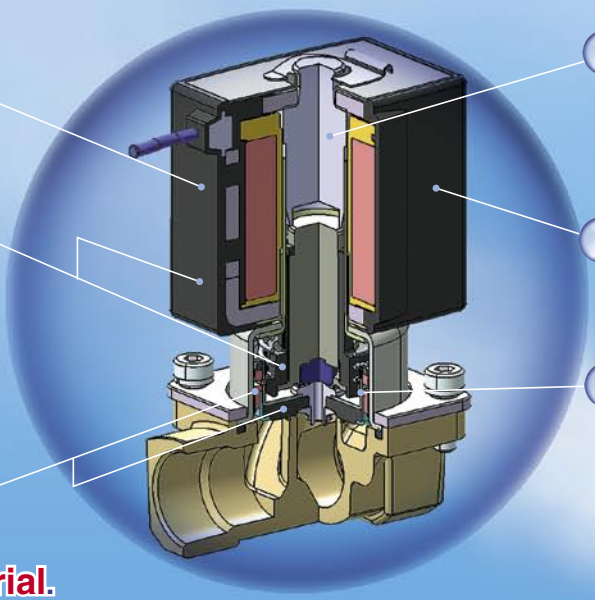
Pilot Operated 2-Port Solenoid Valve/ Zero Pressure Differential Operation

New

For Steam

Compact and Lightweight



Enclosure: IP65

Low-noise construction

Operation noise is reduced due to **full wave rectifier type solenoid** and special valve construction.

Internal leakage of 1.0 cm³/min or less is achieved by using special FKM seal material.

Reliability is improved due to a piston main valve and a rubber seal made of special FKM.

Improved corrosion resistance

Use of special magnetic material

Flame resistance conforms to UL94V-0.

Flame resistant mold coil material

Zero pressure differential

Weight 490 g

(VXS2230)

∗ Dimensions of the VXS2230 [3/8 (10A)]

New

VXS Series VXS22/23

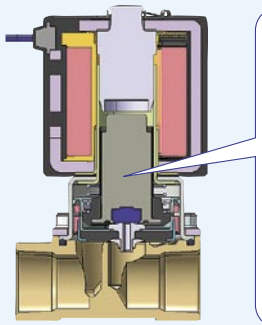
SMC

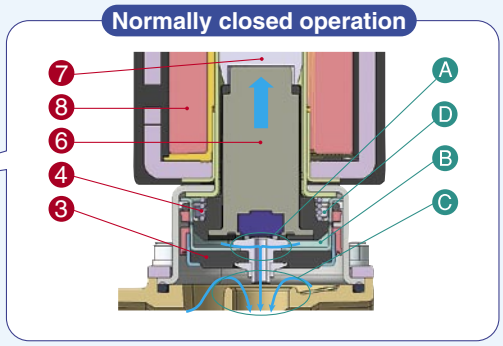
CAT.EUS70-38A-UK

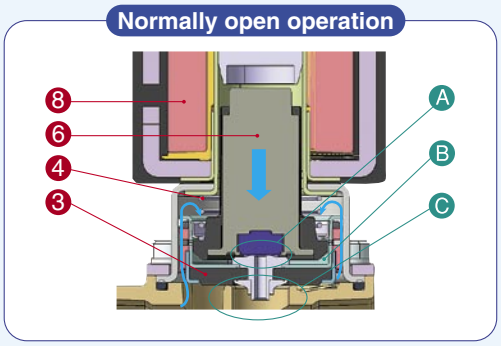
Solenoid valves for various fluids used in a wide variety of

Pilot operated 2-port solenoid valve for steam / Zero pressure differential operation

For Steam — New Series VXS22/23







Working principles

<Valve open – when there is pressure>

When the coil ❽ is energised, the armature assembly ❻ is attracted to the core of the tube assembly ❼ and the pilot valve Ⓐ is opened.
When the pilot valve is open the pressure inside the pilot chamber Ⓑ decreases, resulting in the pressure difference from the inlet pressure. Then the piston assembly ❸ is lifted and the main valve Ⓒ is opened.

<Valve open – when there is no pressure or under low pressure>

The armature assembly ❻ interacts with the piston assembly ❸ at location Ⓓ . The piston assembly is pulled upward when the armature assembly is attracted to open the main valve Ⓒ.

Working principles

<Valve closed>

When the coil ❽ is de-energised, the armature assembly ❻ returns by the reacting force of the return spring ❹. When the pressure inside the pilot chamber Ⓑ increases, the pressure difference from the inlet pressure is lost and the main valve Ⓒ is closed.

Normally Closed (N.C.)

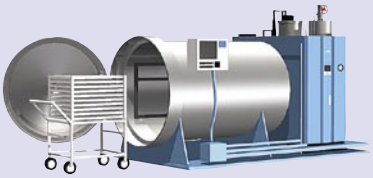
Solenoid valve (Port size)			Orifice symbol (diameter)				Material	
Model	VXS22	VXS23	3 (10 mmø)	4 (15 mmø)	5 (20 mmø)	6 (25 mmø)	Body	Seal
Port symbol (Port size)	**02** (1/4)	—	●	—	—	—	Brass (C37), Stainless steel	FKM
	03 (3/8)	—	●	—	—	—		
	04 (1/2)	—	—	●	—	—		
	—	**06** (3/4)	—	—	●	—		
	—	**10** (1)	—	—	—	●		

Applications

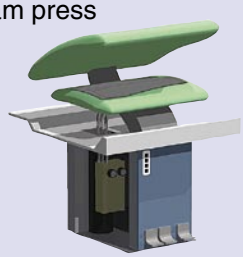
For various industries which use steam

Steam cooker

Dish/container steriliser



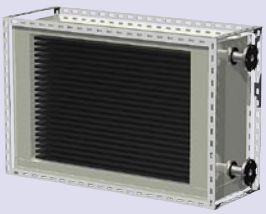
Steam press



Steam dryer

Boiler

Steam heater

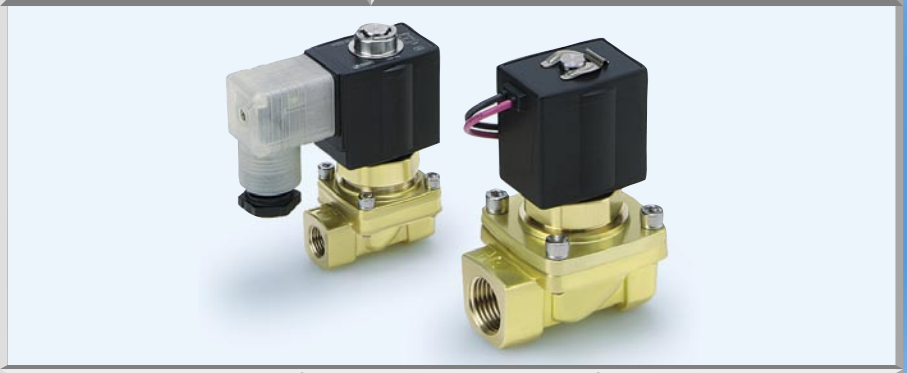


SMC

applications — New VX Series variations

Pilot operated 2-port
Zero pressure differential operation

For Air, Water, Oil — New VXZ22/23



Valve type	Port size	Orifice dia. mmø
N.C./N.O.	1/4 to 1	10 to 25

Direct operated 2-port

New VX21/22/23

For Air, Vacuum, Water, Steam, Oil

Valve type	Port size	Orifice dia. mmø
N.C./N.O.	1/8 to 1/2	2 to 10

Pilot operated 2-port

New VXD21/22/23

For Water, Oil, Air

Valve type	Port size	Orifice dia. mmø
N.C./N.O.	1/4 to 1 32A to 50A	10 to 50

Direct operated 3-port

New VX31/32/33

For Air, Vacuum, Water, Steam, Oil

Valve type	Port size	Orifice dia. mmø
N.C./N.O. COM.	1/8 to 3/8	1.5 to 4

Pilot operated 2-port

VXP21/22/23

For Steam (Air, Water, Oil)

Valve type	Port size	Orifice dia. mmø
N.C./N.O.	1¼ to 2 32A to 50A	35 to 50

Water hammer relief, Pilot operated 2-port

VXR21/22/23

For Water, Oil

Valve type	Port size	Orifice dia. mmø
N.C./N.O.	1/2 to 2	20 to 50

Pilot operated 2-port for high pressure

VXH22

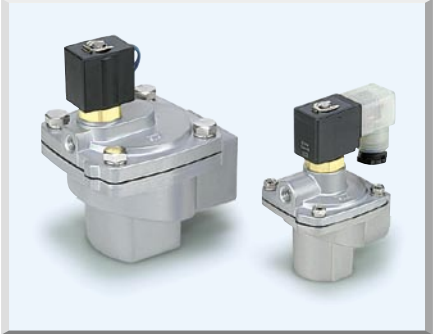
For Air, Water, Oil

Valve type	Port size	Orifice dia. mmø
N.C.	1/4 to 1/2	10

2-port for dust collector (Solenoid type/Air operated type)

VXF21/22, VXFA21/22

For Air



Valve type	Port size	Orifice dia. mmø
N.C.	3/4 to 1½	20 to 40

The **new VX series,** with its improved construction, replaces our previous VX range.

Pilot Operated 2-Port Solenoid Valve for Steam
Zero Pressure Differential Operation
Series VXS22/23

For Steam

■ **Valve**

Normally closed (N.C.)

■ **Solenoid Coil**

Coil: Class H

■ **Electrical Entry**

- Grommet
- Conduit
- Conduit terminal

■ **Rated Voltage**

100 VAC, 200 VAC, 110 VAC,
220 VAC, 240 VAC, 230 VAC, 48 VAC

■ **Material**

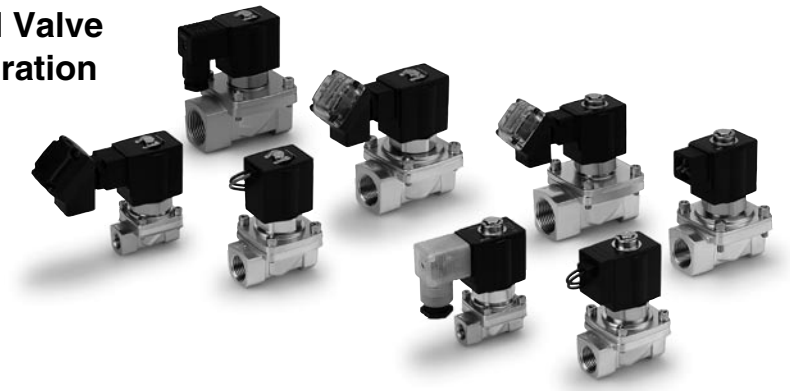
Body — Brass (C37), Stainless steel
Seal — FKM

Model		VXS2230	VXS2240	VXS2350	VXS2360
Orifice dia.	10 mmø	●	–	–	–
	15 mmø	–	●	–	–
	20 mmø	–	–	●	–
	25 mmø	–	–	–	●
Port size (Nominal size)		1/4 (8A) 3/8 (10A)	1/2 (15A)	3/4 (20A)	1 (25A)

The VXZ series is recommended for air, water or oil.

Pilot Operated 2-Port Solenoid Valve
Zero Pressure Differential Operation
For Air, Water, Oil

Series VXZ22/23



Normally Closed (N.C.) / Normally Open (N.O.)

Solenoid valve (Port size)			Orifice symbol (diameter)				Material	
Model	**VXZ22**	**VXZ23**	3 (10 mmø)	4 (15 mmø)	5 (20 mmø)	6 (25 mmø)	Body	Seal
Port symbol (Port size)	**02** (1/4)	–	●	–	–	–	Brass (C37), Stainless steel	NBR FKM EPDM
	03 (3/8)	–	●	–	–	–		
	04 (1/2)	–	–	●	–	–		
	–	**06** (3/4)	–	–	●	–		
	–	**10** (1)	–	–	–	●		

CAT.EUS70-31A-UK

SMC

Common Specifications

Standard Specifications

Valve specifications	**Valve construction**	Pilot operated 2-port piston type/Zero pressure differential operation
	Withstand pressure (MPa) (Water pressure)	3.0
	Body material	Brass (C37), Stainless steel
	Seal material	FKM
	Enclosure	Dusttight, Water-jet-proof (IP65)
	Environment	Location without corrosive or explosive gases
Coil specifications	**Rated voltage**	100 VAC, 200 VAC, 110 VAC, 220 VAC, 230 VAC, 240 VAC, 48 VAC
	Allowable voltage range	±10% of rated voltage
	Allowable leakage voltage	10% or less of rated voltage
	Coil insulation type	Class H (Full wave rectifier type)

Solenoid Coil Specifications

AC Specification (Class H coil, Full wave rectifier type)

Model	Apparent power (VA) Note 2)	Temperature rise (°C) Note 1)
VXS22	18	120
VXS23	20	120

Note 1) The value at an ambient temperature of 20°C and when the rated voltage is applied.
Note 2) There is no difference in the frequency and the inrush and energised apparent power, since a rectifying circuit is used.
Apparent power when the solenoid temperature is 20°C.

Applicable Fluid Check List / All Options

VXS2□□0S□-□□-□□□R1-□

Option symbol

Fluid and application	Option symbol	Seal material	Body material	Guide ring and piston ring material	Coil insulation type
Steam (1 MPa or less)	**S**	FKM	Brass (C37)	PPS	H
	Q		Stainless steel		

∗ Use VXZ series when a fluid other than steam (air, water, oil) is used. (Refer to page 1 for details.)

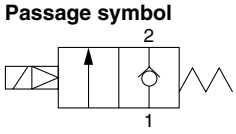
For Steam

(1 MPa, 183°C or less)

Model/Valve Specifications

N.C.

Passage symbol



Normally Closed (N.C.)

Port size (Nominal size)	Orifice diameter (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)	Flow-rate characteristics		Max. system pressure (MPa)	Weight (g)
					Av x 10^{-6} m^2	Conversion Cv		
1/4 (8A)	10	**VXS2230-02**	0	1.0	58	2.4	1.0	490
3/8 (10A)		**VXS2230-03**			67	2.8		
1/2 (15A)	15	**VXS2240-04**			130	5.3		660
3/4 (20A)	20	**VXS2350-06**			220	9.2		1200
1 (25A)	25	**VXS2360-10**			290	12.0		1340

Note) Weight of grommet type. Add 10 g for conduit type, 60 g for conduit terminal type respectively.

• Refer to “Glossary of Terms” on page 12 for details on the maximum operating pressure differential and the maximum system pressure.

Ambient and Fluid Temperature

Power supply	Fluid temperature (°C)	Ambient temperature (°C)
	Solenoid valve option symbol	
	S, Q	
AC, Class H coil	Steam, 183 or less	–10 to 60

Note) Dew point temperature: –10°C or less

Refer to page 9 for selection.

Valve Leakage Rate

Internal Leakage

Seal material	Leakage rate (Air)
FKM	1.0 cm^3/min or less

How to Order

AC, Class H coil (Full wave rectifier type)

VXS 22 3 0 S □ – 02 □ – 1 G R1 – □

Model
Refer to the table below (1) for availability.

Orifice diameter
Refer to the below table (1) for availability.

Valve/Body configuration

0	N.C./Single unit

Solenoid valve option

Symbol	Seal material	Body material	Coil insulation type
S	FKM	Brass (C37)	H
Q		Stainless steel	

Option

—	—
Z	Oil-free spec.

Port size
Refer to the table below (1) for availability.

Thread type

—	Rc
T	NPTF
F	G
N	NPT

Rated voltage

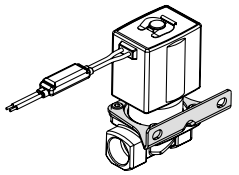
1	100 VAC 50/60 Hz	**7**	240 VAC 50/60 Hz
2	200 VAC 50/60 Hz	**8**	48 VAC 50/60 Hz
3	110 VAC 50/60 Hz	**J**	230 VAC 50/60 Hz
4	220 VAC 50/60 Hz		

∗ Refer to the table below (2) for availability.

Refer to page 7 for ordering coil only.

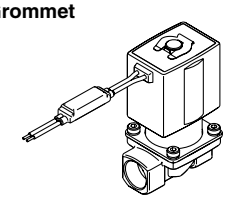
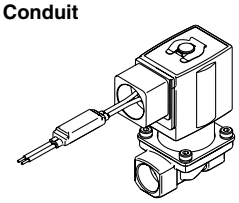
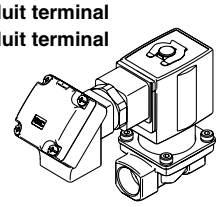
Full wave rectifier type

Bracket

—	None
B: With bracket	

∗ Bracket is not removable.

Electrical entry

G: Grommet	**C:** Conduit	**T:** With conduit terminal **TL:** With conduit terminal and light
		

∗ Refer to the table (2) for the available combinations between electrical option (L) and rated voltage.
∗ Surge voltage suppressor is integrated as standard into the full wave rectifier type.

Table (1) Model – Orifice Diameter – Port Size
Normally Closed (N.C.)

Solenoid valve (Port size)			Orifice symbol (diameter)			
Model	**VXS22**	**VXS23**	**3** (10 mmø)	**4** (15 mmø)	**5** (20 mmø)	**6** (25 mmø)
Port symbol (Port size)	**02** (1/4)	—	●	—	—	—
	03 (3/8)	—	●	—	—	—
	04 (1/2)	—	—	●	—	—
	—	**06** (3/4)	—	—	●	—
	—	**10** (1)	—	—	—	●

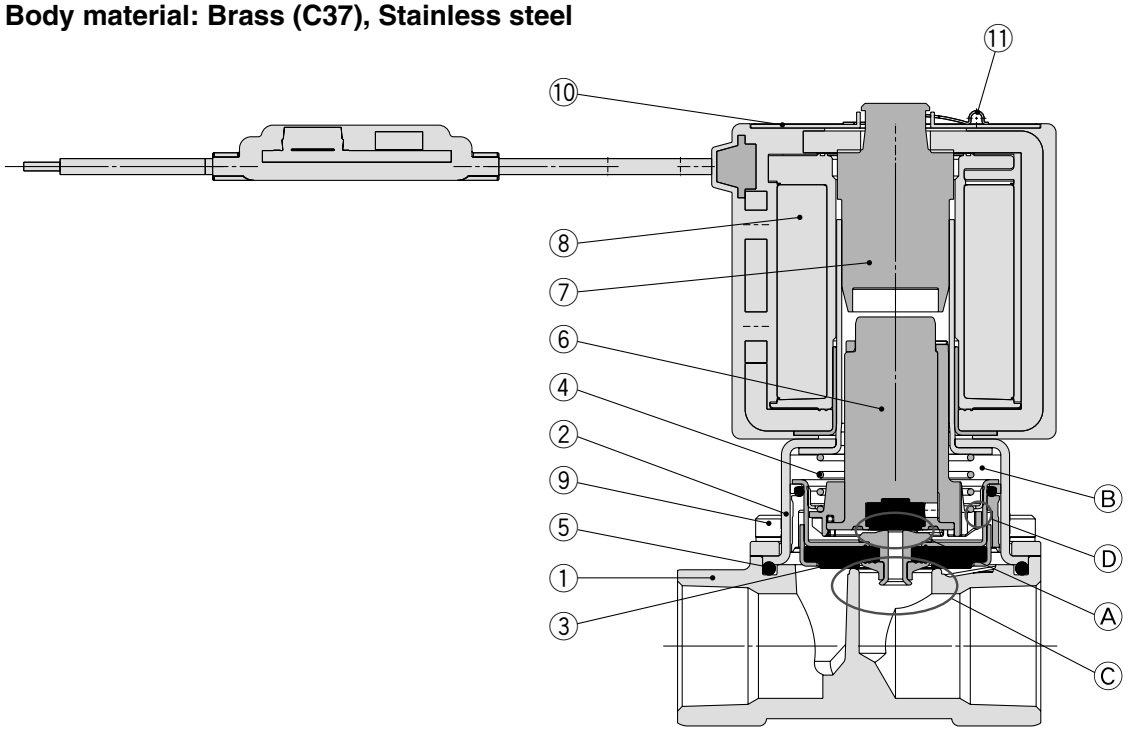
Table (2) Rated Voltage – Electrical Option

Rated voltage			**L** Note)
Specifications	Voltage symbol	Voltage	With light
AC	**1**	100 V	●
	2	200 V	●
	3	110 V	●
	4	220 V	●
	7	240 V	—
	8	48 V	—
	J	230 V	—

Note) Light is available only for conduit terminal type.

Construction

Normally closed (N.C.)
Body material: Brass (C37), Stainless steel



Working principles

<Valve open – when there is pressure>
When the coil ⑧ is energised, the armature assembly ⑥ is attracted to the core of the tube assembly ⑦ and the pilot valve Ⓐ is opened.
When the pilot valve is open the pressure inside the pilot chamber Ⓑ decreases, resulting in the pressure difference from the inlet pressure. Then, the piston assembly ③ is lifted and the main valve Ⓒ is opened.
<Valve open – when there is no pressure or under low pressure>
The armature assembly ⑥ interacts with the piston assembly ③ at location Ⓓ. The piston assembly is pulled upward when the armature assembly is attracted to open the main valve Ⓒ.
<Valve closed>
When the coil ⑧ is de-energised, the armature assembly ⑥ returns by the reacting force of the return spring ④ and the pilot valve Ⓐ is closed.
When the pilot valve is closed, the pressure inside the pilot chamber Ⓑ increases, resulting that the pressure difference from the inlet pressure is lost and the main valve Ⓒ is closed.

Component Parts

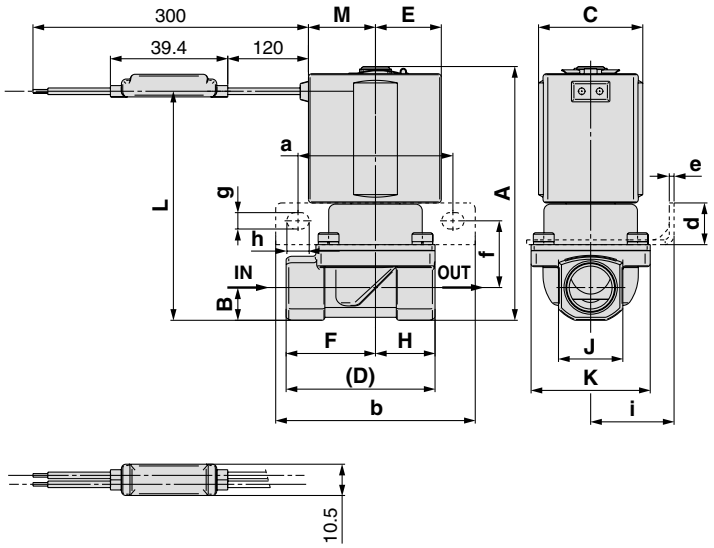
No.	Description	Material	
		Body material Brass (C37) specifications	Body material stainless steel specifications
1	**Body**	Brass (C37)	Stainless steel
2	**Bonnet**	Stainless steel	
3	**Piston assembly**	PPS, Stainless steel (PTFE, FKM)	
4	**Return spring**	Stainless steel	
5	**O-ring**	FKM	
6	**Armature assembly**	Stainless steel, PPS	
7	**Tube assembly**	Stainless steel	
8	**Solenoid coil**	—	
9	**Hexagon socket head bolt**	Stainless steel	
10	**Name plate**	AL	
11	**Clip**	SK	

The materials in parentheses are the seal materials.

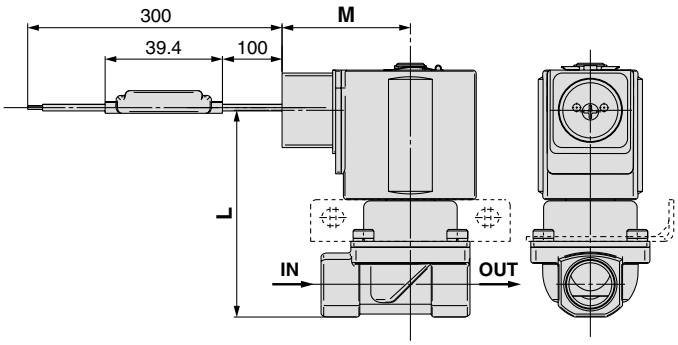
Dimensions/Body Material: Brass (C37), Stainless Steel

VXS22□0/VXS23□0

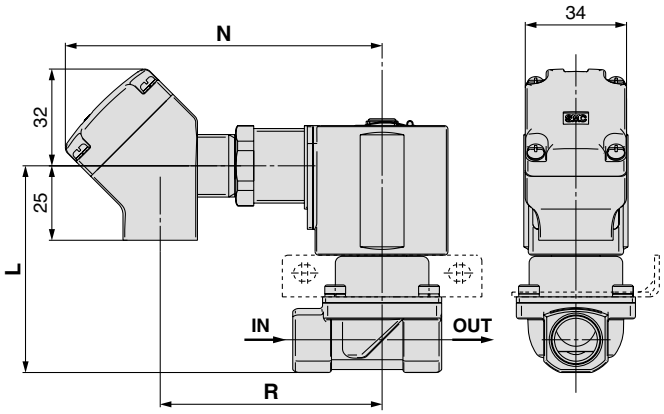
Grommet: G



Conduit: C



Conduit terminal: T



(mm)

Model	Port size P	A	B	C	D	E	F	H	J	K	Electrical entry						
											Grommet		Conduit		Conduit terminal		
N.C.											L	M	L	M	L	N	R
VXS2230	1/4, 3/8	85.5	11	35	50	22.5	30	20	22	40	77	22.5	71	43	71	106.5	74.5
VXS2240	1/2	92.5	14	35	63	22.5	37	26	29.5	52	84	22.5	78	43	78	106.5	74.5
VXS2350	3/4	109	18	40	80	25	47.5	32.5	36	65	100.5	25.5	93	46	93	109	77
VXS2360	1	115	21	40	90	25	55	35	40.5	70	106.5	25.5	99	46	99	109	77

(mm)

Model	Port size P	a	b	d	e	f	g	h	i	Weight (g)
N.C.										
VXS2230	1/4, 3/8	52	67	14	1.6	22.5	5.5	7.5	28	490
VXS2240	1/2	60	75	17	2.3	28.5	6.5	8.5	35	660
VXS2350	3/4	68	87	22	2.6	37	6.5	9	43	1200
VXS2360	1	73	92	22	2.6	40	6.5	9	45	1340

Replacement Parts

● Solenoid coil assembly part number

AC, Class H coil (DIN terminal is not available.)

VX02 2 N− 1 G −R −H

Series

2	VXS22□□
3	VXS23□□

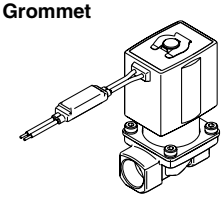
Coil insulation type

Symbol	Type
H	Class H

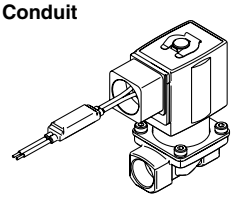
With full wave rectifier

Electrical entry

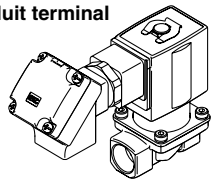
G: Grommet



C: Conduit



T: With conduit terminal
TL: With conduit terminal and light



∗ Refer to the table (1) for the available combinations between electrical option (L) and rated voltage.
∗ The rectifier and the surge voltage suppressor are integrated as standard.

Rated voltage Note)

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	110 VAC 50/60 Hz
4	220 VAC 50/60 Hz
7	240 VAC 50/60 Hz
8	48 VAC 50/60 Hz
J	230 VAC 50/60 Hz

Note) Refer to the table (1) for the available combinations.

Table (1) Rated Voltage – Electrical Option

Rated voltage			Class H
			L Note)
Specifi-cations	Voltage symbol	Voltage	With light
AC	**1**	100 V	●
	2	200 V	●
	3	110 V	●
	4	220 V	●
	7	240 V	—
	8	48 V	—
	J	230 V	—

Note) Light is available only for conduit terminal type.

● Name plate part number

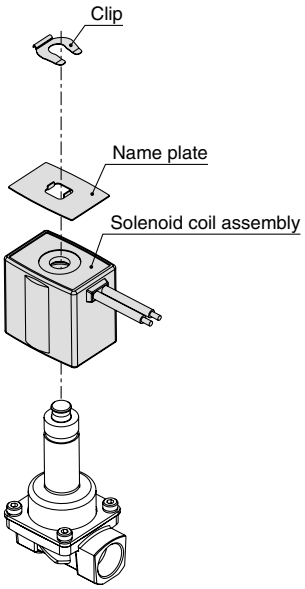
AZ-T- **Valve model**

↑ Enter by referring to "How to Order" (Single Unit).

● Clip part number

For VXS22: VX022N-10

For VXS23: VX023N-10



Solenoid Valve Flow-rate Characteristics
(How to indicate flow-rate characteristics)

1. Indication of Flow-rate Characteristics

The flow-rate characteristics in equipment such as a solenoid valve, etc. are indicated in their specifications shown in Table (1).

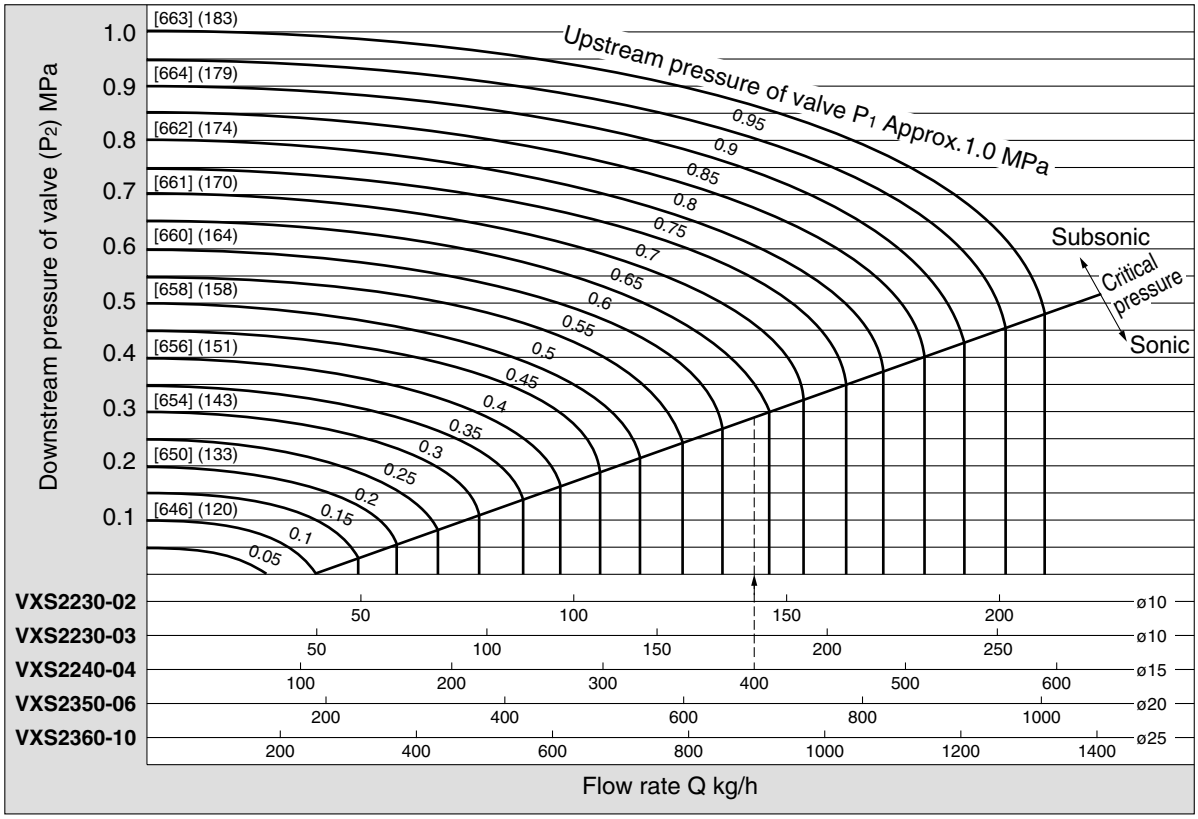
Table (1) Indication of Flow-rate Characteristics

Corresponding equipment	Indication by international standard	Other indications	Conformed standards
Process fluid control equipment	*Av*	—	IEC60534-2-3: 1997 JIS B 2005: 1995 Equipment: JIS B 8471, 8472, 8473
	—	*Cv*	
Pneumatic equipment	*C, b*	—	ISO 6358: 1989 JIS B 8390: 2000
	—	*S*	JIS B 8390: 2000 Equipment: JIS B 8373, 8374, 8375, 8379, 8381
		Cv	ANSI/(NFPA)T3.21.3: 1990

2. Flow-rate Characteristics

Note) Use this chart as a guide. In the case of finding an accurate flow rate, refer to pages 9 to 11.

For Saturated Steam



Figures inside [ ] indicate the saturated steam holding heat (kcal/kg). Figures inside ( ) indicate the saturation temperature (°C).

How to read the chart

The sonic range pressure to generate a flow rate of 400 kg/h is P1 Approx. 0.64 MPa for ø15 orifice (VXS224□-04).
The holding heat slightly differs depending on the pressure P1, but at 400 kg/h it is approx. 25900 kcal/h.

3. Process Fluid Control Equipment

(1) Conformed standard

IEC60534-2-3: 1997: Industrial process control valves. Part 2: Flow capacity, Section Three-Test procedures

JIS B 2005: 1995: Test method for the flow coefficient of a valve

Equipment standards: JIS B 8471: Solenoid valve for water

JIS B 8472: Solenoid valve for steam

JIS B 8473: Solenoid valve for fuel oil

(2) Definition of flow-rate characteristics

Av factor: Value of the clean water flow rate represented by m^3/s which runs through a valve (equipment for test) when the pressure differential is 1 Pa. It is calculated using the following formula.

$$Av = Q\sqrt{\frac{\rho}{\Delta P}} \quad \cdots\cdots (1)$$

Av : Flow coefficient [m^2]
Q : Flow rate [m^3/s]
ΔP : Pressure differential [Pa]
ρ : Density of fluid [kg/m^3]

(3) Formula of flow rate

It is described by the practical units. Also, the flow-rate characteristics are shown in Chart (1).
For saturated steam:

$$\text{Critical pressure} = \frac{P_1 - 0.1}{2}$$

When

$P_2 > \frac{P_1 - 0.1}{2}$, **subsonic flow**

$$Q = 8.3 \times 10^6\, Av\sqrt{\Delta P\,(P_2 + 0.1)} \quad \cdots\cdots (2)$$

When

$P_2 < \frac{P_1 - 0.1}{2}$, **sonic flow**

$$Q = 8.3 \times 10^6\, Av\sqrt{\frac{(P_1 - 0.1)^2}{4} + 0.1 \times P_1} \quad \cdots\cdots (3)$$

Q : Flow rate [ℓ/min]
Av : Flow coefficient [m^2]
ΔP : Pressure differential [MPa]
P_1 : Upstream pressure [MPa]: $\Delta P = P_1 - P_2$
P_2 : Downstream pressure [MPa]

Conversion of flow coefficient:

$$Av = 28 \times 10^{-6}\, Kv = 24 \times 10^{-6}\, Cv \quad \cdots\cdots (4)$$

Here,

Kv factor : Value of the clean water flow rate represented by m^3/h which runs through a valve at 5 to 40°C, when the pressure differential is 1 bar.

Cv factor (Reference values) : Figures representing the flow rate of clean water by US gal/min which runs through a valve at 60°F, when the pressure differential is 1 lbf/in^2 (psi).

Value is different from Kv and Cv factors for pneumatic purpose due to different test method.

Solenoid Valve Flow-rate Characteristics

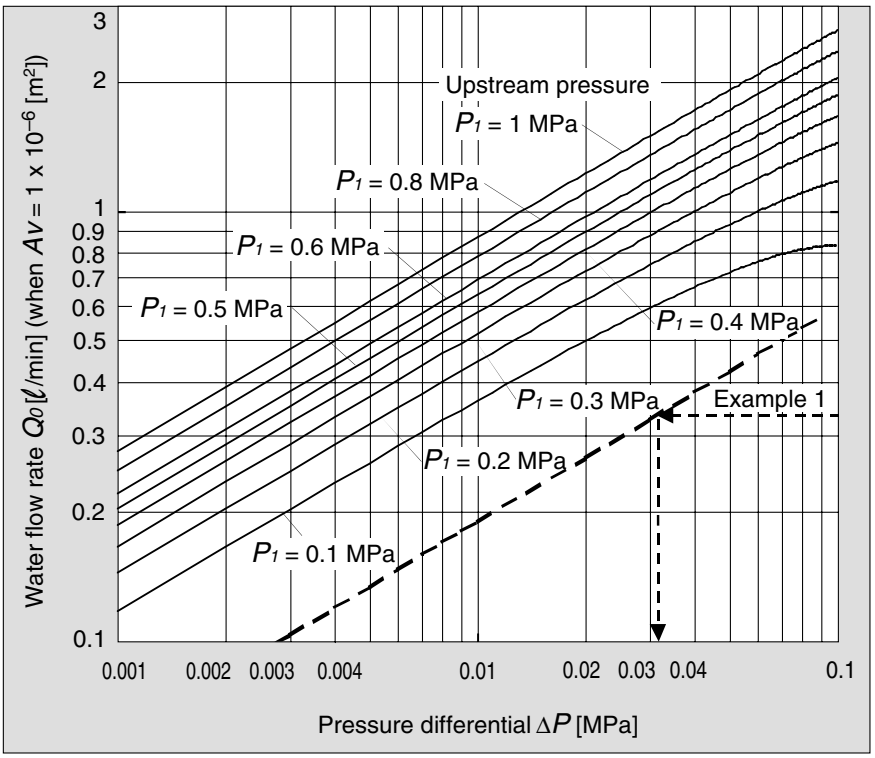


Chart (1) Flow-rate characteristics

Example 1)
Find the pressure differential when water 15 [ℓ/min] runs through a solenoid valve with an Av = 45 x 10^{-6} [m^2].
Since Q_0 = 15/45 = 0.33 [ℓ/min], according to Chart (1), if reading ΔP when Q_0 is 0.33, it will be 0.031 [MPa].

(4) Test method
Attach a test equipment to the test circuit shown in Fig. (2). Next, pour water at 5 to 40°C, then measure the flow rate with a pressure differential of 0.075 MPa. However, the pressure differential needs to be set with a large enough difference so that the Reynolds number does not go below a range of 4 x 10^4.
By substituting the measurement results in formula (1) is figured out Av.

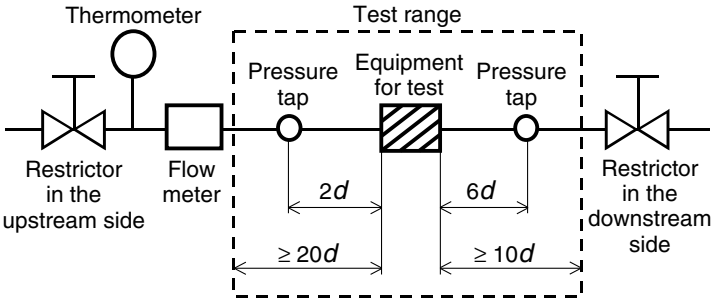
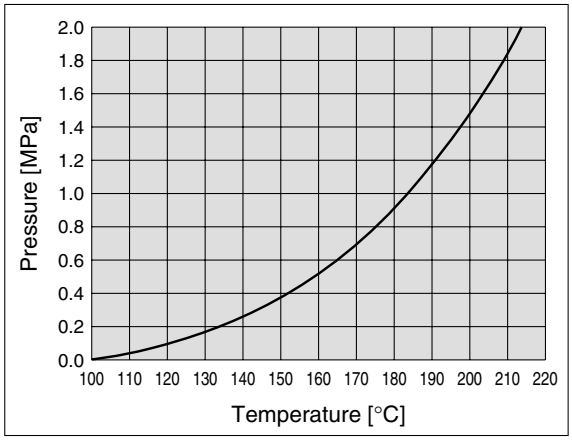


Fig. (2) Test circuit based on IEC60534-2-3, JIS B 2005

Vapour Dome (Water)



The chart above is calculated using the Antoine equation.

Glossary of Terms

Pressure Terminology

1. Maximum operating pressure differential

The maximum pressure differential (the difference between the inlet and outlet pressure) which is allowed for operation, with the valve closed or open. When the outlet pressure is 0 MPa, this becomes the maximum operating pressure.

2. Minimum operating pressure differential

The minimum pressure differential (the difference between the inlet pressure and outlet pressure) required to keep the main valve stably operated.

3. Maximum system pressure

The maximum pressure that can be applied inside the pipelines. (Line pressure) [The pressure differential of the solenoid valve portion must be less than the maximum operating pressure differential.]

4. Proof pressure

The pressure the valve must be withstand without a drop in performance after holding for 1 minute under the prescribed pressure (static pressure) and returning to the operating pressure range. [Value under the prescribed conditions]

Electrical Terminology

1. Apparent power (VA)

Volt-ampere is the product of voltage (V) and current (A). Power consumption (W): For AC, $W = V \cdot A \cdot \cos\theta$. For DC, $W = V \cdot A$.
Note) $\cos\theta$ shows power factor. $\cos\theta = 0.6$

2. Surge voltage

A high voltage which is momentarily generated by shutting off the power in the shut-off area.

3. Enclosure

A degree of protection defined in the “JIS C 0920: Waterproof test of electric machinery/appliance and the degree of protection against the intrusion of solid foreign objects”.
IP65: Dusttight, Water-jet-proof
“Water-jet-proof” means that no water intrudes inside an equipment that could hinder from operating normally by means of applying water for 3 minutes in the prescribed manner. Take appropriate protection measures, since a device is not usable in an environment where a droplet of water is splashed.

Others

1. Material

NBR: Nitrile rubber
FKM: Fluoro rubber – Product name: Viton®, Dai-el®, etc.
EPDM: Ethylene propylene rubber

2. Oil-free treatment

The degreasing and washing of wetted parts.

3. Passage symbol

In the JIS symbol () IN and OUT are in a blocked condition (), but actually in the case of reverse pressure (OUT> IN), there is a limit to the blocking.
() is used to indicate that blocking of reverse pressure is not possible.

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)[Note 1)], and other safety regulations.

Note 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: Manipulating industrial robots - Safety.
etc.

⚠ 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

1. **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
   Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
2. **Only personnel with appropriate training should operate machinery and equipment.**
   The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.
3. **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.
4. **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Safety Instructions

⚠ Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.[Note 2)]
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.

Note 2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Series VXS
Specific Product Precautions 1

Be sure to read before handling.
Refer to back pages 1 and 2 for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) for 2 Port Solenoid Valves for Fluid Control Precautions.

Operating Environment

⚠ Warning

1. Do not use the valves in an atmosphere having corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.

2. Do not use in explosive atmospheres.

3. Do not use in locations subject to vibration or impact.

4. Do not use in locations where radiated heat will be received from nearby heat sources.

5. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

Lubrication

⚠ Caution

1. Do not apply lubricant to the solenoid valve.

Scale and sludge are generated by the reaction of oil and steam, and cause destruction and malfunction.
Do not apply lubricant to the solenoid valve.

Maintenance

⚠ Warning

1. 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.

1. Shut off the fluid supply and release the fluid pressure in the system.
2. Shut off the power supply.
3. Dismount the product.

2. 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 a half year.

Maintenance

⚠ Caution

1. Lubrication

Do not apply lubricant to the solenoid valve.
Scale and sludge are generated by the reaction of oil and steam, and cause destruction and malfunction.

2. 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.

3. Depending on the water quality, the brass body may corrode due to dezincification, causing internal leakage.

Inspect the product once every six months. If any problem is found, replace it with a product with a stainless steel body.

Operating Precautions

⚠ Warning

1. Valves will reach high temperatures from high temperature fluids. Use caution, as there is a danger of being burned if a valve is touched directly.

2. Arrange piping so that condensate will not accumulate in the solenoid valve.

Install the piping to the solenoid valve higher than peripheral piping. Be sure to avoid installing the piping to the solenoid valve at the lowest part of the piping layout. If condensate accumulates in the solenoid valve or peripheral piping, the steam entering the piping will cause steam hammer. This will lead to destruction and malfunction of the solenoid valve and piping. If steam hammer causes problems, install by-pass piping to thoroughly discharge condensate from the piping. Apply steam to the device afterwards to start operation.

⚠ Caution

1. The valve of the pilot-operated 2-port solenoid valve may be opened momentarily and result in fluid leakage when pressure is applied to the valve suddenly (if the pump or supply valve starts, for example) while the valve is closed. Please be cautious of this.

Series VXS
Specific Product Precautions 2

Be sure to read before handling.
Refer to back pages 1 and 2 for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) for 2 Port Solenoid Valves for Fluid Control Precautions.

Design

⚠ Warning

1. Cannot be used as an emergency shutoff valve, etc.

The valves presented in this catalogue are not designed for safety applications such as an emergency shutoff valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

2. Extended periods of continuous energisation

The solenoid coil will generate heat when continuously energised. Avoid using in a tightly shut container. Install it in a well-ventilated area. Furthermore, do not touch it while it is being energised or right after it is energised.

3. This solenoid valve cannot be used for explosion proof applications.

4. Maintenance space

The installation should allow sufficient space for maintenance activities.

5. Actuator drive

When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures to prevent potential danger caused by actuator operation.

6. Pressure (including vacuum) holding

It is not usable for an application such as holding the pressure (including vacuum) inside of a pressure vessel because air leakage is entailed in a valve.

7. When the conduit type is used as equivalent to an IP65 enclosure, install a wiring conduit, etc.

8. When an impact, such as steam hammer, etc., caused by the rapid pressure fluctuation is applied, the solenoid valve may be damaged. Give an attention to it.

Selection

⚠ Warning

1. Confirm the specifications.

Give careful consideration to the operating conditions such as the application, fluid and environment, and use within the operating ranges specified in this catalogue.

2. Fluid

1. Type of fluid
This product is applicable only for steam of 183°C/1 MPa or less.

2. Flammable oil, gas
Do not use with these fluids, as they can cause destruction or malfunction.

3. Corrosive gas
Cannot be used since it will lead to cracks by stress corrosion or result in other incidents.

4. Use an oil-free specification when any oily particle must not enter the passage.

5. Applicable fluid on the list may not be used depending on the operating condition. Give adequate confirmation, and then determine a model, just because the compatibility list shows the general case.

3. Steam quality

The use of steam containing foreign matter can cause problems such as malfunction and seal failure by promoting wear of the valve seat and armature, and by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 80 to 100 mesh.

When used to supply water to boilers, substances such as calcium and magnesium which generate hard scale and sludge are included. Since this scale and sludge can cause the valve to malfunction, install water softening equipment, and a filter (strainer) directly upstream from the valve to remove these substances.

Do not use steam which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause destruction or malfunction.

4. Ambient environment

Use within the operable ambient temperature range. Confirm the compatibility between the product's composition materials and the ambient atmosphere. Be sure that the fluid used does not touch the external surface of the product.

Series VXS
Specific Product Precautions 3

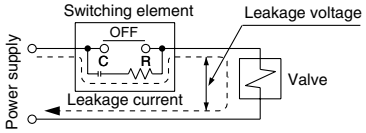
Be sure to read before handling.
Refer to back pages 1 and 2 for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) for 2 Port Solenoid Valves for Fluid Control Precautions.

Selection

⚠ Caution

1. 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.



10% or less of rated voltage

2. Low temperature operation

1. 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.
2. When using valves for water application in cold climates, take appropriate countermeasures to prevent the water from freezing in tubing 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 a freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.

Mounting

⚠ Warning

1. 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.

2. 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.

3. 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 malfunction.

4. Do not warm the coil assembly with a heat insulator, etc.

Use tape, heaters, etc., for freeze prevention in the piping and body only. They can cause the coil to burn out.

5. Secure with brackets, except in the case of steel piping and copper fittings.

6. Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.

7. Painting and coating

Warnings or specifications printed or labeled on the product should not be erased, removed or covered up.

Piping

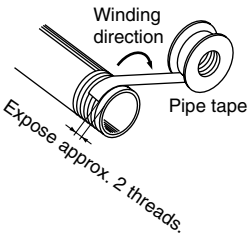
⚠ Caution

1. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.
Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.

2. Wrapping of pipe tape

When connecting pipes, fittings, etc., be sure that chips from the pipe threads and sealing material do not enter the valve.
Furthermore, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



3. If an excessive amount of thread sealant such as seal tape or liquid thread sealant is used during piping, it will get inside the product and lead to malfunction.

4. Always tighten threads with the proper tightening torque.

When attaching fittings to valves, tighten with the proper tightening torque shown below.

Tightening Torque for Piping

Connection thread	Proper tightening torque N·m
Rc1/4	12 to 14
Rc3/8	22 to 24
Rc1/2	28 to 30
Rc3/4	28 to 30
Rc1	36 to 38

5. Connection of piping to products

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

6. Steam generated in a boiler contains a large amount of drainage. Be sure to operate it with a drain trap installed.

7. Arrange piping so that condensate will not accumulate in the solenoid valve.

Install the piping to the solenoid valve higher than peripheral piping. Be sure to avoid installing the piping to the solenoid valve at a lower part of the piping layout. If condensate accumulates in the solenoid valve or peripheral piping, the steam entering the piping will cause steam hammer. This will lead to destruction and malfunction of the solenoid valve and piping. If steam hammer causes problems, install by-pass piping to thoroughly discharge condensate from the piping. Apply steam to the device afterwards to start operation.

8. If the effective area of piping on the fluid supply side is restricted, the operating time may become unstable due to differential pressure fluctuation when the valve is closed.

9. For the convenience of maintenance and repair, install a by-pass circuit and use a union for piping.

10. To control the fluid in the tank, connect the piping a little higher than the bottom of the tank.

Series VXS
Specific Product Precautions 4

Be sure to read before handling.
Refer to back pages 1 and 2 for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) for 2 Port Solenoid Valves for Fluid Control Precautions.

Wiring

⚠ Caution

1. **As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25 mm² for wiring. Furthermore, do not allow excessive force to be applied to the lines.**
2. **Use electrical circuits which do not generate chattering in their contacts.**
3. **Use voltage which is within ±10% of the rated voltage. The voltage drop is the value in the lead wire section connecting the coil.**

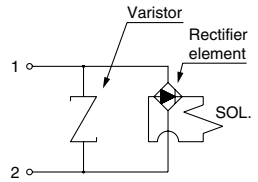
Electrical Circuits

⚠ Caution

[AC, Class H coil (Full wave rectifier type) circuit]

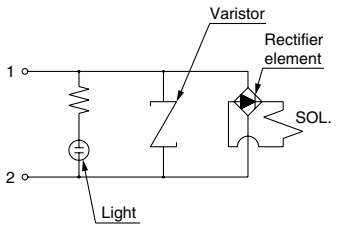
∗ The standard product is equipped with surge voltage suppressor.

Grommet, Conduit, Conduit terminal



Without electrical option

Conduit terminal with light



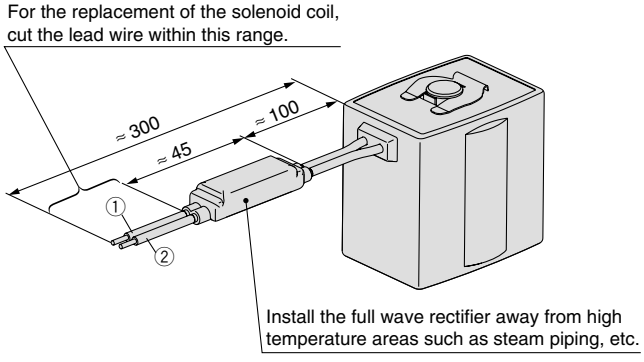
With light

Electrical Connections

⚠ Caution

Grommet

Class H coil: AWG18 Insulator O.D. 2.2 mm



Rated voltage	Lead wire colour	
	①	②
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

∗ There is no polarity.

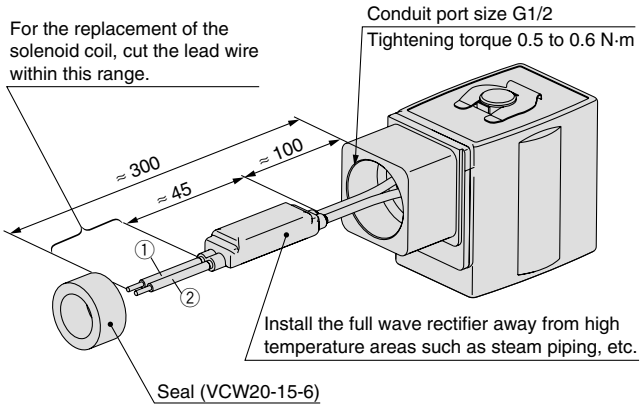
Electrical Connections

⚠ Caution

Conduit

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



Rated voltage	Lead wire colour	
	①	②
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

∗ There is no polarity.

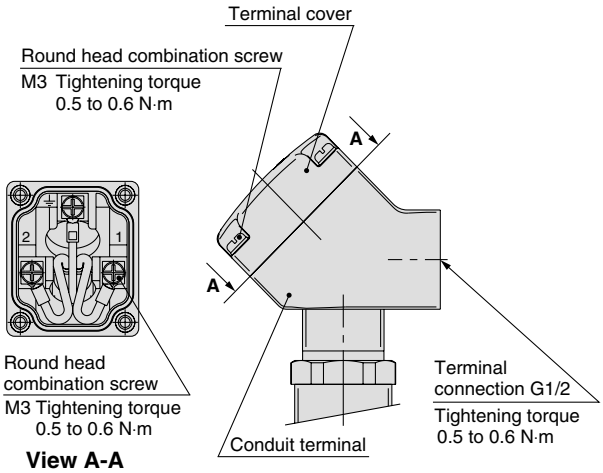
Description	Part no.
Seal	VCW20-15-6

Note) Please order separately.

Conduit terminal

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.



View A-A

(Internal connection diagram)

EUROPEAN SUBSIDIARIES:

Austria
SMC Pneumatik GmbH (Austria).
Girakstrasse 8, A-2100 Korneuburg
Phone: +43 2262-622800, Fax: +43 2262-62285
E-mail: office@smc.at
http://www.smc.at

Belgium
SMC Pneumatics N.V./S.A.
Nijverheidsstraat 20, B-2160 Wommelgem
Phone: +32 (0)3-355-1464, Fax: +32 (0)3-355-1466
E-mail: info@smcpneumatics.be
http://www.smcpneumatics.be

Bulgaria
SMC Industrial Automation Bulgaria EOOD
Business Park Sofia, Building 8 - 6th floor, BG-1715 Sofia
Phone:+359 2 9744492, Fax:+359 2 9744519
E-mail: office@smc.bg
http://www.smc.bg

Croatia
SMC Industrijska automatika d.o.o.
Crnomerec 12, HR-10000 ZAGREB
Phone: +385 1 377 66 74, Fax: +385 1 377 66 74
E-mail: office@smc.hr
http://www.smc.hr

Czech Republic
SMC Industrial Automation CZ s.r.o.
Hudcova 78a, CZ-61200 Brno
Phone: +420 5 414 24611, Fax: +420 5 412 18034
E-mail: office@smc.cz
http://www.smc.cz

Denmark
SMC Pneumatik A/S
Egeskovvej 1, DK-8700 Horsens
Phone: +45 70252900, Fax: +45 70252901
E-mail: smc@smcdk.com
http://www.smcdk.com

Estonia
SMC Pneumatics Estonia OÜ
Laki 12, 106 21 Tallinn
Phone: +372 6510370, Fax: +372 65110371
E-mail: smc@smcpneumatics.ee
http://www.smcpneumatics.ee

Finland
SMC Pneumatics Finland Oy
PL72, Tiistinniityntie 4, SF-02231 ESPOO
Phone: +358 207 513513, Fax: +358 207 513595
E-mail: smcfi@smc.fi
http://www.smc.fi

France
SMC Pneumatique, S.A.
1, Boulevard de Strasbourg, Parc Gustave Eiffel
Bussy Saint Georges F-77607 Marne La Vallee Cedex 3
Phone: +33 (0)1-6476 1000, Fax: +33 (0)1-6476 1010
E-mail: contact@smc-france.fr
http://www.smc-france.fr

Germany
SMC Pneumatik GmbH
Boschring 13-15, D-63329 Egelsbach
Phone: +49 (0)6103-4020, Fax: +49 (0)6103-402139
E-mail: info@smc-pneumatik.de
http://www.smc-pneumatik.de

Greece
SMC Hellas EPE
Anagenniseos 7-9 - P.C. 14342. N. Philadelphia, Athens
Phone: +30-210-2717265, Fax: +30-210-2717766
E-mail: sales@smchellas.gr
http://www.smchellas.gr

Hungary
SMC Hungary Ipari Automatizálási Kft.
Torbágy út 19, H-2045 Törökbálint
Phone: +36 23 511 390, Fax: +36 23 511 391
E-mail: office@smc.hu
http://www.smc.hu

Ireland
SMC Pneumatics (Ireland) Ltd.
2002 Citywest Business Campus, Naas Road, Saggart, Co. Dublin
Phone: +353 (0)1-403 9000, Fax: +353 (0)1-464-0500
E-mail: sales@smcpneumatics.ie
http://www.smcpneumatics.ie

Italy
SMC Italia S.p.A
Via Garibaldi 62, I-20061 Carugate, (Milano)
Phone: +39 (0)2-92711, Fax: +39 (0)2-9271365
E-mail: mailbox@smcitalia.it
http://www.smcitalia.it

Latvia
SMC Pneumatics Latvia SIA
Dzelzavas str. 120g, Riga LV-1021, LATVIA
Phone: +371 67817700, Fax: +371 67817701
E-mail: info@smclv.lv
http://www.smclv.lv

Lithuania
SMC Pneumatics Lietuva, UAB
Oslo g.1, LT-04123 Vilnius
Phone: +370 5 2308118, Fax: +370 5 2648126
E-mail: info@smclt.lt
http://www.smclt.lt

Netherlands
SMC Pneumatics BV
De Ruyterkade 120, NL-1011 AB Amsterdam
Phone: +31 (0)20-5318888, Fax: +31 (0)20-5318880
E-mail: info@smcpneumatics.nl
http://www.smcpneumatics.nl

Norway
SMC Pneumatics Norway A/S
Vollsveien 13 C, Granfos Næringspark N-1366 Lysaker
Tel: +47 67 12 90 20, Fax: +47 67 12 90 21
E-mail: post@smc-norge.no
http://www.smc-norge.no

Poland
SMC Industrial Automation Polska Sp.z.o.o.
ul. Poloneza 89, PL-02-826 Warszawa,
Phone: +48 22 211 9600, Fax: +48 22 211 9617
E-mail: office@smc.pl
http://www.smc.pl

Portugal
SMC Sucursal Portugal, S.A.
Rua de Engº Ferreira Dias 452, 4100-246 Porto
Phone: +351 226 166 570, Fax: +351 226 166 589
E-mail: postpt@smc.smces.es
http://www.smc.eu

Romania
SMC Romania srl
Str Frunzei 29, Sector 2, Bucharest
Phone: +40 213205111, Fax: +40 213261489
E-mail: smcromania@smcromania.ro
http://www.smcromania.ro

Russia
SMC Pneumatik LLC.
4B Sverdlovskaja nab, St. Petersburg 195009
Phone.:+7 812 718 5445, Fax:+7 812 718 5449
E-mail: info@smc-pneumatik.ru
http://www.smc-pneumatik.ru

Slovakia
SMC Priemyselná Automatizáciá, s.r.o.
Fatranská 1223, 01301 Teplicka Nad Váhom
Phone: +421 41 3213212 - 6 Fax: +421 41 3213210
E-mail: office@smc.sk
http://www.smc.sk

Slovenia
SMC industrijska Avtomatika d.o.o.
Mirnska cesta 7, SI-8210 Trebnje
Phone: +386 7 3885412 Fax: +386 7 3885435
E-mail: office@smc.si
http://www.smc.si

Spain
SMC España, S.A.
Zuazobidea 14, 01015 Vitoria
Phone: +34 945-184 100, Fax: +34 945-184 124
E-mail: post@smc.smces.es
http://www.smc.eu

Sweden
SMC Pneumatics Sweden AB
Ekhagsvägen 29-31, S-141 71 Huddinge
Phone: +46 (0)8-603 12 00, Fax: +46 (0)8-603 12 90
E-mail: post@smcpneumatics.se
http://www.smc.nu

Switzerland
SMC Pneumatik AG
Dorfstrasse 7, CH-8484 Weisslingen
Phone: +41 (0)52-396-3131, Fax: +41 (0)52-396-3191
E-mail: info@smc.ch
http://www.smc.ch

Turkey
Entek Pnömatik San. ve Tic. A*.
Perpa Ticaret Merkezi B Blok Kat:11 No: 1625, TR-34386, Okmeydani, Istanbul
Phone: +90 (0)212-444-0762, Fax: +90 (0)212-221-1519
E-mail: smc@entek.com.tr
http://www.entek.com.tr

UK
SMC Pneumatics (UK) Ltd
Vincent Avenue, Crownhill, Milton Keynes, MK8 0AN
Phone: +44 (0)845 121 5122 Fax: +44 (0)1908-555064
E-mail: sales@smcpneumatics.co.uk
http://www.smcpneumatics.co.uk

OTHER SUBSIDIARIES WORLDWIDE:

ARGENTINA, AUSTRALIA, BOLIVIA, BRASIL, CANADA, CHILE, CHINA, HONG KONG, INDIA, INDONESIA, MALAYSIA, MEXICO, NEW ZEALAND, PHILIPPINES, SINGAPORE, SOUTH KOREA, TAIWAN, THAILAND, USA, VENEZUELA

http://www.smc.eu
http://www.smcworld.com

SMC CORPORATION Akihabara UDX 15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN Phone: 03-5207-8249 FAX: 03-5298-5362

1st printing OO printing OO 00 Printed in Spain