact SMC
Duty cycle			
Minimum operating frequency			1 cycle / 30 days
Maximum operating frequency [Hz]			Contact SMC
Lubrication			Not required
Impact / Vibration resistance Note 2)			150 / 30
Enclosure			IP65
Mounting orientation			Coil upwards
Weight			Refer to catalogue
Valve Leakage	Air [cm³/min]	Internal	≤1
		External	
	Medium vacuum [Pa.m³/s] Note 3)	Internal	≤10⁻⁶
		External	
	Water/Oil [cm³/min]	Internal	≤0.1
		External	
Body material			Brass (C37), SUS
Seal material			NBR, FKM, EPDM, PTFE

Table 1.

Note 1) Refer catalogue for other applicable fluids.
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) Value for options 'V' and 'M' (Non-leak / Oil-free / Medium vacuum), when differential pressure is 0.1 MPa.

2.2 Solenoid specifications

Model	VXE21	VXE22	VXE23
Solenoid coil assembly	VXE02□N-□□E-□		
Rated voltage [VDC]	24, 12		
Electrical entry	Grommet, Conduit, Conduit terminal, DIN terminal		
Allowable voltage fluctuation	±10% of rated voltage		
Allowable leakage voltage	≤2% of rated voltage		

Coil insulation type		Class B		
Power consumption (Holding) [W]		1.5	2.3	3
Inrush current [A] Note 1)	24 VDC	0.19	0.29	0.44
	12 VDC	0.38	0.58	0.88
Temperature rise [°C] Note 2)		25		30
Surge voltage suppressor		Varistor (Built-in)		
Indicator light Note 3)		LED		

Table 2.

Note 1) Energizing time should be 200 ms or longer.
Note 2) Value for ambient temperature at 20°C and when the rated voltage is applied.
Note 3) Indicator light only available with Conduit terminal and DIN terminal.

2.3 Manifold specifications

Refer to catalogue for manifold specifications.

2.4 Indicator light

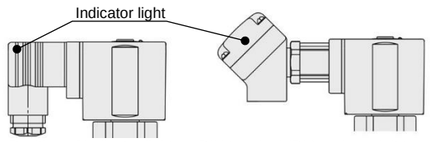


Figure 1. Position of indicator light on DIN terminal (DL) and conduit terminal (TL)

2.5 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 Installation - continued

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 IP65 enclosures are protected against dust and water, however, these products cannot be used in water.
- Products compliant with IP65 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 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Port size	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.

3.4 Fluid supply

⚠ Caution

The use of a fluid that contains foreign matter can cause problems, such as malfunction and seal failure by promoting wear of the valve seat and armature, by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream of the valve. Select a filter with a filtration size of 5 µm or smaller for air, and 100 mesh for water.

3.4.1 Air

⚠ 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.
- Compressed air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer or after cooler, etc.
- If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction. Install mist separators upstream of the valves to eliminate it.
- When operating fluid air with a dew point of −70°C or lower, the inside of the valve may wear and the product life will be shortened.

3.4.2 Water

⚠ Warning

- Be aware that rust stains, chloride separation, etc., from the piping may cause malfunction, leakage, or, in worse case scenarios, damage due to corrosion. Also, such damage may result in the spraying of fluids or scattering of parts. Please be sure to have protective measures in place in case such incidents should occur.
- In the case that water contains substances such as calcium and magnesium, which generate hard scale and sludge, install water softening equipment and a filter (strainer) directly upstream from the valve to remove these substances, as this scale and sludge can cause the valve to malfunction.
- The water pressure of tap water is usually 0.4 MPa or less, but the pressure can sometimes increase to 1.0 MPa in tall buildings. Therefore, pay attention to the max. operating pressure differential.

3.4.3 Oil

⚠ Warning

Generally, FKM is used as seal material, as it is resistant to oil. However, the resistance of the seal material may deteriorate depending on the type of oil, manufacturer, or additives. Check the resistance before using. The kinematic viscosity of fluid must not exceed 50 mm²/s.

3 Installation - continued

3.5 Mounting

⚠ Warning

- Ensure sufficient space for maintenance activities.
- 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 ports.
- 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.
- After installation, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly. If leakage increases or equipment does not operate properly, stop operation.
- Valve becomes hot during and after energization. Do not touch it with bare hands as it may cause burns.
- Do not install with the coil downwards. If a valve is mounted with the coil positioned downwards, foreign objects in the fluid will adhere to the core/armature leading to a malfunction.

3.5.1 Bracket mounting

3.5.1.1 Orifice Ø2, Ø3, Ø4.5, Ø6 (Bracket is not attached)

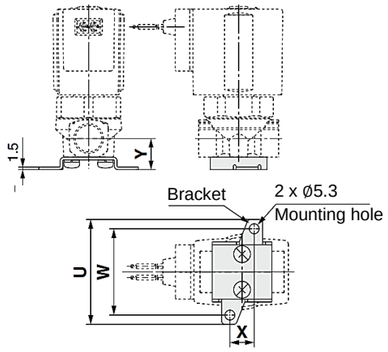


Figure 2.

Note) Refer to catalogue for dimensions U, W, X and Y.

3.5.1.2 Orifice Ø8 and Ø10 (Bracket is attached before shipping)

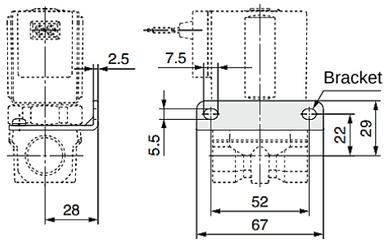


Figure 3.

3.6 Electrical circuits

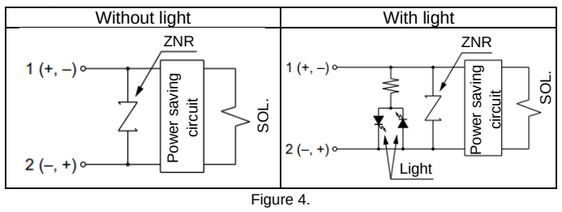


Figure 4.

3.7 Electrical connections

⚠ Caution

- As a rule, use electrical wire with a cross sectional area of 0.5 mm² to 1.25 mm² 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.

3 Installation - continued

- 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.

3.7.1 Grommet

Class B coil: AWG20 Insulator O.D. 2.5 mm

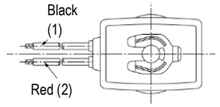


Figure 5.

Note) There is no polarity.

3.7.2 DIN terminal

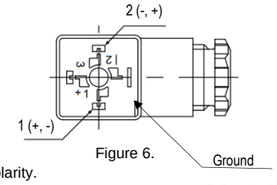


Figure 6.

Note 1) There is no polarity.
Note 2) Use compatible heavy-duty cords with cable O.D. of ø6 mm to 12 mm.
Note 3) For an outside cable diameter of ø9 to 12 mm, remove the internal parts of the rubber seal before using.

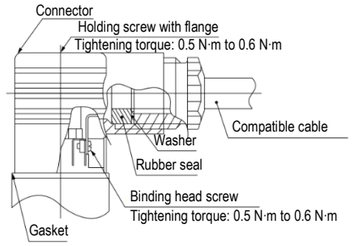
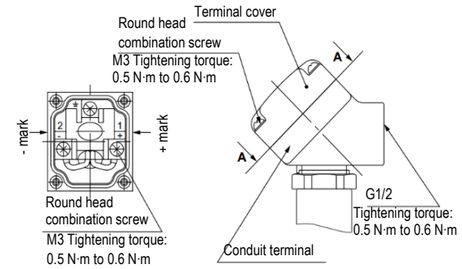


Figure 7.

3.7.3 Conduit terminal

Make the connections to the marks shown below:

- Use the tightening torques below for each section.
- Properly seal the terminal connection (G 1/2) with the special wiring conduit etc.



View A-A
(Internal connection diagram)

Figure 8.

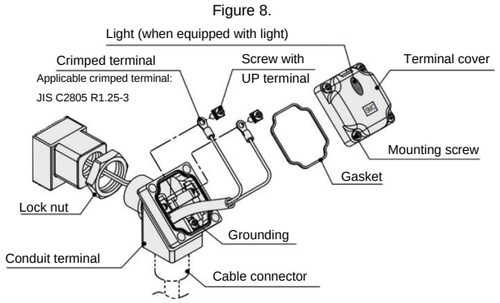


Figure 9.

3 Installation - continued

3.8 Conduit

Caution

- When used as an IP65 equivalent, use seal to install the wiring conduit. Also, use the tightening torque below for the conduit.
- There is no polarity.
- Tightening torque 0.5 to 0.6 N·m (Bore size G1/2).
- Class B coil: AWG20 Insulator O.D 2.5 mm

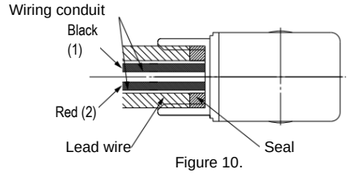


Figure 10.

3.9 Residual voltage

Caution

- 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.

3.10 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.

3.11 Extended period of continuous energization

Warning

- The solenoid coil will generate heat when continuously energized so avoid installing in an enclosed space. Install the valve in a well-ventilated area.
- Do not touch the coil while it is being energized or immediately after energization.

3.12 Effect of back pressure when using a manifold

Warning

Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure.

4 How to Order

Refer to catalogue for 'How to Order'.

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.
- 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 Maintenance - continued

- Periodic maintenance of filter.
  - Replace filter element every 1 year or when the pressure drop becomes 0.1MPa, whichever comes first.
- Exhaust drainage from the air filters periodically.
  If drainage overflows and enters the air line, this may cause malfunction of pneumatic equipment.

Warning

- 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.

6.2 Storage

Caution

In the case of long-term storage after use, thoroughly remove all moisture to prevent rust and deterioration of rubber materials, etc.

6.3 Replacement parts

Refer to catalogue for replacement parts.

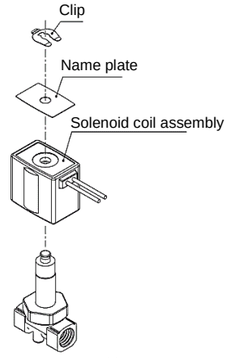


Figure 11.

7 Limitations of Use

7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

Warning

7.2 Fluids

- The compatibility of the components of this product with the fluid used may vary depending on the type of fluid, additives, concentration, temperature, etc. Check the compatibility with the actual machine before use.
- Take measures to prevent static electricity since some fluids can cause static electricity.
- Do not use the product with the fluids listed below:
  - Fluids that are harmful to the human body.
  - Combustible or flammable fluids.
  - Corrosive gas and fluid.
  - Sea water, saline.

7.3 Effect of energy loss on valve switching

Supply pressure present, electrical supply cut	Valve returns to the initial de-energised position by spring force.
Electrical supply present, supply pressure cut	Valve remains in the energized position.

Table 4.

7.4 Low temperature operation

- The valve can be used in an ambient temperature down 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 warming by a heater, etc., be careful not to expose the coil portion to a heater. Installation of a dryer, heat retaining of the body is recommended to prevent freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.

7 Limitations of Use - continued

7.5 Holding of pressure

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

7.6 Cannot be used as an emergency shut-off valve

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.

7.7 Closed liquid circuit

In a closed circuit, when liquid is static, pressure could rise due to changes in temperature. This pressure rise could cause malfunction and damage to components such as valves. To prevent this, install a relief valve in the system.

7.8 Impact by rapid pressure fluctuation

When an impact caused by the rapid pressure fluctuation, such as water hammer etc., is applied, the solenoid valve may be damaged. Install water hammer relief equipment (accumulator, etc.), or use a SMC water hammer relief valve (e.g. VXR series).

7.9 Normally closed valves

Although the valves are normally closed (IN and OUT port blocked), and flow is blocked from Port 1 to Port 2, the fluid will not be blocked if Port 2 pressure is greater than Port 1 pressure, and fluid will flow from Port 2 to Port 1.

Caution

7.10 Leakage voltage

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes ≤ 2% of the rated voltage across the valve.

7.11 EMC restrictions

7.11.1 Class and group description

- This product is group 1, class A equipment according to EN55011.
- Group 1 equipment does not intentionally generate radio-frequency energy in the range 9 kHz to 400 GHz.
- Class A equipment is equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
- This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

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 Return of Product

Warning

If the product to be returned is contaminated or is possibly contaminated with substances that are harmful to humans, for safety reasons, please contact SMC beforehand and then employ a specialist cleaning company to decontaminate the product. After the decontamination prescribed above has been carried out, submit a Product Return Request Sheet or the Detoxification/Decontamination Certificate to SMC and await SMC's approval and further instructions before attempting to return the item. Please refer to the International Chemical Safety Cards (ICSC) for a list of harmful substances. If you have any further questions, please don't hesitate to contact your SMC sales representative.

10 Contacts

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

SMC Corporation

URL : https:// www.smcworld.com (Global) https:// www.smc.eu (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan

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