

# Zero Differential Pressure Type Pilot Operated

2 Port Solenoid Valve

For Air, Water, Oil



**New**  
**VXZ** Series **VXZ22/23**

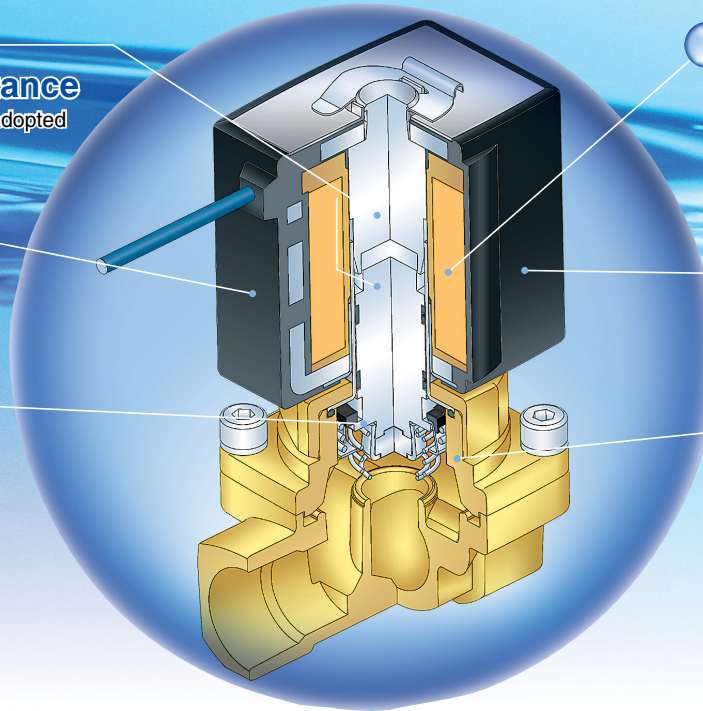


# Solenoid valves for various fluids used in a wide variety of

**Improved corrosion resistance**  
Special magnetic material adopted

**Enclosure: IP65**

**Low-noise construction**  
Special construction enables to reduce the metal noise. (DC spec.)



**Reduced power consumption (DC spec.)**

VXZ22: 8 W → **7 W**

VXZ23: 11.5 W → **10.5 W**

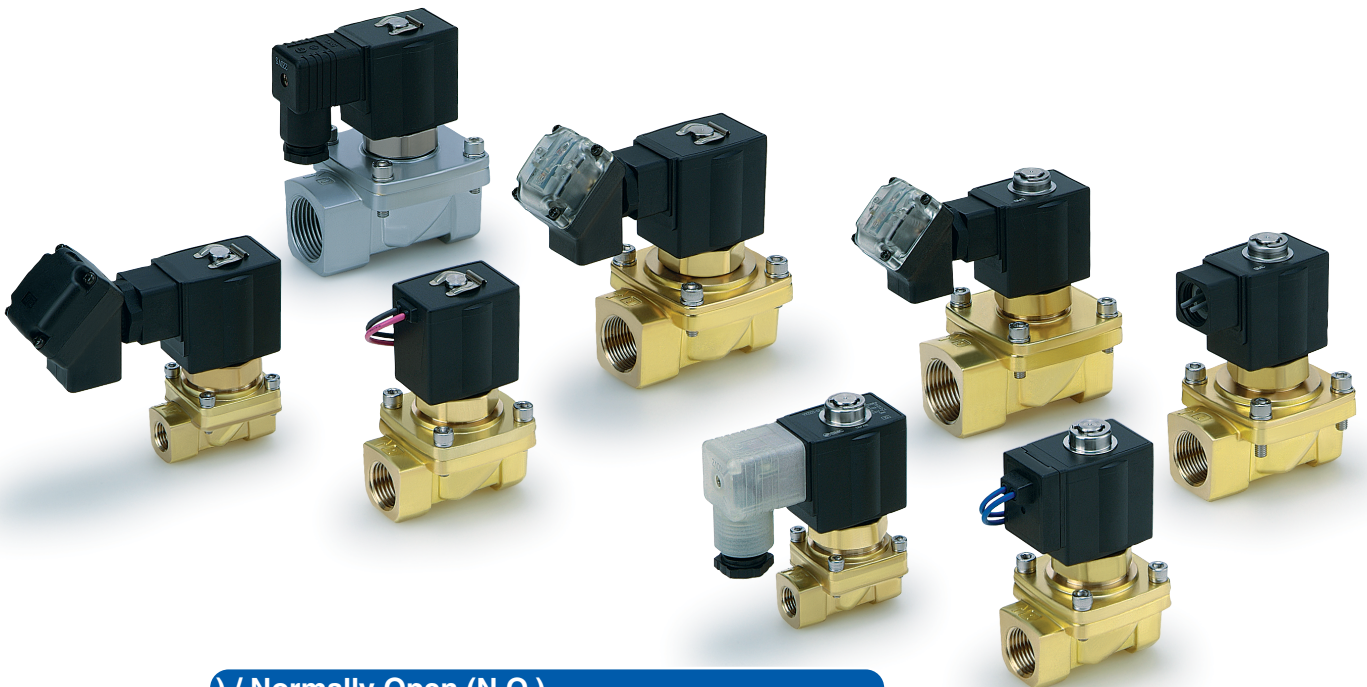
**Flame resistance**  
**UL94V-0 conformed**  
Flame resistant mold coil material

**Improved maintenance performance**  
Maintenance is performed easily due to the threaded assembly.

## Pilot Operated 2 Port Solenoid Valve

For Air, Water, Oil

**New Series VXZ22/23**



### **( ) / Normally Open (N.O.)**

Solenoid valve (Port size)			Orifice size				Material	
Model	VXZ22	VXZ23	3 (10 mmø)	4 (15 mmø)	5 (20 mmø)	6 (25 mmø)	Body	Seal
Port no. (Port size)	<b>02</b> (1/4)	—	●	—	—	—	Brass (C37) Stainless steel	NBR
	<b>03</b> (3/8)	—	●	—	—	—		
	<b>04</b> (1/2)	—	—	●	—	—		
	—	<b>06</b> (3/4)	—	—	●	—		
	—	<b>10</b> (1)	—	—	—	●		

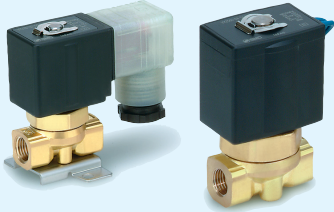


# applications — **New VX Series variations**

## Direct Operated 2 Port

### **New VX21/22/23**

For Air, Vacuum, Water, Steam, Oil

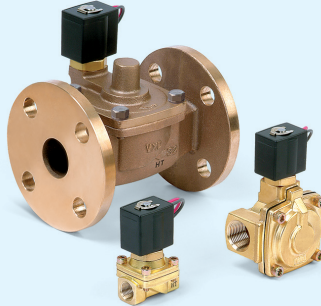


Valve type	Port size	Orifice size mmØ
N.C./N.O.	1/8 to 1/2	2 to 10

## Pilot Operated 2 Port

### **New VXD21/22/23**

For Water, Oil, Air

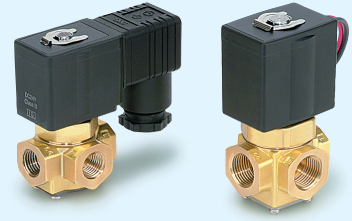


Valve type	Port size	Orifice size mmØ
N.C./N.O.	1/4 to 1 32 A to 50 A	10 to 50

## Direct Operated 3 Port

### **New VX31/32/33**

For Air, Vacuum, Water, Steam, Oil

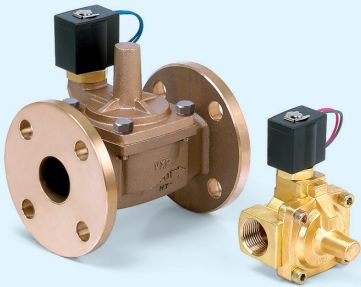


Valve type	Port size	Orifice size mmØ
N.C./N.O. COM.	1/8 to 3/8	1.5 to 4

## Pilot Operated 2 Port

### **VXP21/22/23**

For Steam (Air, Water, Oil)

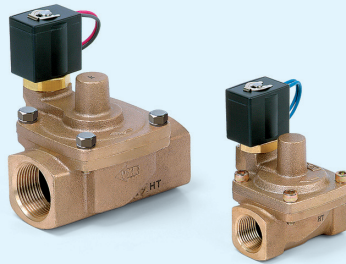


Valve type	Port size	Orifice size mmØ
N.C./N.O.	1/4 to 2 32 A to 50 A	10 to 50

## Water Hammer Relief, Pilot Operated 2 Port

### **VXR21/22/23**

For Water, Oil

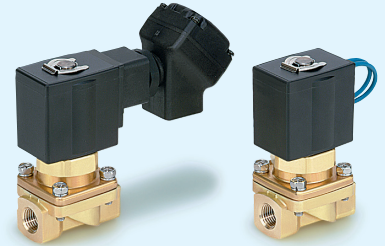


Valve type	Port size	Orifice size mmØ
N.C./N.O.	1/2 to 2	20 to 50

## Pilot Operated 2 Port for High Pressure

### **VXH22**

For Air, Water, Oil

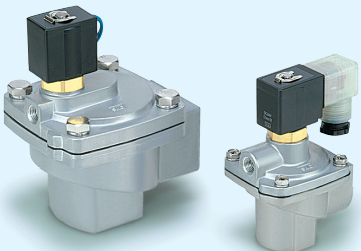


Valve type	Port size	Orifice size mmØ
N.C.	1/4 to 1/2	10

## 2 Port for Dust Collector (Solenoid type, Air Operated type)

### **VXF21/22, VXFA21/22**

For Air

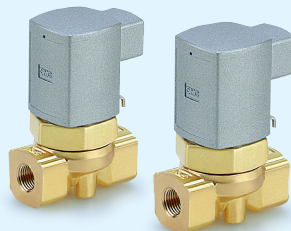


Valve type	Port size	Orifice size mmØ
N.C.	3/4 to 1 1/2	20 to 40

## Air Operated 2/3 Port

### **VXA21/22, VXA31/32**

For Air, Vacuum, Water, Oil



Model	Valve type	Port size	Orifice size mmØ
VXA21/22	N.C./N.O.	1/8 to 1/2	3 to 10
VXA31/32	COM.	1/8 to 3/8	1.5 to 4

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

# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve

## Series VXZ22/23

For Air, Water, Oil

Specifications



### ■ Valve

Normally closed (N.C.)  
Normally open (N.O.)

### ■ Solenoid Coil

Coil: Class B, Class H

### ■ Rated Voltage

100 VAC, 200 VAC, 110 VAC,  
220 VAC, 240 VAC, 230 VAC,  
48 VAC, 24 VDC, 12 VDC

### ■ Material

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



### ■ Electrical Entry

- Grommet
- Conduit
- DIN terminal
- Conduit terminal

Model		VXZ223 <sup>2</sup> <sub>0</sub>	VXZ224 <sup>2</sup> <sub>0</sub>	VXZ235 <sup>2</sup> <sub>0</sub>	VXZ236 <sup>2</sup> <sub>0</sub>
Orifice size	10 mmø	●	—	—	—
	15 mmø	—	●	—	—
	20 mmø	—	—	●	—
	25 mmø	—	—	—	●
Port size (Flange)		1/4 (8A) 3/8 (10A)	1/2 (15A)	3/4 (20A)	1 (25A)

For Air

For Water

For Oil

Construction

Dimensions



# Common Specifications

## Standard Specifications

Valve specifications	Valve construction		Zero differential pressure type pilot operated 2 port diaphragm type
	Withstand pressure (MPa)		5.0
	Body material		Brass (C37), Stainless steel
	Seal material		NBR, FKM, EPDM
	Enclosure		Dusttight, Low jetproof (equivalent to IP65)*
	Environment		Location without corrosive or explosive gases
	Vibration resistance/Impact resistance (m/s <sup>2</sup> )		30/150 or less
Coil specifications	Rated voltage	AC (Class B coil, Built-in full-wave rectifier type)	100 VAC, 200 VAC, 110 VAC, 220 VAC, 230 VAC, 240 VAC, 48 VAC
		AC (Class H coil)	
		DC (Class B coil only)	24 VDC, 12 VDC
	Allowable voltage fluctuation		10% of rated voltage
	Allowable leakage voltage	AC (Class B coil, Built-in full-wave rectifier type)	10% or less of rated voltage
		AC (Class H coil)	20% or less of rated voltage
		DC (Class B coil only)	2% or less of rated voltage
	Coil insulation type		Class B, Class H

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

## Solenoid Coil Specifications

### DC Specification (Class B coil only)

Model	Power consumption (W)	Temperature rise (C) <sup>Note)</sup>
VXZ22	7	45
VXZ23	10.5	60

Note) The value at ambient temperature of 20C and when the rated voltage is applied.

### AC Specification (Class B coil, Built-in full-wave rectifier type)

Model	Apparent power (VA) <sup>Note 2)</sup>	Temperature rise (C) <sup>Note 1)</sup>
VXZ22	9.5	60
VXZ23	12	65

Note 1) The value at ambient temperature of 20C and when the rated voltage is applied.

Note 2) There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used in the AC (Class B coil, built-in full-wave rectifier type).

### AC Specification (Class H coil)

Model	Frequency (Hz)	Apparent power (VA)		Temperature rise (C) <sup>Note)</sup>
		Inrush	Energized	
VXZ22	50	65	33	100
	60	55	27	95
VXZ23	50	94	50	120
	60	79	41	115

Note) The value at ambient temperature of 20C and when the rated voltage is applied.

# Applicable Fluid Check List

## All Options

VXZ2   0       1   R1

• Option symbol

Fluid and application	Option symbol	Seal material	Body/ Shading coil material <small>Note 5)</small>	Guide ring and push rod (N.O. only) material	Coil insulation type <small>Note 3)</small>	Note
Air	Nil	NBR	Brass (C37)/-	PPS	B	
	G		Stainless steel/-			
Water	Nil	NBR	Brass (C37)/-		B	
	G		Stainless steel/-			
Heated water	E	EPDM	Brass (C37)/Cu		H	
	P		Stainless steel/Ag			
Oil <small>Note 2)</small>	A	FKM	Brass (C37)/-		B	
	H		Stainless steel/-			
	D		Brass (C37)/Cu		H	
	N		Stainless steel/Ag			
High corrosive spec., Oil-free	L <small>Note 1)</small>	FKM	Stainless steel/-		B	
Copper-free, Fluoro-free <small>Note 4)</small>	J	EPDM	Stainless steel/-		B	
	P		Stainless steel/Ag		H	
Other combinations	B	EPDM	Brass (C37)/-		B	

Note 1) "L" option is the oil-free treatment.

Note 2) The dynamic viscosity of the fluid must not exceed 50 mm<sup>2</sup>/s.

The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON.

Select the DC spec. or AC spec. built-in full-wave rectifier type when the dynamic viscosity is higher than water or when the OFF response is prioritized.

Note 3) Coil insulation type Class H: AC spec. only

Note 4) The nuts (non-wetted parts) are nickel-plated on the C37 material.

Note 5) There is no shading coil attached to the DC spec. or AC spec built-in full-wave rectifier type.

\* Please contact SMC when fluids other than above are used.

Specifications

For Air

For Water

For Oil

Construction

Dimensions



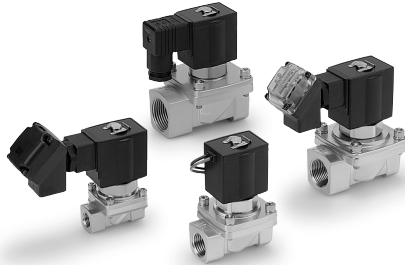
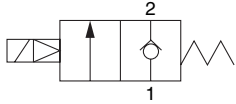
## For Air

(Inert gas)

### Model/Valve Specifications

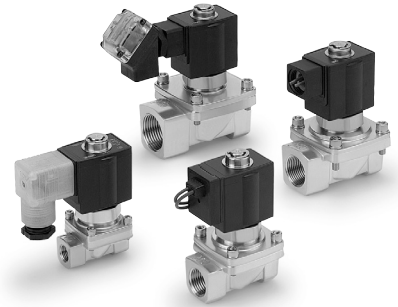
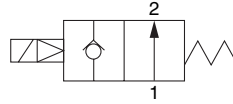
#### N.C.

Passage symbol



#### N.O.

Passage symbol



#### Normally Closed (N.C.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics			Max. system pressure (MPa)	Weight (g)
				AC	DC	C	b	Cv		
1/4 (8A)	10	VXZ2230-02	0	1.0	0.7	8.5	0.44	2.4	1.5	550
3/8 (10A)		VXZ2230-03				11.0	0.42	2.8		760
1/2 (15A)	15	VXZ2240-04				23.0	0.34	6.0		1300
3/4 (20A)	20	VXZ2350-06				38.0	0.20	9.5		

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics	Max. system pressure (MPa)	Weight (g)
				AC	DC	Effective area (mm <sup>2</sup> )		
1 (25A)	25	VXZ2360-10	0	1.0	0.7	215	1.5	1480

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

#### Normally Open (N.O.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics			Max. system pressure (MPa)	Weight (g)
				AC	DC	C	b	Cv		
1/4 (8A)	10	VXZ2232-02	0	0.7	0.6	8.5	0.44	2.4	1.5	600
3/8 (10A)		VXZ2232-03				11.0	0.42	2.8		850
1/2 (15A)	15	VXZ2242-04				23.0	0.34	6.0		1370
3/4 (20A)	20	VXZ2352-06				38.0	0.20	9.5		

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics	Max. system pressure (MPa)	Weight (g)
				AC	DC	Effective area (mm <sup>2</sup> )		
1 (25A)	25	VXZ2362-10	0	0.7	0.6	215	1.5	1550

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

### Ambient and Fluid Temperature

Power source	Fluid temperature (C)	Ambient temperature (C)
	Solenoid valve option symbol	
	Nil, G	
AC/Class B coil	-10 to 60 <sup>Note)</sup>	-10 to 60
DC	-10 to 60 <sup>Note)</sup>	-10 to 60



Note) Dew point temperature: -10C or less

### Valve Leakage Rate

#### Internal Leakage

Seal material	Leakage rate (Air)
NBR	1 cm <sup>3</sup> /min or less

#### External Leakage

Seal material	Leakage rate (Air)
NBR	1 cm <sup>3</sup> /min or less

## How to Order

**DC**

**AC/Class B coil (Built-in full-wave rectifier type)**

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

**Valve/Body configuration**

0	N.C. / Single unit
2	N.O. / Single unit

**Suffix**

Nil	—
Z	Oil-free spec.

**Rated voltage**

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

\* Refer to the table (3) shown below for availability.

Refer to page 12 for ordering coil only.

**VXZ 22 3 0 [ ] [ ] - 02 [ ] - 5 G 1 - [ ]**

**VXZ 22 3 0 [ ] [ ] - 02 [ ] - 1 G R1 - [ ]**

**Orifice size**  
Refer to the table (1) shown below for availability.

**Solenoid valve option**  
Refer to the table (2) shown below for availability.

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

**Thread type**

Nil	Rc
T	NPTF
F	G
N	NPT

**Bracket**

Nil	None
B	With bracket

\* Bracket is not removable.

**Built-in full-wave rectifier type**

**Electrical entry**

**G -Grommet**  
**GS-With grommet surge voltage suppressor**

**T -With conduit terminal**  
**TS-With conduit terminal and surge voltage suppressor**  
**TL-With conduit terminal and light**  
**TZ-With conduit terminal, surge voltage suppressor and light**

**C-Conduit**

**D -DIN terminal**  
**DS -DIN terminal with surge voltage suppressor**  
**DL -DIN terminal with light**  
**DZ -DIN terminal with surge voltage suppressor and light**  
**DO-For DIN terminal (without connector, gasket is included.)**

\* DIN type is available with class B only.

**Table (1) Model – Orifice Size – Port Size**  
**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 no. (Port size)	02 (1/4)	—	●	—	—	—	Brass (C37), Stainless steel	NBR
	03 (3/8)	—	●	—	—	—		
	04 (1/2)	—	—	●	—	—		
	—	06 (3/4)	—	—	●	—		
	—	10 (1)	—	—	—	●		

**Table (2) Solenoid Valve Option**

Option symbol	Seal material	Body material	Coil insulation type	Note
Nil	NBR	Brass (C37)	B	—
G		Stainless steel		

**Table (3) Rated Voltage – Electrical Option**

Rated voltage			Class B			Class H		
			S	L	Z	S	L	Z
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	1	100 V	—	●	—	●	●	●
	2	200 V	—	●	—	●	●	●
	3	110 V	—	●	—	●	●	●
	4	220 V	—	●	—	●	●	●
	7	240 V	—	—	—	●	—	—
	8	48 V	—	—	—	●	—	—
DC	J	230 V	—	—	—	●	—	—
	5	24 V	●	●	●	DC spec. is not available.		
	6	12 V	●	—	—			

\* Option "S", "Z" are not available as surge voltage suppressor is integrated into the AC/Class B, as a standard.

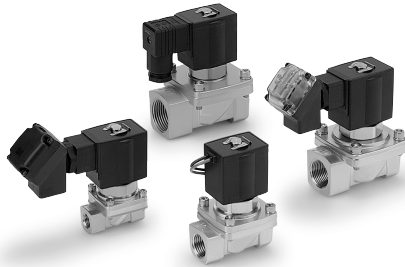
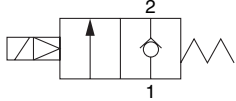


## For Water

### Model/Valve Specifications

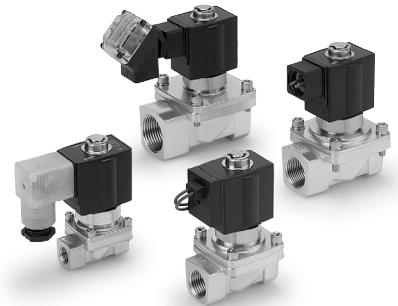
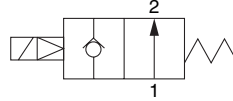
#### N.C.

Passage symbol



#### N.O.

Passage symbol



#### Normally Closed (N.C.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics		Max. system pressure (MPa)	Weight (g)
				AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted		
1/4 (8A)	10	VXZ2230-02	0	1.0	0.7	46	1.9	1.5	550
3/8 (10A)		VXZ2230-03				58	2.4		
1/2 (15A)	15	VXZ2240-04				130	5.3		760
3/4 (20A)		VXZ2350-06			1.0	220	9.2		1300
1 (25A)	25	VXZ2360-10				290	12.0		1480

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

#### Normally Open (N.O.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics		Max. system pressure (MPa)	Weight (g)
				AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted		
1/4 (8A)	10	VXZ2232-02	0	0.7	0.6	46	1.9	1.5	600
3/8 (10A)		VXZ2232-03				58	2.4		
1/2 (15A)	15	VXZ2242-04				130	5.3		850
3/4 (20A)	20	VXZ2352-06				220	9.2		1370
1 (25A)	25	VXZ2362-10				290	12.0		1550

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

### Ambient and Fluid Temperature

Power source	Fluid temperature (C)		Ambient temperature (C)
	Solenoid valve option symbol		
	Nil, G, L	E, P	
AC/Class B coil	1 to 60	—	–10 to 60
AC/Class H coil	—	1 to 99	–10 to 60
DC	1 to 60	—	–10 to 60



Note) With no freezing

### Valve Leakage Rate

#### Internal Leakage

Seal material	Leakage rate (Water)
NBR, FKM, EPDM	0.1 cm <sup>3</sup> /min or less

#### External Leakage

Seal material	Leakage rate (Water)
NBR, FKM, EPDM	0.1 cm <sup>3</sup> /min or less

# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve **Series VXZ22/23**

For Water

## How to Order

**DC**  
**AC/Class H coil**  
**AC/Class B coil (Built-in full-wave rectifier type)**

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

**Orifice size** • Refer to the table (1) shown below for availability.

**Valve/Body configuration** •

0	N.C. / Single unit
2	N.O. / Single unit

**Solenoid valve option** • Refer to the table (2) shown below for availability.

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

**Thread type** •

Nil	Rc
T	NPTF
F	G
N	NPT

**Suffix** •

Nil	—
Z	Oil-free spec.

Select nil because the solenoid valve option "L" is the oil-free treatment.

**Bracket**

Nil	None
B	With bracket

\* Bracket is not removable.

**Built-in full-wave rectifier type**

**Electrical entry** •

**G** -Grommet  
**GS** -With grommet surge voltage suppressor

**C-Conduit**

**T** -With conduit terminal  
**TS** -With conduit terminal and surge voltage suppressor  
**TL** -With conduit terminal and light  
**TZ** -With conduit terminal, surge voltage suppressor and light

**D** -DIN terminal  
**DS** -DIN terminal with surge voltage suppressor  
**DL** -DIN terminal with light  
**DZ** -DIN terminal with surge voltage suppressor and light  
**DO** -For DIN terminal (without connector, gasket is included.)

\* DIN type is available with class B only.

**Rated voltage** •

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

\* Refer to the table (3) shown below for availability.

Refer to page 12 for ordering coil only.

**Table (1) Model – Orifice Size – Port Size**  
**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 no. (Port size)	02 (1/4)	—	●	—	—	—	Brass (C37), Stainless steel	NBR FKM EPDM
	03 (3/8)	—	●	—	—	—		
	04 (1/2)	—	—	●	—	—		
	—	06 (3/4)	—	—	●	—		
	—	10 (1)	—	—	—	●		

**Table (2) Solenoid Valve Option**

Option symbol	Seal material	Body/Shading coil material*	Coil insulation type	Note
Nil	NBR	Brass (C37)/—	B	—
G		Stainless steel/—		
E	EPDM	Brass (C37)/Cu	H	Heated water (AC only)
P		Stainless steel/Ag		
L	FKM	Stainless steel/—	B	High corrosive, Oil-free

\* There is no shading coil attached to the AC/Class B coil and DC spec.

**Table (3) Rated Voltage – Electrical Option**

Rated voltage			Class B			Class H		
AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	—	●	—	●	●	●
	2	200 V	—	●	—	●	●	●
	3	110 V	—	●	—	●	●	●
	4	220 V	—	●	—	●	●	●
	7	240 V	—	—	—	●	—	—
	8	48 V	—	—	—	●	—	—
DC	J	230 V	—	—	—	●	—	—
	5	24 V	●	●	●	DC spec. is not available.		
	6	12 V	●	—	—			

\* Option "S", "Z" are not available as surge voltage suppressor is integrated into the AC/Class B, as a standard.

\* Class B and H coils cannot be interchanged in order to exchange the coils.

\* AC/Class B (with built-in full wave rectifier type) can be interchanged with DC.

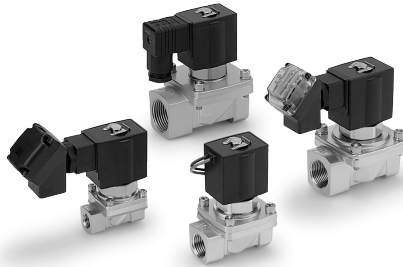
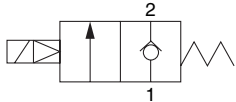


## For Oil

### Model/Valve Specifications

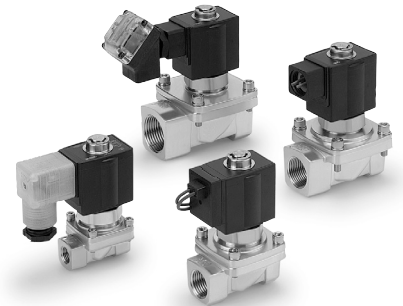
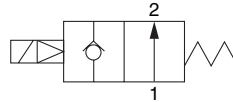
#### N.C.

Passage symbol



#### N.O.

Passage symbol



#### Normally Closed (N.C.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics		Max. system pressure (MPa)	Weight (g)
				AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted		
1/4 (8A)	10	VXZ2230-02	0	0.7		46	1.9	1.5	550
3/8 (10A)		VXZ2230-03				58	2.4		
1/2 (15A)	15	VXZ2240-04				130	5.3		760
3/4 (20A)	20	VXZ2350-06				220	9.2		1300
1 (25A)	25	VXZ2360-10				290	12.0		1480

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

#### Normally Open (N.O.)

Port size (Nominal size)	Orifice size (mmø)	Model	Min. operating pressure differential (MPa)	Max. operating pressure differential (MPa)		Flow characteristics		Max. system pressure (MPa)	Weight (g)
				AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv converted		
1/4 (8A)	10	VXZ2232-02	0	0.7	0.6	46	1.9	1.5	600
3/8 (10A)		VXZ2232-03				58	2.4		
1/2 (15A)	15	VXZ2242-04				130	5.3		850
3/4 (20A)	20	VXZ2352-06				220	9.2		1370
1 (25A)	25	VXZ2362-10				290	12.0		1550

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 20 for details on the max. operating pressure differential and the max. system pressure.

### Ambient and Fluid Temperature

Power source	Fluid temperature (C)		Ambient temperature (C)
	Solenoid valve option symbol		
	A, H	D, N	
AC/Class B coil	-5 to 60	—	-10 to 60
AC/Class H coil	—	-5 to 100	-10 to 60
DC	-5 to 60	—	-10 to 60



Note) Dynamic viscosity: 50 mm<sup>2</sup>/s or less

### Valve Leakage Rate

#### Internal Leakage

Seal material	Leakage rate (Oil)
FKM	0.1 cm <sup>3</sup> /min or less

#### External Leakage

Seal material	Leakage rate (Oil)
FKM	0.1 cm <sup>3</sup> /min or less

# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve **Series VXZ22/23**

For Oil

## How to Order

**DC**  
**AC/Class H coil**  
**AC/Class B coil (Built-in full-wave rectifier type)**

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

**Orifice size** • Refer to the table (1) shown below for availability.

**Valve/Body configuration** •

0	N.C. / Single unit
2	N.O. / Single unit

**Solenoid valve option** • Refer to the table (2) shown below for availability.

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

**Thread type** •

Nil	Rc
T	NPTF
F	G
N	NPT

**Suffix** •

Nil	—
Z	Oil-free spec.

**Bracket**

Nil	None
B	With bracket

\* Bracket is not removable.

**Built-in full-wave rectifier type**

**Electrical entry** •

**G** -Grommet

**GS** -With grommet surge voltage suppressor

**C-Conduit**

**Connector**

**T** -With conduit terminal

**TS** -With conduit terminal and surge voltage suppressor

**TL** -With conduit terminal and light

**TZ** -With conduit terminal, surge voltage suppressor and light

**D** -DIN terminal

**DS** -DIN terminal with surge voltage suppressor

**DL** -DIN terminal with light

**DZ** -DIN terminal with surge voltage suppressor and light

**DO** -For DIN terminal (without connector, gasket is included.)

\* DIN type is available with class B only.

**Rated voltage** •

1	100 VAC 50/60 Hz	6	12 VDC
2	200 VAC 50/60 Hz	7	240 VAC 50/60 Hz
3	110 VAC 50/60 Hz	8	48 VAC 50/60 Hz
4	220 VAC 50/60 Hz	J	230 VAC 50/60 Hz
5	24 VDC		

\* Refer to the table (3) shown below for availability.

Refer to page 12 for ordering coil only.

**Table (1) Model – Orifice Size – Port Size**  
**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 no. (Port size)	02 (1/4)	—	●	—	—	—	Brass (C37), Stainless steel	FKM
	03 (3/8)	—	●	—	—	—		
	04 (1/2)	—	—	●	—	—		
	—	06 (3/4)	—	—	●	—		
	—	10 (1)	—	—	—	●		

**Table (2) Solenoid Valve Option**

Option symbol	Seal material	Body/Shading coil material*	Coil insulation type
A	FKM	Brass (C37)/—	B
H		Stainless steel/—	
D		Brass (C37)/Cu	H
N		Stainless steel/Ag	

\* There is no shading coil attached to the AC/Class B coil and DC spec.

**Table (3) Rated Voltage – Electrical Option**

Rated voltage			Class B			Class H		
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	1	100 V	—	●	—	●	●	●
	2	200 V	—	●	—	●	●	●
	3	110 V	—	●	—	●	●	●
	4	220 V	—	●	—	●	●	●
	7	240 V	—	—	—	●	—	—
	8	48 V	—	—	—	●	—	—
	J	230 V	—	—	—	●	—	—
DC	5	24 V	●	●	●	DC spec. is not available.		
	6	12 V	●	—	—			

\* Option "S", "Z" are not available as surge voltage suppressor is integrated into the AC/Class B, as a standard.

\* Class B and H coils cannot be interchanged in order to exchange the coils.

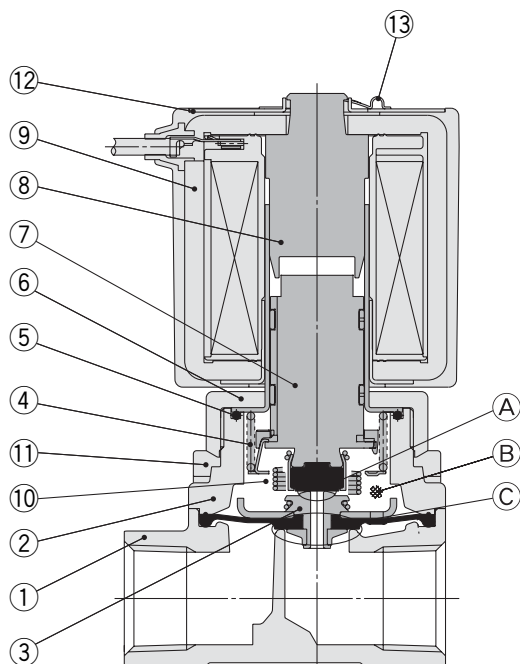
\* AC/Class B (with built-in full wave rectifier type) can be interchanged with DC.



## Construction

### Normally closed (N.C.)

Body material: Brass (C37), Stainless steel



### Working principles

#### <Valve opened – when there is pressure>

When the coil ⑨ is energized, the armature assembly ⑦ is attracted into the core of the tube assembly ⑧ and the pilot valve ① is opened. When the pilot valve is opened and the pressure inside the pilot chamber ② decreases, resulting in the pressure difference from the inlet pressure. Then the diaphragm assembly ③ is lifted and the main valve ④ is opened.

#### <Valve opened – when there is no pressure or under low minute pressure>

The armature assembly ⑦ and the diaphragm assembly ③ are connected with each other with the lift spring ⑩. When the armature assembly is attracted, the diaphragm assembly is pulled up and the main valve ④ is opened.

#### <Valve closed>

When the coil ⑨ is de-energized, the armature assembly ⑦ returns by the reacting force of the return spring ④ and the pilot valve ① is closed. When the pilot valve is closed, the pressure inside the pilot chamber ② increases, resulting that the pressure difference from the inlet pressure is lost and the main valve ④ is closed.

## Component Parts

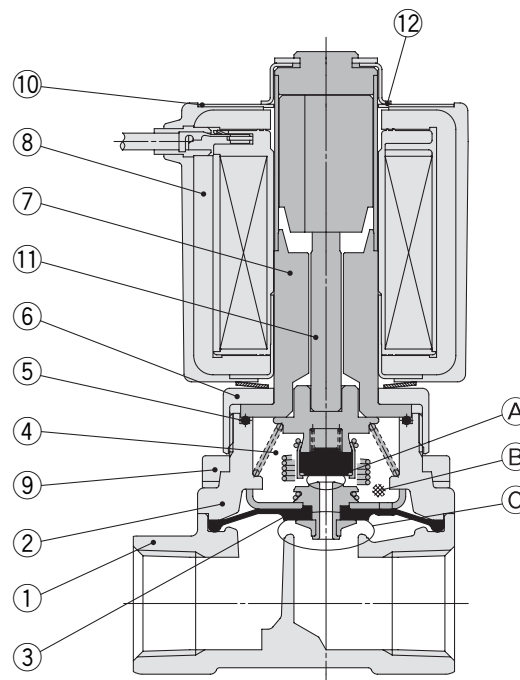
No.	Description	Material	
		Body material brass (C37) specification	Body material stainless steel specification
1	Body	Brass (C37)	Stainless steel
2	Bonnet	Brass (C37)	Stainless steel
3	Diaphragm assembly	Stainless steel (NBR, FKM, EPDM)	
4	Return spring	Stainless steel	
5	O-ring	(NBR, FKM, EPDM)	
6	Nut	Brass (C37)	Brass (C37), Ni plated
7	Armature assembly	Stainless steel	
8	Tube assembly <sup>Note)</sup>	Stainless steel, Cu	Stainless steel, Ag
9	Solenoid coil	—	
10	Lift spring	Stainless steel	
11	Hexagon socket bolt	Stainless steel	
12	Name plate	Aluminum	
13	Clip	SK	

The materials in parentheses are the seal materials.

Note) Cu and Ag are inapplicable to the DC spec and to the AC spec with built-in full-wave rectifier.

### Normally open (N.O.)

Body material: Brass (C37), Stainless steel



### Working principles

#### <Valve closed>

When the coil ⑨ is energized, the armature attached by the core of the tube assembly ⑧ closes the pilot valve ① via the push rod assembly ⑩. When the pilot valve is closed, the pressure inside the pilot chamber ② increases, resulting the the pressure difference from the inlet pressure is lost and the main valve ④ is closed.

#### <Valve opened – when there is pressure>

The coil ⑨ is de-energized, the armature returns by the reacting force of the return spring ④ via the push rod assembly ⑩ and the pilot valve ① is opened.

When the pilot valve is opened, the pressure inside the chamber decreases, resulting in the pressure difference from the inlet pressure. Then the diaphragm assembly ③ is lifted and the main valve ④ is opened.

#### <Valve opened – when there is no pressure or under low minute pressure>

The push rod assembly ⑩ and the diaphragm assembly ③ are connected with each other with the lift spring ⑩. When the push rod assembly returns, the diaphragm assembly is pulled up and the main valve ④ is opened.

## Component Parts

No.	Description	Material	
		Body material brass (C37) specification	Body material stainless steel specification
1	Body	Brass (C37)	Stainless steel
2	Bonnet	Brass (C37)	Stainless steel
3	Diaphragm assembly	Stainless steel (NBR, FKM, EPDM)	
4	Return spring	Stainless steel	
5	O-ring	NBR	FKM, EPDM
6	Nut	Brass (C37)	Brass (C37), Ni plated
7	Armature assembly	Stainless steel	
8	Tube assembly <sup>Note)</sup>	Stainless steel, Cu	Stainless steel, Ag
9	Solenoid coil	—	
10	Lift spring	Stainless steel	
11	Push rod assembly	PPS, Stainless steel, NBR	Stainless steel, FKM, EPDM
12	Name plate	Aluminum	
13	Cover	Stainless steel	

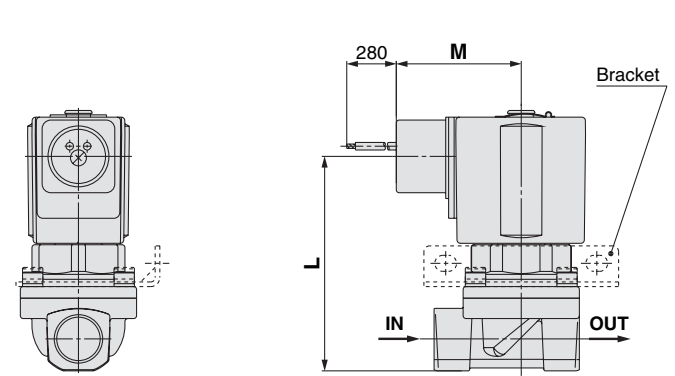
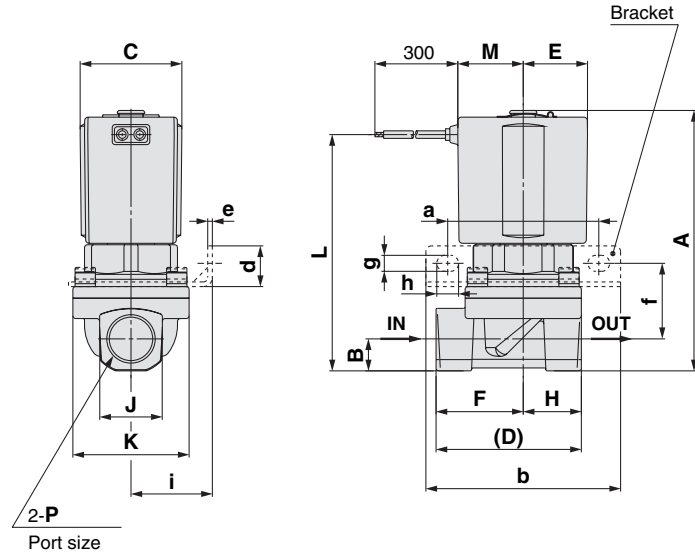
**Dimensions/Body Material: Brass (C37), Stainless Steel**

Normally closed (N.C.): VX21□0/VX22□0/VX23□0

Normally open (N.O.): VX21□2/VX22□2/VX23□2

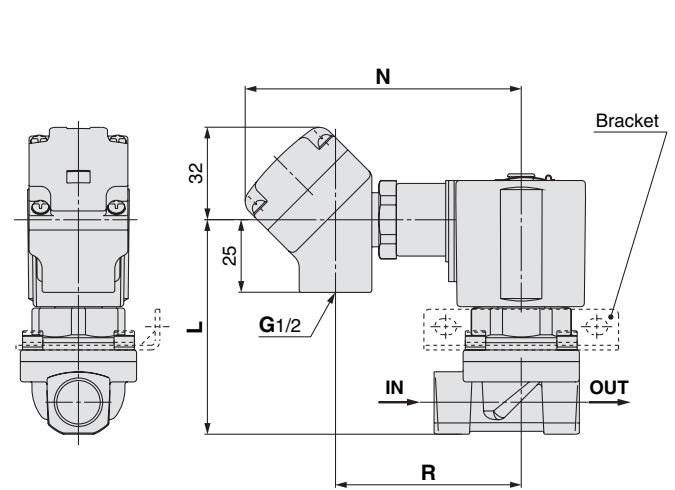
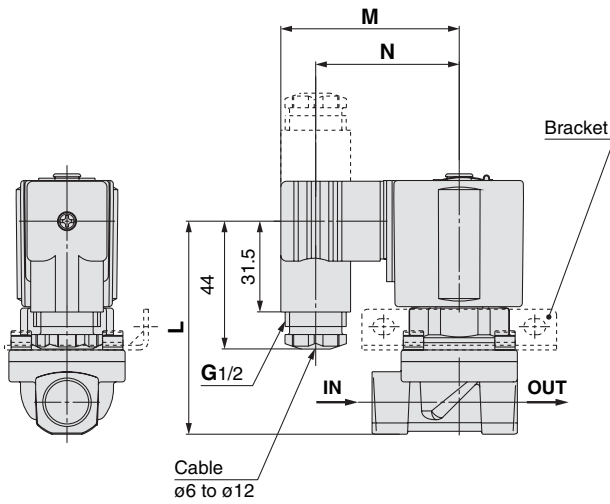
Grommet: G

Conduit: C



DIN terminal: D

Conduit terminal: T



																						(mm)
Model		Port size P	A	B	C	D	E	F	H	J	K	Electrical entry (DC, AC/Class H coil)										
												Grommet		Conduit		DIN terminal			Conduit terminal			
N.C.	N.O.											L	M	L	M	L	M	N	L	M	N	
VXZ2230	VXZ2232	1/4, 3/8	90 (97)	11	35	50	22.5	30	20	22	40	81.5 (83)	22.5	74 (75.5)	43	73.5 (75)	61.5	49.5	74 (75.5)	95	64	
VXZ2240	VXZ2242	1/2	98 (105)	14	35	63	22.5	37	26	29.5	52	89.5 (91)	22.5	82 (83.5)	43	81.5 (83)	61.5	49.5	82 (83.5)	95	64	
VXZ2350	VXZ2352	3/4	110 (117.5)	18	40	80	25	47.5	32.5	36	65	101.5 (103.5)	25.5	94 (96)	46	93.5 (95.5)	64	52	94 (96)	98	66.5	
VXZ2360	VXZ2362	1/1	116.5 (123)	21	40	90	25	55	35	40.5	70	108 (109)	25.5	100.5 (101.5)	46	100 (101)	64	52	100.5 (101.5)	98	66.5	

( ) denotes the value for N.O.

Model		Port size P	a	b	d	e	f	g	h	i	Electrical entry (AC/Class B coil)*									(mm)		
											Grommet		Conduit		DIN terminal			Conduit terminal				
											N.C.	N.O.	N	Q	N	Q	N	Q	R	N	Q	R
VXZ2230	VXZ2232	1/4, 3/8	52	67	14	1.6	26	5.5	7.5	28	77.5	33	72.5	51.5	73.5	68.5	56.5	72.5	103.5	72.5		
VXZ2240	VXZ2242	1/2	60	75	17	2.3	33	6.5	8.5	35	85.5	33	80.5	51.5	81.5	68.5	56.5	80.5	103.5	72.5		
VXZ2350	VXZ2352	3/4	68	87	22	2.6	40	6.5	9	43	97.5	36	92.5	54	93.5	71	59	92.5	106	75		
VXZ2360	VXZ2362	1/1	73	92	22	2.6	45.5	6.5	9	45	104	36	99	54	100	71	59	99	106	75		

\* Coil with built-in full-wave rectifier (electrical option "R")

# Series VXZ22/23

For Air, Water, Oil

## Replacement Parts

### ● Solenoid coil assembly part no.

DC

VX02 **2** N-**5** G-□

Series	
2	VXZ22□□
3	VXZ23□□

Rated voltage (Note)

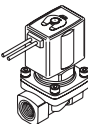

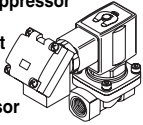
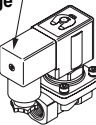
5	24 VDC
6	12 VDC

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

Valve

Symbol	Valve
Nil	N.C.
2	N.O.

Electrical entry

<b>G</b> -Grommet <b>GS</b> -With grommet surge voltage suppressor		<b>C</b> -Conduit	
<b>T</b> -With conduit terminal <b>TS</b> -With conduit terminal and surge voltage suppressor <b>TL</b> -With conduit terminal and light <b>TZ</b> -With conduit terminal, surge voltage suppressor and light		<b>D</b> -DIN terminal <b>DS</b> -DIN terminal with surge voltage suppressor <b>DL</b> -DIN terminal with light <b>DZ</b> -DIN terminal with surge voltage suppressor and light <b>DO</b> -For DIN terminal (without connector)	

\* Refer to the table (1) for the available combinations between each electrical option and rated voltage.

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

VX02 **2** N-**1** G-H-Z

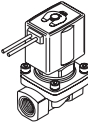
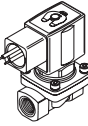
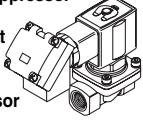
Series	
2	VXZ22□□
3	VXZ23□□

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.

Electrical entry

<b>G</b> -Grommet <b>GS</b> -With grommet surge voltage suppressor		<b>C</b> -Conduit	
<b>T</b> -With conduit terminal <b>TS</b> -With conduit terminal and surge voltage suppressor <b>TL</b> -With conduit terminal and light <b>TZ</b> -With conduit terminal, surge voltage suppressor and light			

\* Refer to the table (1) for the available combinations between each electrical option and rated voltage.

### AC/Class B coil (Built-in full-wave rectifier)

VX02 **2** N-**1** GR-□

Series	
2	VXZ22□□
3	VXZ23□□

Rated voltage (Note)

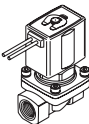
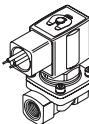
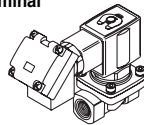
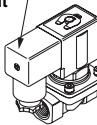
1	100 VAC	50/60 Hz
2	200 VAC	50/60 Hz
3	110 VAC	50/60 Hz
4	220 VAC	50/60 Hz
7	240 VAC	50/60 Hz
8	48 VAC	50/60 Hz
J	230 VAC	50/60 Hz

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

Valve

Symbol	Valve
Nil	N.C.
2	N.O.

Electrical entry

<b>G</b> -Grommet		<b>C</b> -Conduit	
<b>T</b> -With conduit terminal <b>TL</b> -With conduit terminal and light		<b>D</b> -DIN terminal <b>DL</b> -DIN terminal with light <b>DO</b> -For DIN terminal (without connector, gasket is included.)	

\* Refer to the table (1) for the available combinations between each electrical option and rated voltage.

\* The rectifier and the surge voltage suppressor are integrated as a standard.

### ● DIN connector part no.

Without electrical option

**GDM2A**

With electrical option

**GDM2A**-□□

Electrical option

**L** With light

\* Refer to the table (1) for the available combinations between each electrical option (S, L, Z) and rated voltage.

Rated voltage

1	100 VAC, 110 VAC
2	200 VAC, 220 VAC, 230 VAC, 240 VAC
5	24 VDC
6	12 VDC
15	48 VAC

### ● Gasket part no. for DIN connector

**VCW20-1-29-1**

Table (1) Rated Voltage – Electrical Option

Rated voltage			Class B			Class H		
AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor	S With surge voltage suppressor	L With light	Z With light and surge voltage suppressor
AC	1	100 V	—	●	—	●	●	●
	2	200 V	—	●	—	●	●	●
	3	110 V	—	●	—	●	●	●
	4	220 V	—	●	—	●	●	●
	7	240 V	—	—	—	●	—	—
	8	48 V	—	—	—	●	—	—
DC	J	230 V	—	—	—	●	—	—
	5	24 V	●	●	●	DC spec. is not available.		
	6	12 V	●	—	—			

\* Option "S", "Z" are not available as surge voltage suppressor is integrated into the AC/Class B, as a standard.

\* Replacement of solenoid coils:

• DC and AC coils cannot be interchanged in order to change the voltage.

• DC and AC (built-in full-wave rectifier type) coils can be interchanged in order to change the voltage.

• All DC coil voltages are interchangeable.

• All AC coil voltages are interchangeable.



● Name plate part no.

**AZ-T-VX** Valve model

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

● Clip part no. (For N.C.)

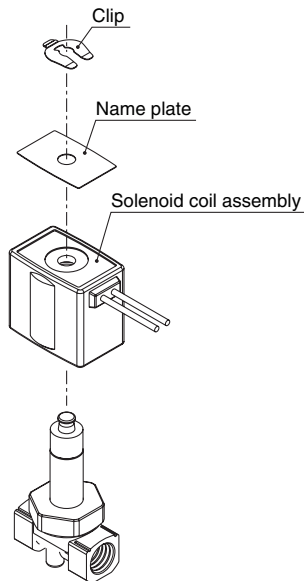
For VXZ22: **VX022N-10**

For VXZ23: **VX023N-10**

● Clip part no. (For N.O.)

For VXZ22: **ETW-8**

For VXZ23: **ETW-9**



Specifications

For Air

For Water

For Oil

Construction

Dimensions

# Solenoid Valve Flow Characteristics

## (How to indicate flow characteristics)

### 1. Indication of flow characteristics

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

Table (1) Indication of Flow Characteristics

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

### 2. Pneumatic equipment

#### 2.1 Indication according to the international standards

(1) Conformed standard

**ISO 6358: 1989 : Pneumatic fluid power—Components using compressible fluids—Determination of flow-rate characteristics**

**JIS B 8390: 2000 : Pneumatic fluid power—Components using compressible fluids—How to test flow-rate characteristics**

(2) Definition of flow characteristics

The flow characteristics are indicated as a result of a comparison between sonic conductance  $C$  and critical pressure ratio  $b$ .  
Sonic conductance  $C$  : Value which divides the passing mass flow rate of an equipment in a choked flow condition by the product of the upstream absolute pressure and the density in a standard condition.

Critical pressure ratio  $b$  : Pressure ratio (downstream pressure/upstream pressure) which will turn to a choked flow when the value is smaller than this ratio.

Choked flow : The flow in which the upstream pressure is higher than the downstream pressure and where sonic speed in a certain part of an equipment is reached.  
Gaseous mass flow rate is in proportion to the upstream pressure and not dependent on the downstream pressure.

Subsonic flow : Flow greater than the critical pressure ratio

Standard condition : Air in a temperature state of 20°C, absolute pressure 0.1 MPa (= 100 kPa = 1 bar), relative humidity 65%.

It is stipulated by adding the “(ANR)” after the unit depicting air volume.  
(standard reference atmosphere)

Conformed standard: ISO 8778: 1990 Pneumatic fluid power—Standard reference atmosphere, JIS B 8393: 2000: Pneumatic fluid power—Standard reference atmosphere

(3) Formula for flow rate

It is described by the practical units as following.

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} \leq b, \text{ choked flow}$$

$$Q = 600 \times C (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \quad \dots\dots\dots (1)$$

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} > b, \text{ subsonic flow}$$

$$Q = 600 \times C (P_1 + 0.1) \sqrt{1 - \left[ \frac{\frac{P_2 + 0.1}{P_1 + 0.1} - b}{1 - b} \right]^2} \sqrt{\frac{293}{273 + t}} \quad \dots\dots\dots (2)$$

$Q$  : Air flow rate [dm<sup>3</sup>/min (ANR)], dm<sup>3</sup> (Cubic decimeter) of SI unit are also allowed to be described by ℓ (liter). 1 dm<sup>3</sup> = 1 ℓ

# Solenoid Valve Flow Characteristics

**C** : Sonic conductance [dm<sup>3</sup>/(s·bar)]

**b** : Critical pressure ratio [—]

**P<sub>1</sub>** : Upstream pressure [MPa]

**P<sub>2</sub>** : Downstream pressure [MPa]

**t** : Temperature [C]

Note) Formula of subsonic flow is the elliptic analogous curve.

Flow characteristics are shown in Graph (1) For details, please make use of SMC's "Energy Saving Program".

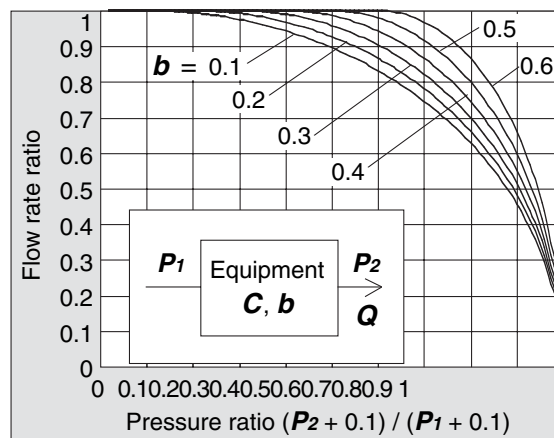
Example)

Obtain the air flow rate for **P<sub>1</sub>** = 0.4 [MPa], **P<sub>2</sub>** = 0.3 [MPa], **t** = 20 [C] when a solenoid valve is performed in **C** = 2 [dm<sup>3</sup>/(s·bar)] and **b** = 0.3.

According to formula 1, the maximum flow rate =  $600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}} = 600$  [dm<sup>3</sup>/min (ANR)]

Pressure ratio =  $\frac{0.3 + 0.1}{0.4 + 0.1} = 0.8$

Based on Graph (1), it is going to be 0.7 if it is read by the pressure ratio as 0.8 and the flow ratio to be **b** = 0.3.  
Hence, flow rate = Max. flow x flow ratio = 600 x 0.7 = 420 [dm<sup>3</sup>/min (ANR)]



Graph (1) Flow characteristics

## (4) Test method

Attach a test equipment with the test circuit shown in Fig. (1) while maintaining the upstream pressure to a certain level which does not go below 0.3 MPa. Next, measure the maximum flow to be saturated in the first place, then measure this flow rate at 80%, 60%, 40%, 20% and the upstream and downstream pressure. And then, obtain the sonic conductance **C** from this maximum flow rate. Besides that, substitute each data of others for the subsonic flow formula to find **b**, then obtain the critical pressure ratio **b** from that average.

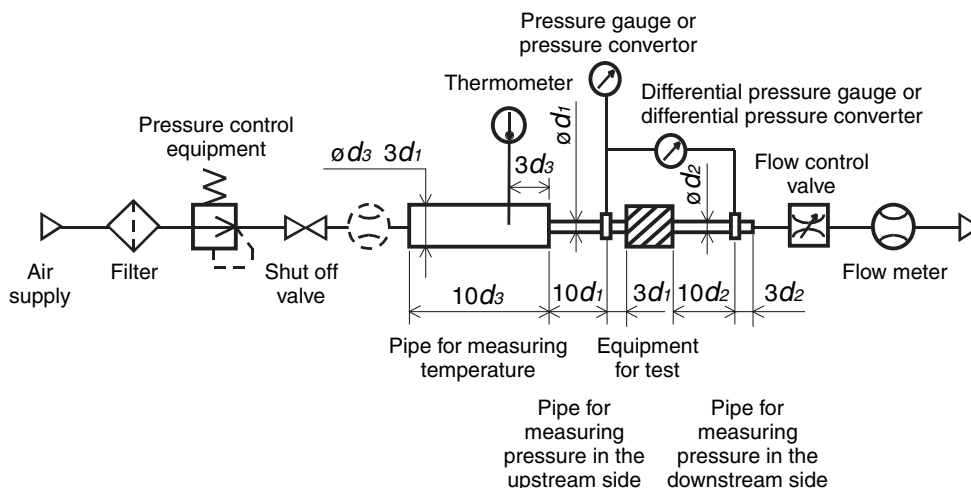


Fig. (1) Test circuit based on ISO 6358, JIS B 8390



# Solenoid Valve Flow Characteristics

## 2.2 Effective area $S$

### (1) Conformed standard

**JIS B 8390: 2000: Pneumatic fluid power—Components using compressible fluids—  
Determination of flow rate characteristics**

**Equipment standards: JIS B 8373: 2 port solenoid valve for pneumatics**

**JIS B 8374: 3 port solenoid valve for pneumatics**

**JIS B 8375: 4 port, 5 port solenoid valve for pneumatics**

**JIS B 8379: Silencer for pneumatics**

**JIS B 8381: Fittings of flexible joint for pneumatics**

### (2) Definition of flow characteristics

Effective area  $S$ : The cross-sectional area having an ideal throttle without friction deduced from the calculation of the pressure changes inside an air tank or without reduced flow when discharging the compressed air in a choked flow, from an equipment attached to the air tank. This is the same concept representing the “easy to run through” as sonic conductance  $C$ .

### (3) Formula for flow rate

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} \leq 0.5, \text{ choked flow}$$

$$Q = 120 \times S (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \dots\dots\dots(3)$$

When

$$\frac{P_2 + 0.1}{P_1 + 0.1} > 0.5, \text{ subsonic flow}$$

$$Q = 240 \times S \sqrt{(P_2 + 0.1) (P_1 - P_2)} \sqrt{\frac{293}{273 + t}} \dots\dots\dots(4)$$

Conversion with sonic conductance  $C$ :

$$S = 5.0 \times C \dots\dots\dots(5)$$

$Q$  : Air flow rate[dm<sup>3</sup>/min(ANR)], dm<sup>3</sup> (cubic decimeter) of SI unit are also allowed to be described by  $\ell$  (liter) 1 dm<sup>3</sup> = 1  $\ell$

$S$  : Effective area [mm<sup>2</sup>]

$P_1$  : Upstream pressure [MPa]

$P_2$  : Downstream pressure [MPa]

$t$  : Temperature [C]

Note) Formula for subsonic flow (4) is only applicable when the critical pressure ratio  $b$  is the unknown equipment. In the formula (2) by the sonic conductance  $C$ , it is the same formula as when  $b = 0.5$ .

### (4) Test method

Attach a test equipment with the test circuit shown in Fig. (2) in order to discharge air into the atmosphere until the pressure inside the air tank goes down to 0.25 MPa (0.2 MPa) from an air tank filled with the compressed air at a certain pressure level (0.5 MPa) which does not go below 0.6 MPa. At this time, measure the discharging time and the residual pressure inside the air tank which had been left until it turned to be the normal values to determine the effective area  $S$ , using the following formula. The volume of an air tank should be selected within the specified range by corresponding to the effective area of an equipment for test. In the case of JIS B 8373, 8374, 8375, 8379, 8381, the pressure values are in parentheses and the coefficient of the formula is 12.9.

$$S = 12.1 \frac{V}{t} \log_{10} \left( \frac{P_s + 0.1}{P + 0.1} \right) \frac{293}{T} \dots\dots\dots(6)$$

$S$  : Effective area [mm<sup>2</sup>]

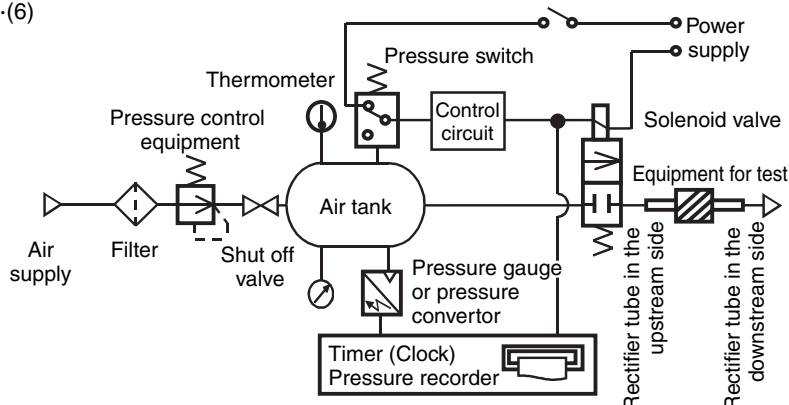
$V$  : Air tank capacity [dm<sup>3</sup>]

$t$  : Discharging time [s]

$P_s$  : Pressure inside air tank before discharging [MPa]

$P$  : Residual pressure inside air tank after discharging [MPa]

$T$  : Temperature inside air tank before discharging [K]



**Fig. (2) Test circuit based on JIS B 8390**

# Solenoid Valve Flow Characteristics

## 2.3 Flow coefficient $C_v$ factor

### The United States Standard ANSI(NFPA)T3.21.3:1990: Pneumatic fluid power—Flow rating test procedure and reporting method for fixed orifice components

Defines the  $C_v$  factor of flow coefficient by the following formula which is based on the test conducted by the test circuit analogous to ISO 6358.

$$C_v = \frac{Q}{114.5 \sqrt{\frac{P(P_2 + P_a)}{T_1}}} \dots\dots\dots(7)$$

$P$  : Pressure drop between the static pressure tapping ports [bar]

$P_1$  : Pressure of the upstream tapping port [bar gauge]

$P_2$  : Pressure of the downstream tapping port [bar gauge]:  $P_2 = P_1 - P$

$Q$  : Flow rate [dm<sup>3</sup>/s standard condition]

$P_a$  : Atmospheric pressure [bar absolute]

$T_1$  : Test conditions of the upstream absolute temperature [K]  
is <  $P_1 + P_a = 6.5 \pm 0.2$  bar absolute,  $T_1 = 297 \pm 5$ K, 0.07 bar  $P = 0.14$  bar.

This is the same concept as effective area  $A$  which ISO6358 stipulates as being applicable only when the pressure drop is smaller than the upstream pressure and the compression of air does not become a problem.

## 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 characteristics

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

$$Av = Q \sqrt{\frac{\rho}{P}} \dots\dots\dots(8)$$

$Av$  : Flow coefficient [m<sup>2</sup>]

$Q$  : Flow rate [m<sup>3</sup>/s]

$P$  : Pressure difference [Pa]

$\rho$  : Density of fluid [kg/m<sup>3</sup>]

### (3) Formula of flow rate

It is described by the practical units. Also, the flow characteristics are shown in Graph (2).

In the case of liquid:

$$Q = 1.9 \times 10^6 Av \sqrt{\frac{P}{G}} \dots\dots\dots(9)$$

$Q$  : Flow rate [ℓ/min]

$Av$  : Flow coefficient [m<sup>2</sup>]

$P$  : Pressure difference [MPa]

$G$  : Relative density [water = 1]

# Solenoid Valve Flow Characteristics

Conversion of flow coefficient:

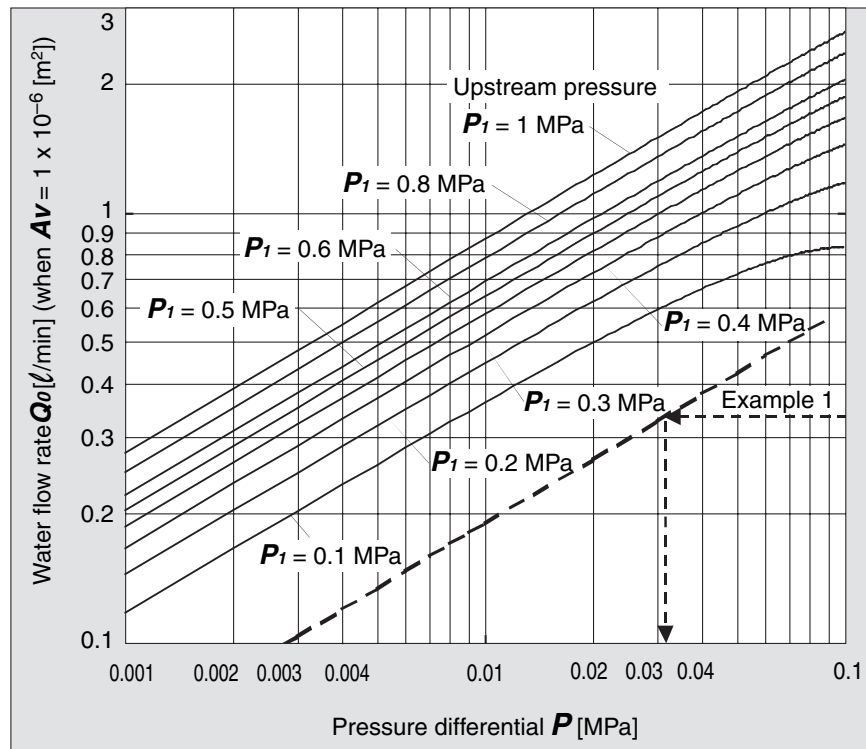
$$Av = 28 \times 10^{-6} Kv = 24 \times 10^{-6} Cv \dots\dots\dots(10)$$

Here,

**Kv** factor: Value of the clean water flow rate represented by m<sup>3</sup>/h which runs through a valve at 5 to 40C, when the pressure difference 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 60F, when the pressure difference is 1 lbf/in<sup>2</sup> (psi).

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



**Graph (2) Flow characteristics**

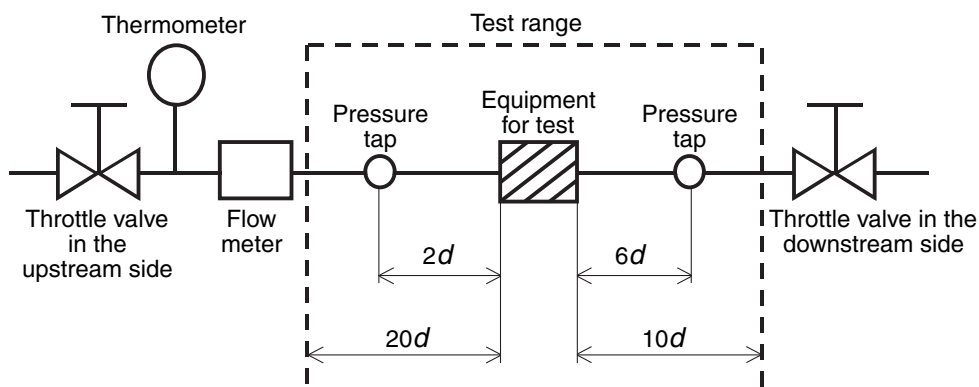
Example 1)

Obtain the pressure difference when water 15 [l/min] runs through a solenoid valve with an  $Av = 45 \times 10^{-6} [m^2]$ . Since  $Q0 = 15/45 = 0.33 [l/min]$ , according to Graph (2), if reading  $P$  when  $Q0$  is 0.33, it will be 0.031 [MPa].

## (4) Test method

Attach a test equipment with the test circuit shown in Fig. (3). Next, pour water at 5 to 40C, then measure the flow rate with a pressure difference of 0.075 MPa. However, the pressure difference needs to be set with a large enough difference so that the Reynolds number does not go below a range of  $4 \times 10^4$ .

By substituting the measurement results for formula (8) to figure out **Av**.



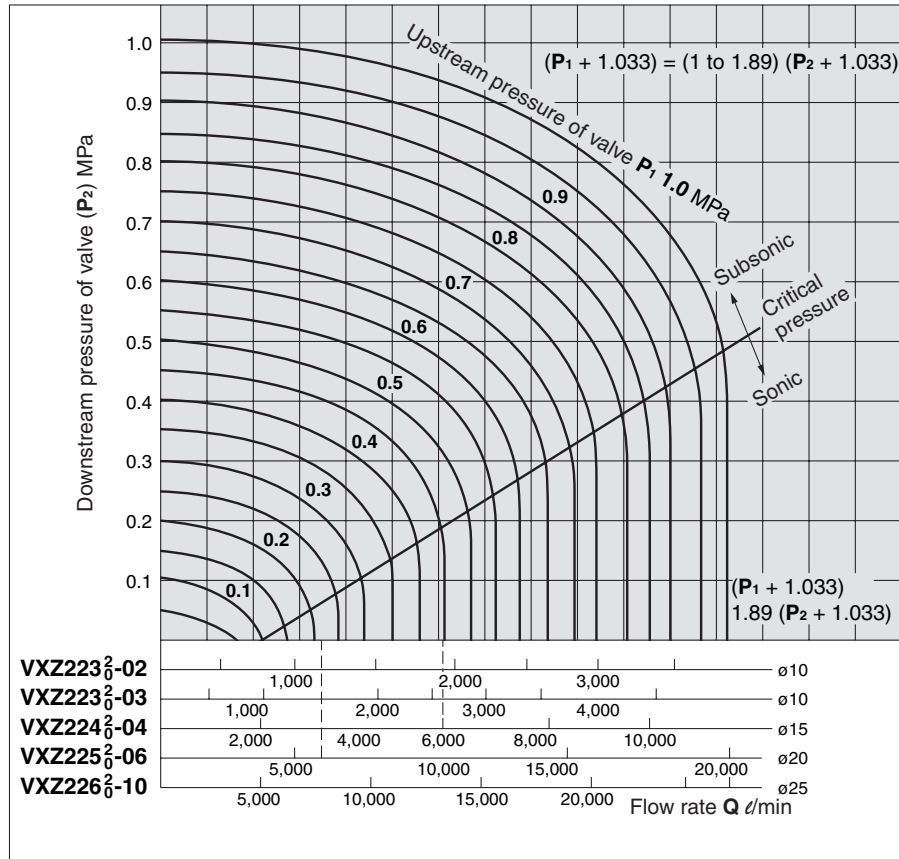
**Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005**



# Flow Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to pages 14 through to 18.

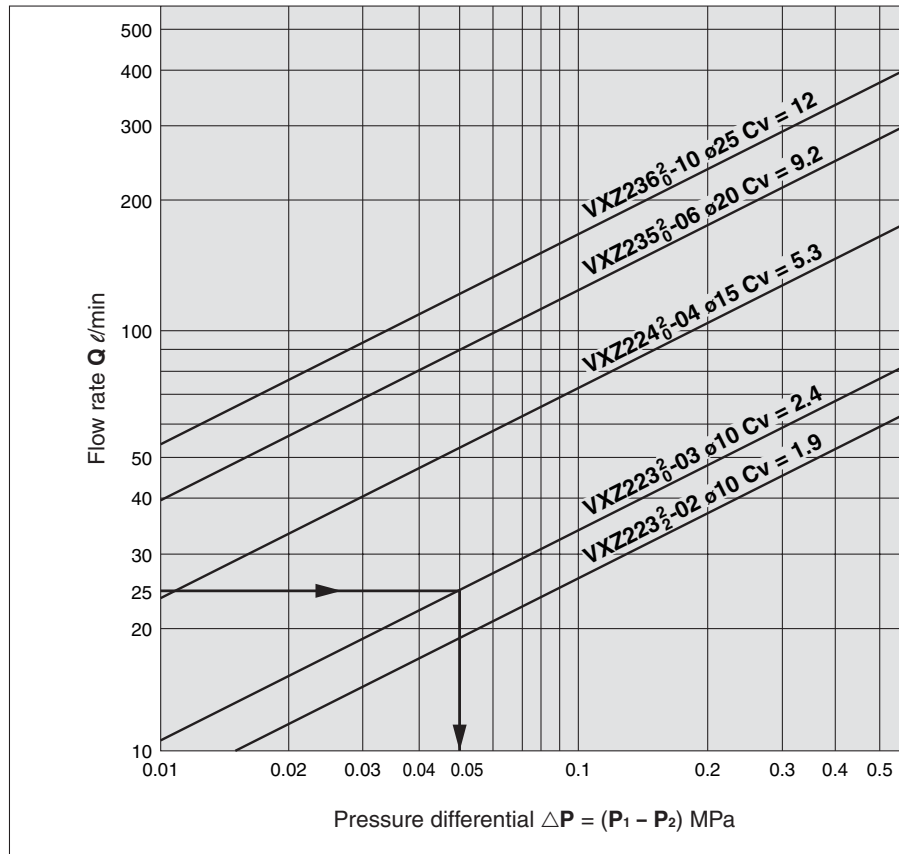
## For Air



### How to read the graph

The sonic range pressure to generate a flow rate of 6,000  $\text{dm}^3/\text{min}$  (ANR) is  $P_1 = 0.47 \text{ MPa}$  for a  $\phi 15$  orifice (VXZ224 $\frac{3}{2}$ -04) and  $P_1 = 0.23 \text{ MPa}$  for a  $\phi 20$  orifice (VXZ225 $\frac{3}{2}$ -06).

## For Water



### How to read the graph

When a water flow of 25  $\text{dm}^3/\text{min}$  is generated,  $\Delta P = 0.05 \text{ MPa}$  for a valve with  $\phi 10$  orifice (VXZ223 $\frac{3}{2}$ -03).

# 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 fully opened.

### 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 in which the valve must be withstood without a drop in performance after holding for one minute under prescribed 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, Low jetproof type

"Low jetproof type" 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 – Trade names: 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 ( )

IN), there is a limit to the blocking.


( ) is used to indicate that blocking of reverse pressure is not possible.





Series **VXZ22/23**

# Safety Instructions

The following safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by all safety practices, including labels of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, please observe ISO 4414 <sup>Note 1)</sup>, JIS B 8370 <sup>Note 2)</sup>.

 **Caution:** Operator error could result in injury or equipment damage.

 **Warning:** Operator error could result in serious injury or loss of life.

 **Danger :** In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

## **Warning**

### **1. The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility with a specific system must be based on specifications, post analysis and/or tests to meet a specific requirement. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information and taking into consideration the possibility of equipment failure when configuring a system. Be particularly careful in determining the compatibility with the fluid to be used.

### **2. Only trained personnel should operate machinery and equipment.**

The fluid can be dangerous if handled incorrectly. Assembly, handling or maintenance of the system should be performed by trained and experienced operators.

### **3. Do not service machinery/equipment or attempt to remove components until the safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven object have been confirmed. Measures to prevent danger from a fluid should also be confirmed.

2. When equipment is to be removed, confirm the safety processes mentioned above, release the fluid pressure and be certain there is no danger from fluid leakage or fluid remaining in the system.

3. Carefully restart the machinery, confirming that safety measures are being implemented.

### **4. Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.

2. With fluids whose application causes concern due to the type of fluid or additives, etc.

3. An application which has the possibility of having a negative effect on people, property, and therefore requires special safety analysis.



# 2 Port Solenoid Valve for Fluid Control

## Precautions 1

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

### Design

#### Warning

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

The valves presented in this catalog 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 energization

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

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

##### 4. Maintenance space

The installation should allow sufficient space for maintenance activities.

##### 5. Liquid rings

In cases with a flowing liquid, provide a by-pass valve in the system to prevent the liquid from entering the liquid seal circuit.

##### 6. 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.

##### 7. 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.

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

##### 9. When an impact, such as water 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 catalog.

##### 2. Fluid

###### 1. Type of fluid

Before using a fluid, confirm whether it is compatible with the materials from each model by referring to the fluids listed in this catalog. Use a fluid with a dynamic viscosity of 50 mm<sup>2</sup>/s or less. If there is something you do not know, please contact us.

###### 2. Flammable oil, Gas,

Confirm the specification for leakage in the interior and/or exterior area.

### Selection

#### Warning

##### 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. Fluid quality

The use of a fluid which contains 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.

##### 4. Air quality

###### 1. Use clean air.

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

###### 2. Install air filters.

Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.

###### 3. Install an air dryer or after cooler, etc.

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.

###### 4. If excessive carbon powder is generated, eliminate it by installing mist separators at the upstream side of valves.

If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

Refer to SMC's Best Pneumatics 2004 Vol. 14 catalog for further details on compressed air quality.

##### 5. 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.

##### 6. Countermeasures against static electricity

Take measures to prevent static electricity since some fluids can cause static electricity.

##### 7. For the low particle generation specification, confirm us separately.

##### 8. Minimum differential operating pressure

Even if the differential pressure is greater than the minimum differential operating pressure when the valve is closed, it may become lower than the minimum differential operating pressure when the valve is open due to restrictors in the piping of the supply source (such as a pump, compressor, etc.). Please exercise caution.





# 2 Port Solenoid Valve for Fluid Control

## Precautions 2

Be sure to read this before handling.

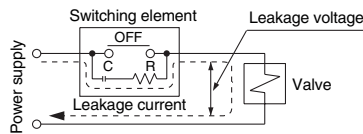
For detailed precautions on each series, refer to the main text.

### 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.



AC coil: 20% or less of rated voltage

DC coil: 2% or less of rated voltage

##### 2. Low temperature operation

1. The valve can be used in an ambient temperature of between  $-10$  to  $-20^{\circ}\text{C}$ . 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 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 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 a malfunction.

##### 4. 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.

##### 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

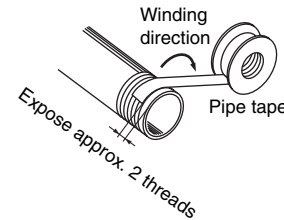
Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

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. Avoid connecting ground lines to piping, as this may cause electric corrosion of the system.

##### 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 threads	Proper tightening torque N·m
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30

##### 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. In applications such as vacuum and non-leak specifications, use caution specifically against the contamination of foreign matters or airtightness of the fittings.

##### 8. If a regulator is directly connected to a solenoid valve, their interaction will cause them to enter a state of resonance. In some cases, this will result in chattering.



# 2 Port Solenoid Valve for Fluid Control

## Precautions 3

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

### Wiring

#### ⚠ Caution

1. As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25 mm<sup>2</sup> 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. 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.
4. When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, adopt an option that comes with the surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with us.)

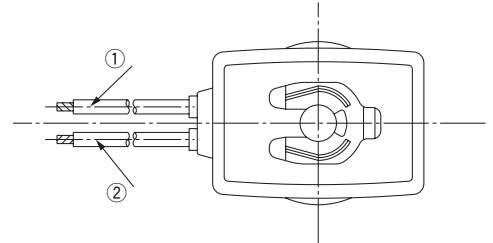
### Electrical Connections

#### ⚠ Caution

##### Grommet

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

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

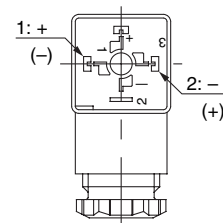


Rated voltage	Lead wire color	
	①	②
DC (Class B only)	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

\* There is no polarity.

##### DIN terminal (Class B only)

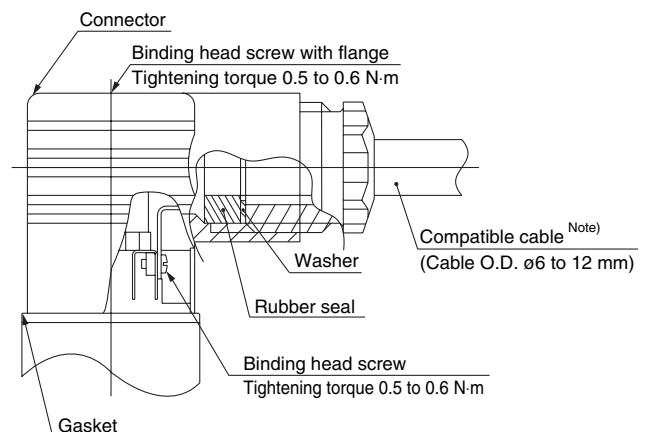
Since internal connections are as shown below for the DIN terminal, make connections to the power supply accordingly.



Terminal no.	1	2
DIN terminal	+ (-)	- (+)

\* There is no polarity.

- Use compatible heavy duty cords with cable O.D. of ø6 to 12 mm.
- Use the tightening torques below for each section.



Note) For an outside cable diameter of ø9 to 12 mm, remove the internal parts of the rubber seal before using.



# 2 Port Solenoid Valve for Fluid Control

## Precautions 4

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

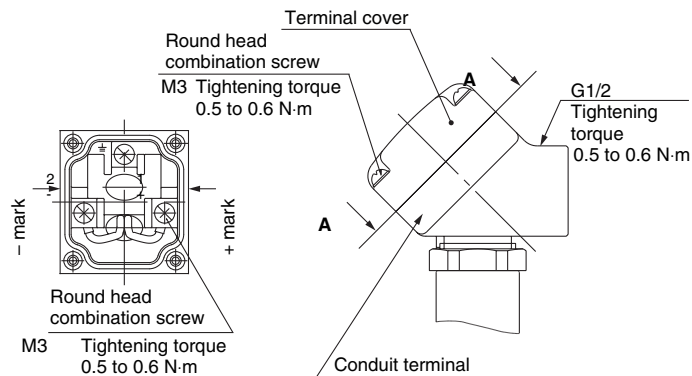
### Electrical Connections

#### Caution

##### 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.



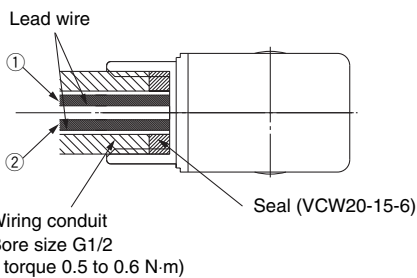
#### View A-A

(Internal connection diagram)

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



Rated voltage	Lead wire color	
	①	②
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

\* There is no polarity for DC.

Description	Part no.
Seal	VCW20-15-6

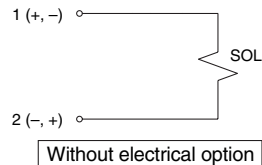
Note) Please order separately.

### Electrical Circuits

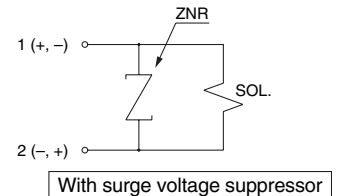
#### Caution

##### [DC circuit]

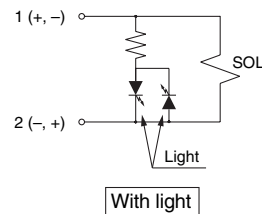
Grommet, Conduit,  
Conduit terminal,  
DIN type



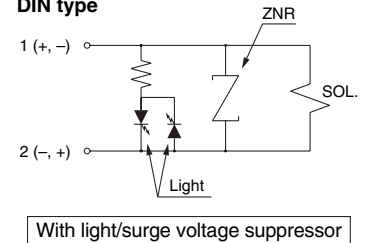
Grommet, Conduit terminal,  
DIN type



Conduit terminal,  
DIN type



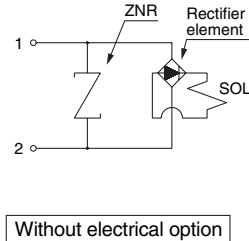
Conduit terminal,  
DIN type



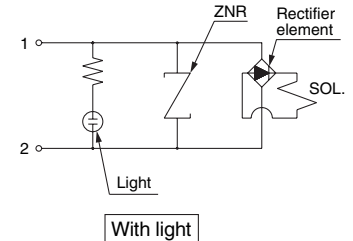
##### [AC, Class B (Built-in full wave rectifier type) circuit]

\* For AC/Class B, the standard product is equipped with surge voltage suppressor.

Grommet, Conduit,  
Conduit terminal,  
DIN type

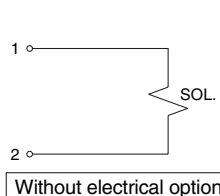


Conduit terminal,  
DIN type

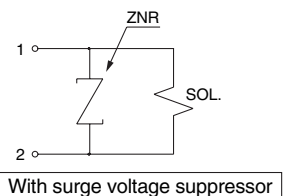


##### [AC, Class B/H circuit]

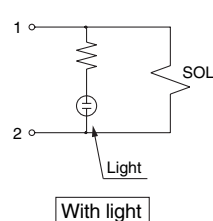
Grommet, Conduit,  
Conduit terminal



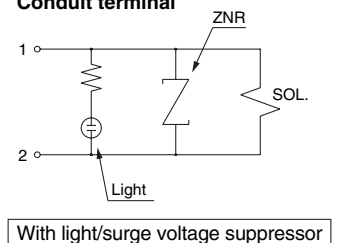
Grommet,  
Conduit terminal



Conduit terminal



Conduit terminal





# 2 Port Solenoid Valve for Fluid Control

## Precautions 5

Be sure to read this before handling.

For detailed precautions on each series, refer to the main text.

### Operating Environment

#### Warning

1. Do not use the valves in an atmosphere having corrosive gases, chemicals, salt 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. This solenoid valve can be operated without lubrication.

If a lubricant is used in the system, use turbine oil Class 1, ISO VG32 (with no additive). But do not lubricate a valve with EPDM seal. Refer to the table of brand name of lubricants compliant with Class 1 turbine oil (with no additive), ISO VG32.

#### Class 1 Turbine Oil (with no additive), ISO VG32

Classification of viscosity (cst) (40C)	Viscosity according to ISO Grade	32
Idemitsu Kosan Co.,Ltd.		Turbine oil P-32
Nippon Oil Corp.		Turbine oil 32
Cosmo Oil Co.,Ltd.		Cosmo turbine 32
Japan Energy Corp.		Kyodo turbine 32
Kygnus Oil Co.		Turbine oil 32
Kyushu Oil Co.		Stork turbine 32
Nippon Oil Corp.		Mitsubishi turbine 32
Showa Shell Sekiyu K.K.		Turbine 32
Tonen General Sekiyu K.K.		General R turbine 32
Fuji Kosan Co.,Ltd.		Fucoal turbine 32

Please contact SMC regarding Class 2 turbine oil (with additives), ISO VG32.

### 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. Filters and strainers

1. Be careful regarding clogging of filters and strainers.
2. Replace filter elements after one year of use, or earlier if the pressure drop reaches 0.1 MPa.
3. Clean strainers when the pressure drop reaches 0.1 MPa.

##### 2. Lubrication

When using after lubricating, never forget to lubricate continuously.

##### 3. 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.

##### 4. Exhaust the drain from an air filter periodically.

### Operating Precautions

#### Warning

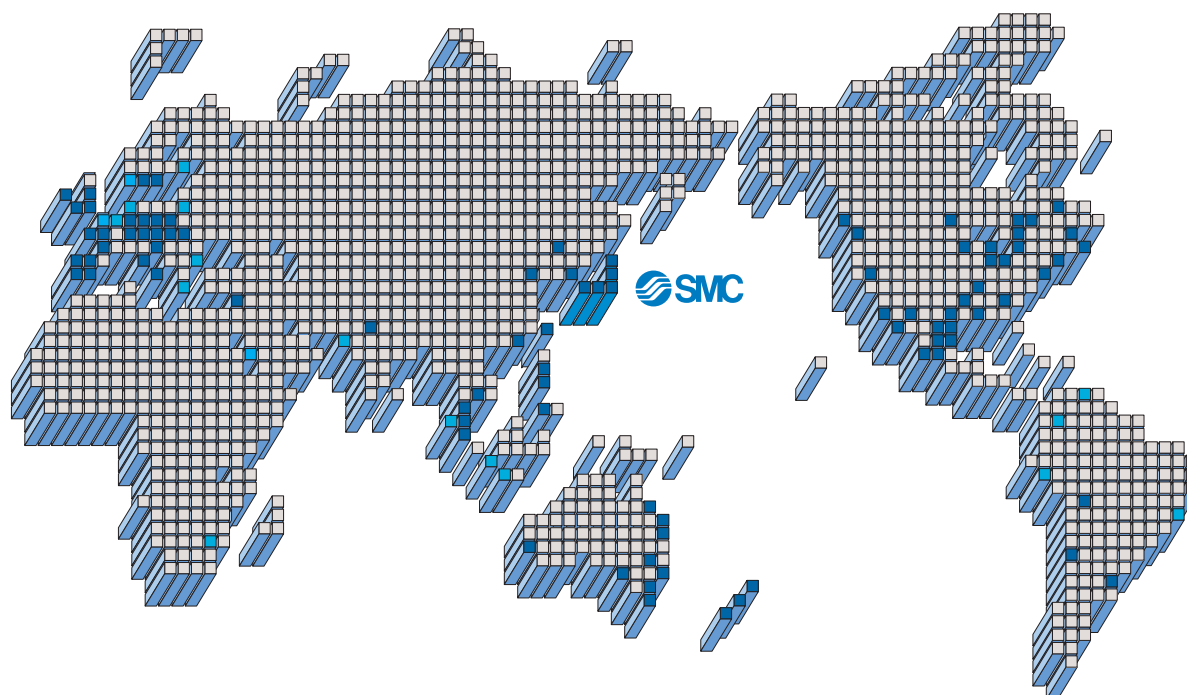
1. Valves will reach high temperatures from high temperature fluids. Use caution, as there is a danger of being burned if a valve is touched directly.

#### 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 compressor starts, for example) while the valve is closed. Please be cautious of this.
2. If a water hammer problem occurs, install either a water hammer attenuator (such as an accumulator) or use our water hammer resistant valve, the VXR series. For details, please contact us.



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D-DN

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# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve

**New**



**RoHS**



Air



Water



Oil



Heated water



High temperature oil

**Compact**

Height

**4% Smaller\*** (4 mm)

(VXZ24, C37 (Brass) body)

\* Comparison with SMC conventional model

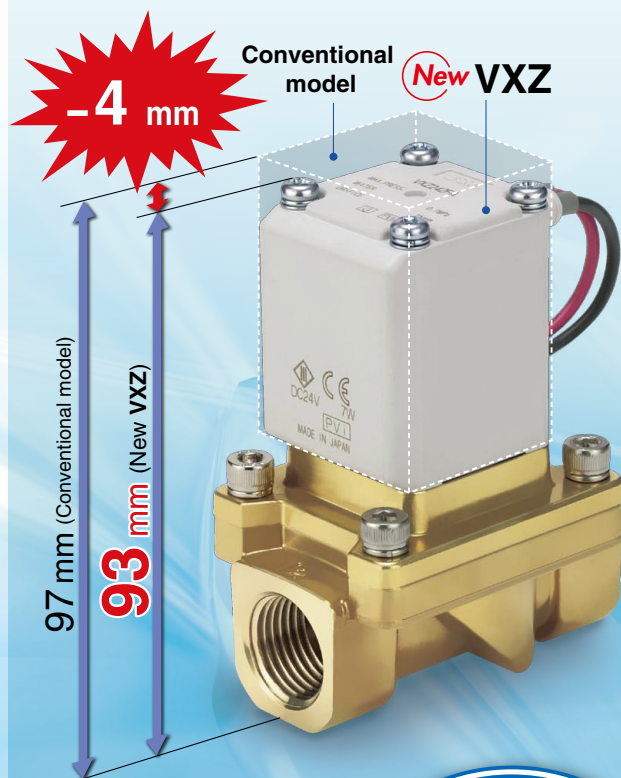
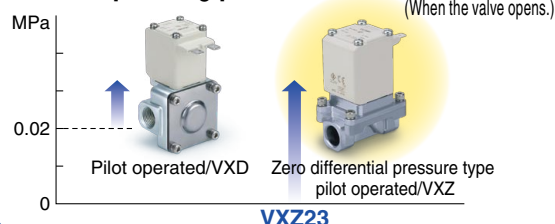
**Lightweight**

Weight

**27% Lighter\*** (150 g)

(VXZ23, Resin body)

- Can be used at 0 m hydraulic head!
- Min. operating pressure differential: 0 MPa (When the valve opens.)



Air

..... **Body material** .....

**Aluminum\*, Resin\*** (Built-in One-touch fittings)

\* VXZ23

Bracket  
Standard equipment

Applicable tubing O.D.  
ø10, ø12  
Metric size  
ø3/8"  
Inch size



Resin body



Aluminum body



Air



Water



Oil



Heated water



High temperature oil

..... **Body material** .....

**C37, Stainless steel** (VXZ23 to 26)



C37 (Brass) body



Stainless steel body

**Enclosure**

**IP65\***

\* Electrical entry  
"Faston" type  
terminal is IP40.

**Valve type**

N.C.

N.O.



**Series VXZ**



CAT.ES70-51A

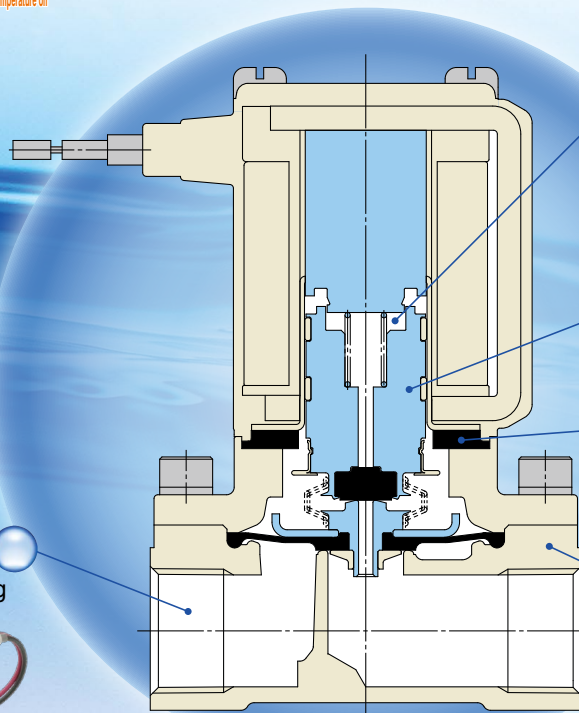
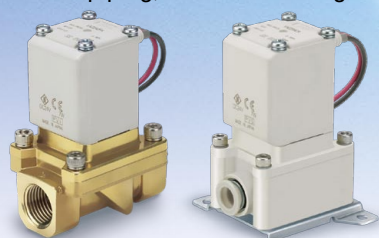
# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve *Series VXZ*



**Enclosure**  
IP65

**Flame resistance**  
UL94V-0 conformed

**Piping variations**  
Thread piping, One-touch fitting



## Clearance

By providing a bumper and clearance, we reduced the collision sound of the core when ON (when the valve is open). Because of the clearance, when using highly viscous fluids such as oil, the armature does not get stuck and the responsiveness when OFF (when the valve is closed) is improved.

## Improved armature durability

## Low-noise construction

Metal noise reduced by the rubber bumper

## Body material

Aluminum, Resin **Air** (VXZ2<sup>3</sup><sub>A</sub>)

C37, Stainless steel

**Water/**  
**Oil/Air/**  
**Heated water/**  
**High temperature oil**

## Built-in full-wave rectifier type (AC specification)

- Improved durability**  
Service life is extended by the special construction. (compared with current AC specification)
- Reduced buzz noise**  
Rectified to DC by the full-wave rectifier, resulting in a buzz noise reduction.
- Improved OFF response**  
Specially constructed to improve the OFF response when operated with a higher viscosity fluid such as oil.
- Low-noise construction**  
Specially constructed to reduce the metal noise during operation.



## Variations

### <Fluid>

Model	Applicable fluid*				
	Air	Water	Oil	Heated water	High temperature oil
For Air <b>VXZ2□0</b> P.4	●				
For Water <b>VXZ2□2</b> P.7	●	●			
For Oil <b>VXZ2□3</b> P.10	●	●	●		
For Heated water <b>VXZ2□5</b> P.13	●	●		●	
For High temperature oil <b>VXZ2□6</b> P.16	●	●	●		●

### <Body Size>

Model	Body size	Orifice diameter mmø	Port size	Body material	Fluid
<b>VXZ2<sup>3</sup><sub>A</sub></b>	10A	10	1/4, 3/8	Aluminum	Air
			ø10, ø12, ø3/8"	Resin	
			1/4, 3/8	C37	Water
<b>VXZ2<sup>4</sup><sub>B</sub></b>	15A	15	1/2	Stainless steel	
<b>VXZ2<sup>5</sup><sub>C</sub></b>	20A	20	3/4	C37	Oil
				Stainless steel	
<b>VXZ2<sup>6</sup><sub>D</sub></b>	25A	25	1	C37	High temperature oil
				Stainless steel	

\* For details, refer to pages 37 and 38.

# Series VXZ

## Common Specifications

### Standard Specifications

Valve specifications	Valve construction		Zero differential pressure type pilot operated 2 port diaphragm type
	Withstand pressure		2.0 MPa (Resin body type 1.5 MPa)
	Body material		Aluminum, Resin, C37 (Brass), Stainless steel <sup>Note 1)</sup>
	Seal material		NBR, FKM, EPDM
	Enclosure		Dust-tight, Water-jet-proof type (equivalent to IP65) <sup>Note 2)</sup>
	Environment		Location without corrosive or explosive gases
Coil specifications	Rated voltage	AC	100 VAC, 200 VAC, 110 VAC, 230 VAC, (220 VAC, 240 VAC, 48 VAC, 24 VAC) <sup>Note 3)</sup>
		DC	24 VDC, (12 VDC) <sup>Note 3)</sup>
	Allowable voltage fluctuation		±10% of rated voltage
	Allowable leakage voltage	AC (Built-in full-wave rectifier type)	10% or less of rated voltage
		DC	2% or less of rated voltage
	Coil insulation type		Class B (for air, water, oil), Class H (for heated water, high temperature oil)

Note 1) Body material is aluminum. Resin body is available only for the VXZ2<sup>3</sup>.

Note 2) Electrical entry "Faston" type terminal is IP40.

Note 3) Voltage in ( ) indicates special voltage. (Refer to page 20.)

⚠ Be sure to read "Specific Product Precautions" before handling.

⚠ When pressure differential is less than 0.01 MPa, operation may become unstable. Please contact SMC in case of low flow operation. (Refer to page 23.)

### Solenoid Coil Specifications

#### Normally Closed (N.C.)

##### DC Specification

###### Class B

Model	Power consumption (W) <sup>Note 1)</sup>	Temperature rise (°C) <sup>Note 2)</sup>
VXZ23, 24	7	55
VXZ25, 26	10.5	65

###### Class H

Model	Power consumption (W) <sup>Note 1)</sup>	Temperature rise (°C) <sup>Note 2)</sup>
VXZ23, 24	12	100
VXZ25, 26	15	100

#### Normally Open (N.O.)

##### DC Specification

###### Class B

Model	Power consumption (W) <sup>Note 1)</sup>	Temperature rise (°C) <sup>Note 2)</sup>
VXZ2A, 2B	8.5	70
VXZ2C, 2D	12.5	70

###### Class H

Model	Power consumption (W) <sup>Note 1)</sup>	Temperature rise (°C) <sup>Note 2)</sup>
VXZ2A, 2B	12	100
VXZ2C, 2D	15	100

Note 1) Power consumption, Apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)

Note 2) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

#### Normally Closed (N.C.)

##### AC Specification (Built-in Full-wave Rectifier Type)

###### Class B

Model	Apparent power (VA) <sup>Note 1) 2)</sup>	Temperature rise (°C) <sup>Note 3)</sup>
VXZ23, 24	9.5	70
VXZ25, 26	12	70

###### Class H

Model	Apparent power (VA) <sup>Note 1) 2)</sup>	Temperature rise (°C) <sup>Note 3)</sup>
VXZ23, 24	12	100
VXZ25, 26	15	100

#### Normally Open (N.O.)

##### AC Specification (Built-in Full-wave Rectifier Type)

###### Class B

Model	Apparent power (VA) <sup>Note 1) 2)</sup>	Temperature rise (°C) <sup>Note 3)</sup>
VXZ2A, 2B	10	70
VXZ2C, 2D	14	70

###### Class H

Model	Apparent power (VA) <sup>Note 1) 2)</sup>	Temperature rise (°C) <sup>Note 3)</sup>
VXZ2A, 2B	12	100
VXZ2C, 2D	15	100

Note 1) Power consumption, Apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)

Note 2) There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used in the AC (Built-in full-wave rectifier type).

Note 3) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.








# Series VXZ

## Selection Steps

### Selection Steps

#### Step 1 Select the fluid.

Item	Selection item	Page	Symbol
Select the fluid.	Air 	Page 4	0
	Water 	Page 7	2
	Oil 	Page 10	3
	Heated water 	Page 13	5
	High temperature oil 	Page 16	6

VXZ2 3 0 A A

#### Step 2 Select "Body material", "Port size" and "Orifice diameter" from "Flow rate — Pressure" of each fluid.

Item	Selection item	Symbol
Select from "Flow rate — Pressure." • Body material • Port size • Orifice diameter	Body size, Valve 10A, N.C.	3
	Body material Aluminum	A
	Port size 1/8	A
	Orifice diameter 10	A

VXZ2 3 0 A A

#### Step 3 Select electrical specification.

Item	Selection item	Symbol
Select electrical specification.	Voltage 24 VDC	A
	Electrical entry Grommet	A

VXZ2 3 0 A A

#### Step 4 For other special options, refer to pages 20 and 21.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

# Series VXZ



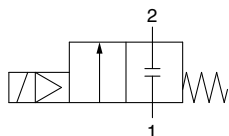
## For Air

\* Can be used with low vacuum (up to 133 Pa.abs).

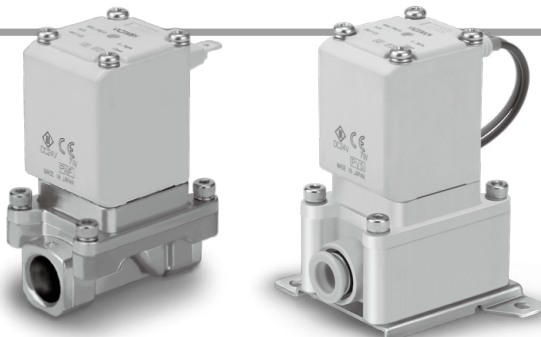
## Flow-rate Characteristics

**N.C.**

### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Closed (N.C.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics				Max. system pressure (MPa)	Note 2) Weight (g)			
					AC	DC	C [dm³/(s·bar)]	b	Cv	Effective area (mm²)					
Resin	ø10	10	VXZ230	0	1.0	0.7	6.2	0.38	1.7	—	1.5	400			
	ø3/8"						5.3		1.2						
	ø12						8.0		2.0						
Aluminum	1/4 (8A)	15	VXZ240				8.5	0.44	2.4						
	3/8 (10A)						9.3	0.43	2.6						
C37, Stainless steel	1/2 (15A)	20	VXZ250		1.0	1.0	23.0	0.34	6.0			720			
	3/4 (20A)	25	VXZ260				36.0	0.26	9.4			1100			
	1 (25A)	25	VXZ260				—		185	1300					

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

● Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-10 Note) to 60	-20 to 60

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

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Air) Note 1)
NBR (FKM) Note 2)	15 cm <sup>3</sup> /min or less (Aluminum body type)
	15 cm <sup>3</sup> /min or less (Resin body type)
	1 cm <sup>3</sup> /min or less (Metal body type)

### External Leakage

Seal material	Leakage rate (Air) Note 1)
NBR (FKM) Note 2)	15 cm <sup>3</sup> /min or less (Aluminum body type)
	15 cm <sup>3</sup> /min or less (Resin body type)
	1 cm <sup>3</sup> /min or less (Metal body type)

Note 1) Leakage is the value at ambient temperature 20°C.

Note 2) For seal material/FKM, refer to "Other options" on page 20 for the selection.

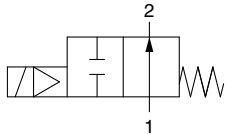
Note 3) When the product is used with low vacuum (to 133 Pa.abs), give caution to the external leakage outlined above.



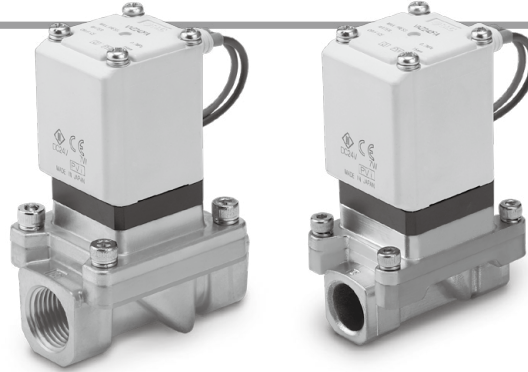
## Flow-rate Characteristics

**N.O.**

**Symbol**



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Open (N.O.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics				Max. system pressure (MPa)	<sup>Note 2)</sup> Weight (g)		
					AC	DC	C [dm³/(s·bar)]	b	Cv	Effective area (mm²)				
Resin	ø10	10	VXZ2A0	0	0.7	0.6	6.2	0.38	1.7	—	1.5	430		
	ø3/8"						5.3		1.2					
	ø12						8.0		2.0					
Aluminum	1/4 (8A)	15	VXZ2B0				8.5	0.44	2.4				630	
	3/8 (10A)						9.3	0.43	2.6					
C37, Stainless steel	1/2 (15A)	20	VXZ2C0				23.0	0.34	6.0				750	
	3/4 (20A)	25	VXZ2D0				36.0	0.26	9.4				1150	
	1 (25A)						—						185	1350

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-10 Note) to 60	-20 to 60

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

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Air) Note 1)
NBR (FKM) Note 2)	15 cm <sup>3</sup> /min or less (Aluminum body type)
	15 cm <sup>3</sup> /min or less (Resin body type)
	1 cm <sup>3</sup> /min or less (Metal body type)

### External Leakage

Seal material	Leakage rate (Air) Note 1)
NBR (FKM) Note 2)	15 cm <sup>3</sup> /min or less (Aluminum body type)
	15 cm <sup>3</sup> /min or less (Resin body type)
	1 cm <sup>3</sup> /min or less (Metal body type)

Note 1) Leakage is the value at ambient temperature 20°C.

Note 2) For seal material/FKM, refer to "Other options" on page 20 for the selection.

## How to Order (Single Unit)



**VXZ2** **3** **0** **A** **A**

Fluid

**0** For Air

### Size/Valve type

Symbol	Body size	Valve type
<b>3</b>	10A	N.C.
<b>A</b>		N.O.

### Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
<b>A</b>	Aluminum	1/4	10
<b>B</b>		3/8	
<b>C</b>	Resin	ø10 One-touch fitting	
<b>D</b>		ø3/8" One-touch fitting	
<b>E</b>		ø12 One-touch fitting	

<b>4</b>	15A	N.C.
<b>B</b>		N.O.

<b>F</b>	C37	1/2	15
<b>G</b>	Stainless steel		

<b>5</b>	20A	N.C.
<b>C</b>		N.O.

<b>H</b>	C37	3/4	20
<b>J</b>	Stainless steel		

<b>6</b>	25A	N.C.
<b>D</b>		N.O.

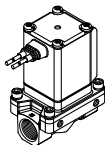
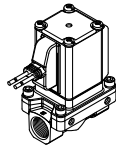
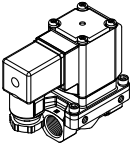
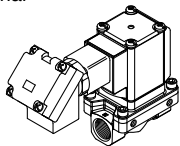
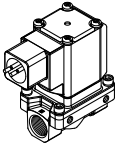
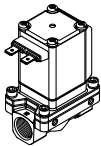
<b>K</b>	C37	1	25
<b>L</b>	Stainless steel		

### Common Specifications

Seal material	NBR
Coil insulation type	Class B
Thread type	Rc*

\* One-touch fittings are attached to the resin body type.

### Voltage/Electrical entry

Symbol	Voltage	Electrical entry
A	24 VDC	Grommet 
B	100 VAC	Grommet (With surge voltage suppressor) 
C	110 VAC	
D	200 VAC	
E	230 VAC	
F	24 VDC	
G	24 VDC	DIN terminal (With surge voltage suppressor) 
H	100 VAC	
J	110 VAC	
K	200 VAC	
L	230 VAC	
M	24 VDC	Conduit terminal (With surge voltage suppressor) 
N	100 VAC	
P	110 VAC	
Q	200 VAC	
R	230 VAC	
S	24 VDC	Conduit (With surge voltage suppressor) 
T	100 VAC	
U	110 VAC	
V	200 VAC	
W	230 VAC	
Y	24 VDC	Faston terminal 
Z	Other voltages	

For other special options, refer to pages 20 and 21.

Special voltage	24 VAC
	48 VAC
	220 VAC
	240 VAC
	12 VDC
DIN terminal with light	
Conduit terminal with light	
Without DIN connector	
Low concentration ozone resistant (Seal material: FKM)	
Oil-free	
G thread	
NPT thread	
With bracket	
Special electrical entry direction	



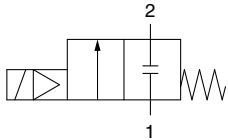
## For Water

\* Can be used with air (Up to 133 Pa.abs for vacuum).  
Note that the maximum operating pressure differential and flow-rate characteristics should be within the specifications for air.

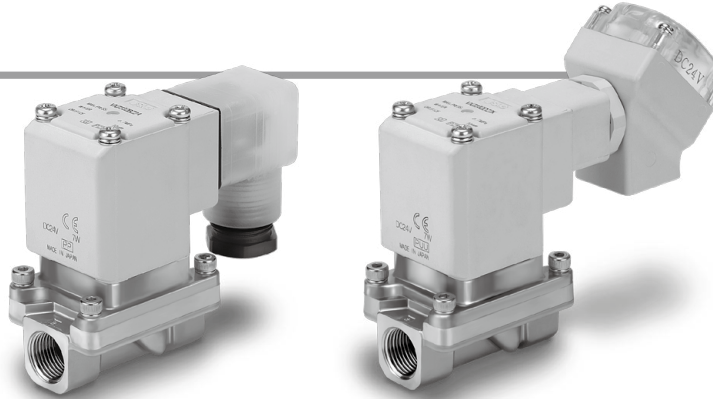
### Flow-rate Characteristics

**N.C.**

#### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



#### Normally Closed (N.C.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2)</sup> (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	VXZ232	0	1.0	0.7	46	1.9	1.5	600
	3/8 (10A)						58	2.4		
	1/2 (15A)	15	VXZ242				130	5.3		1100
	3/4 (20A)	20	VXZ252			1.0	220	9.2		
	1 (25A)	25	VXZ262				245	10.2		

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

### Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 60	-20 to 60

Note) With no freezing

### Valve Leakage Rate

#### Internal Leakage

Seal material	Leakage rate (Water) Note 1)
NBR (FKM) Note 2)	0.1 cm <sup>3</sup> /min or less

#### External Leakage

Seal material	Leakage rate (Water) Note 1)
NBR (FKM) Note 2)	0.1 cm <sup>3</sup> /min or less

Note 1) Leakage is the value at ambient temperature 20°C.

Note 2) For seal material/FKM, refer to "Other options" on page 20 for the selection.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

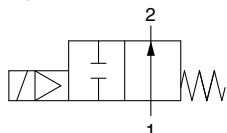
# Series VXZ



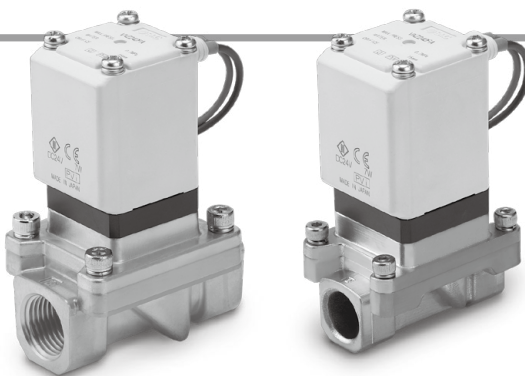
## Flow-rate Characteristics

N.O.

Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Open (N.O.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2</sup> (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	VXZ2A2	0	0.7	0.6	46	1.9	1.5	630
	3/8 (10A)		VXZ2B2				58	2.4		
	1/2 (15A)	15	VXZ2C2				130	5.3		
	3/4 (20A)	20	VXZ2C2				220	9.2		
	1 (25A)	25	VXZ2D2				245	10.2		

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 60	-20 to 60

Note) With no freezing

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Water) <sup>Note 1</sup>
NBR (FKM) <sup>Note 2</sup>	0.1 cm <sup>3</sup> /min or less

### External Leakage

Seal material	Leakage rate (Water) <sup>Note 1</sup>
NBR (FKM) <sup>Note 2</sup>	0.1 cm <sup>3</sup> /min or less

Note 1) Leakage is the value at ambient temperature 20°C.

Note 2) For seal material/FKM, refer to "Other options" on page 20 for the selection.

# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve

# Series VXZ



For Water



RoHS

## How to Order (Single Unit)

**VXZ2 3 2 A A**

Fluid

2 For Water

### Size/Valve type

Symbol	Body size	Valve type
3	10A	N.C.
A		N.O.

### Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
A	C37	1/4	10
B		3/8	
C	Stainless steel	1/4	10
D		3/8	

4	15A	N.C.
B		N.O.

F	C37	1/2	15
G	Stainless steel		

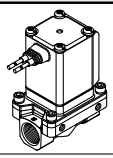
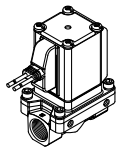
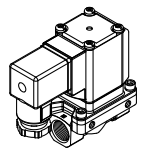
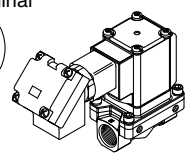
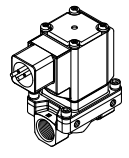
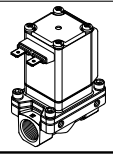
5	20A	N.C.
C		N.O.

H	C37	3/4	20
J	Stainless steel		

6	25A	N.C.
D		N.O.

K	C37	1	25
L	Stainless steel		

### Voltage/Electrical entry

Symbol	Voltage	Electrical entry
A	24 VDC	Grommet 
B	100 VAC	Grommet (With surge voltage suppressor) 
C	110 VAC	
D	200 VAC	
E	230 VAC	
F	24 VDC	DIN terminal (With surge voltage suppressor) 
G	24 VDC	
H	100 VAC	
J	110 VAC	
K	200 VAC	Conduit terminal (With surge voltage suppressor) 
L	230 VAC	
M	24 VDC	
N	100 VAC	
P	110 VAC	Conduit (With surge voltage suppressor) 
Q	200 VAC	
R	230 VAC	
S	24 VDC	
T	100 VAC	Faston terminal 
U	110 VAC	
V	200 VAC	
W	230 VAC	
Y	24 VDC	Faston terminal
Z	Other voltages	

### Common Specifications

Seal material	NBR
Coil insulation type	Class B
Thread type	Rc

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

For other special options,  
refer to pages 20 and 21.

Special voltage	24 VAC
	48 VAC
	220 VAC
	240 VAC
	12 VDC
DIN terminal with light	
Conduit terminal with light	
Without DIN connector	
Applicable to deionized water (Seal material: FKM)	
Oil-free	
G thread	
NPT thread	
With bracket	
Special electrical entry direction	

Dimensions → Page 26 and after



# Series VXZ



## For Oil

\* Can be used with air and water.

Note that the maximum operating pressure differential and flow-rate characteristics should be within the specifications of the fluid used.

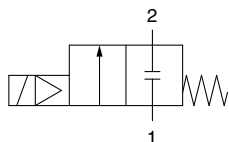
### ⚠ When the fluid is oil.

The kinematic viscosity must not exceed 50 mm<sup>2</sup>/s. The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON.

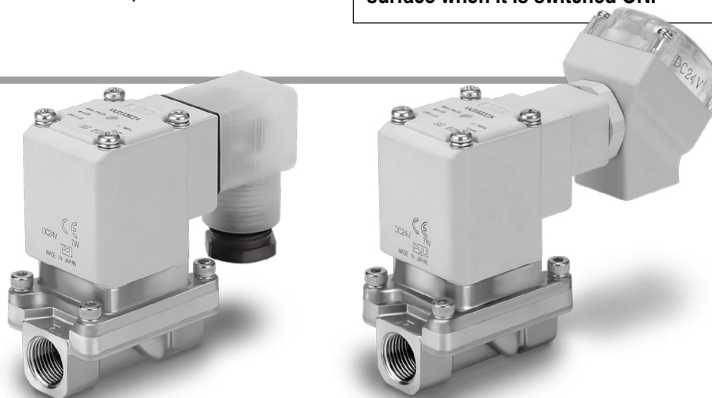
## Flow-rate Characteristics

N.C.

### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Closed (N.C.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2)</sup> (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	VXZ233	0	0.7		46	1.9	1.5	600
	3/8 (10A)		VXZ243				58	2.4		720
	1/2 (15A)	15	VXZ253				130	5.3		1100
	3/4 (20A)	20	VXZ253				220	9.2		1300
	1 (25A)	25	VXZ263				245	10.2		1300

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-5 <sup>Note)</sup> to 60	-20 to 60

Note) Kinematic viscosity: 50 mm<sup>2</sup>/s or less

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Oil) <sup>Note)</sup>
FKM	0.1 cm <sup>3</sup> /min or less

### External Leakage

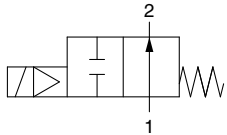
Seal material	Leakage rate (Oil) <sup>Note)</sup>
FKM	0.1 cm <sup>3</sup> /min or less

Note) Leakage is the value at ambient temperature 20°C.

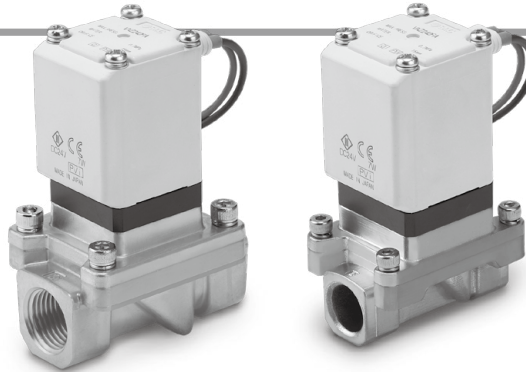
## Flow-rate Characteristics

**N.O.**

**Symbol**



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Open (N.O.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential Note 1) (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight Note 2) (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	<b>VXZ2A3</b>	0	0.7	0.6	46	1.9	1.5	630
	3/8 (10A)						58	2.4		
	1/2 (15A)	15	<b>VXZ2B3</b>				130	5.3		750
	3/4 (20A)	20	<b>VXZ2C3</b>				220	9.2		1150
	1 (25A)	25	<b>VXZ2D3</b>				245	10.2		1350

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

● Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-5 Note) to 60	-20 to 60

Note) Kinematic viscosity: 50 mm<sup>2</sup>/s or less

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Oil) Note)
FKM	0.1 cm <sup>3</sup> /min or less

### External Leakage

Seal material	Leakage rate (Oil) Note)
FKM	0.1 cm <sup>3</sup> /min or less

Note) Leakage is the value at ambient temperature 20°C.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions



## How to Order (Single Unit)



**VXZ2** **3** **3** **A** **A**

Fluid

**3** For Oil

### Size/Valve type

Symbol	Body size	Valve type
<b>3</b>	10A	N.C.
<b>A</b>		N.O.

### Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
<b>A</b>	C37	1/4	10
<b>B</b>		3/8	
<b>C</b>	Stainless steel	1/4	
<b>D</b>		3/8	

<b>4</b>	15A	N.C.
<b>B</b>		N.O.

<b>F</b>	C37	1/2	15
<b>G</b>	Stainless steel		

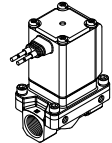
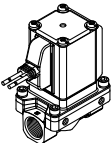
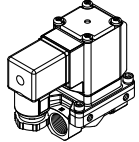
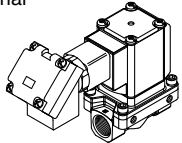
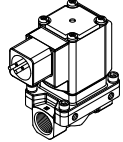
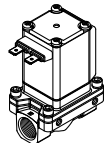
<b>5</b>	20A	N.C.
<b>C</b>		N.O.

<b>H</b>	C37	3/4	20
<b>J</b>	Stainless steel		

<b>6</b>	25A	N.C.
<b>D</b>		N.O.

<b>K</b>	C37	1	25
<b>L</b>	Stainless steel		

### Voltage/Electrical entry

Symbol	Voltage	Electrical entry
<b>A</b>	24 VDC	Grommet 
<b>B</b>	100 VAC	Grommet (With surge voltage suppressor) 
<b>C</b>	110 VAC	
<b>D</b>	200 VAC	
<b>E</b>	230 VAC	
<b>F</b>	24 VDC	DIN terminal (With surge voltage suppressor) 
<b>G</b>	24 VDC	
<b>H</b>	100 VAC	
<b>J</b>	110 VAC	
<b>K</b>	200 VAC	Conduit terminal (With surge voltage suppressor) 
<b>L</b>	230 VAC	
<b>M</b>	24 VDC	
<b>N</b>	100 VAC	
<b>P</b>	110 VAC	Conduit (With surge voltage suppressor) 
<b>Q</b>	200 VAC	
<b>R</b>	230 VAC	
<b>S</b>	24 VDC	
<b>T</b>	100 VAC	Faston terminal 
<b>U</b>	110 VAC	
<b>V</b>	200 VAC	
<b>W</b>	230 VAC	
<b>Y</b>	24 VDC	
<b>Z</b>	Other voltages	

### Common Specifications

Seal material	FKM
Coil insulation type	Class B
Thread type	Rc

For other special options, refer to pages 20 and 21.

Special voltage	24 VAC
	48 VAC
	220 VAC
	240 VAC
	12 VDC
DIN terminal with light	
Conduit terminal with light	
Without DIN connector	
Oil-free	
G thread	
NPT thread	
With bracket	
Special electrical entry direction	



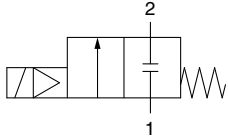
## For Heated Water

\* Can be used with air (up to 99°C) and water.  
Note that the maximum operating pressure differential and flow-rate characteristics should be within the specifications of the fluid used.

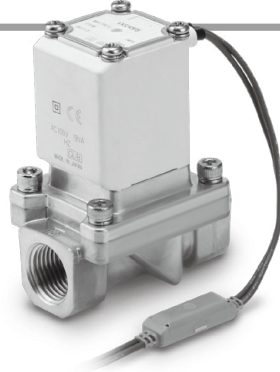
### Flow-rate Characteristics

**N.C.**

#### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



#### Normally Closed (N.C.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2)</sup> (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	VXZ235	0	1.0	0.7	46	1.9	1.5	600
	3/8 (10A)		58				2.4	720		
	1/2 (15A)	15	VXZ245				130			5.3
	3/4 (20A)	20	VXZ255			1.0	220			9.2
	1 (25A)	25	VXZ265				245	10.2		

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

### Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 99	-20 to 60

Note) With no freezing

### Valve Leakage Rate

#### Internal Leakage

Seal material	Leakage rate (Water) Note)
EPDM	0.1 cm <sup>3</sup> /min or less

#### External Leakage

Seal material	Leakage rate (Water) Note)
EPDM	0.1 cm <sup>3</sup> /min or less

Note) Leakage is the value at ambient temperature 20°C.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

# Series VXZ

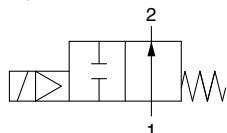


For Heated Water

## Flow-rate Characteristics

N.O.

Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Open (N.O.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2)</sup> (g)	
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv			
C37, Stainless steel	1/4 (8A)	10	VXZ2A5	0	0.7	0.6	46	1.9	1.5	630	
	3/8 (10A)						58	2.4			
	1/2 (15A)	15	VXZ2B5				130	5.3			750
	3/4 (20A)	20	VXZ2C5				220	9.2			1150
	1 (25A)	25	VXZ2D5				245	10.2			1350

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 99	-20 to 60

Note) With no freezing

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Water) <sup>Note)</sup>
EPDM	0.1 cm <sup>3</sup> /min or less

### External Leakage

Seal material	Leakage rate (Water) <sup>Note)</sup>
EPDM	0.1 cm <sup>3</sup> /min or less

Note) Leakage is the value at ambient temperature 20°C.



# Zero Differential Pressure Type Pilot Operated 2 Port Solenoid Valve

# Series VXZ



For Heated Water



RoHS

## How to Order (Single Unit)

**VXZ2** **3** **5** **A** **B**

Fluid

**5** For Heated water

### Size/Valve type

Symbol	Body size	Valve type
<b>3</b>	10A	N.C.
<b>A</b>		N.O.

### Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
<b>A</b>	C37	1/4	10
<b>B</b>		3/8	
<b>C</b>		1/4	
<b>D</b>	Stainless steel	3/8	

<b>4</b>	15A	N.C.
<b>B</b>		N.O.

<b>F</b>	C37	1/2	15
<b>G</b>	Stainless steel		

<b>5</b>	20A	N.C.
<b>C</b>		N.O.

<b>H</b>	C37	3/4	20
<b>J</b>	Stainless steel		

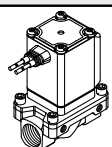
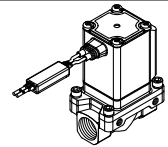
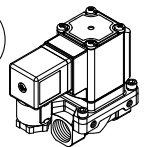
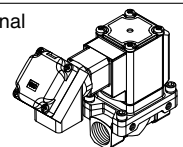
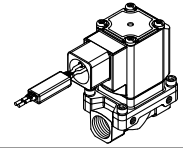
<b>6</b>	25A	N.C.
<b>D</b>		N.O.

<b>K</b>	C37	1	25
<b>L</b>	Stainless steel		

### Common Specifications

Seal material	EPDM
Coil insulation type	Class H
Thread type	Rc

### Voltage/Electrical entry

Symbol	Voltage	Electrical entry <small>Note 3)</small>
A	24 VDC	Grommet 
B	100 VAC	Grommet (With surge voltage suppressor) 
C	110 VAC	
D	200 VAC	
E	230 VAC	
G	24 VDC	DIN terminal (With surge voltage suppressor <small>Note 1) 2)</small> 
H	100 VAC	
J	110 VAC	
K	200 VAC	
L	230 VAC	
N	100 VAC	Conduit terminal (With surge voltage suppressor) 
P	110 VAC	
Q	200 VAC	
R	230 VAC	
T	100 VAC	Conduit (With surge voltage suppressor) 
U	110 VAC	
V	200 VAC	
W	230 VAC	
Z	Other voltages	

Note 1) AC voltage coil for "H" of DIN terminal type does not have full-wave rectifier.

Full-wave rectifier is built on the DIN connector side.

Please refer to page 29 to order it as an accessory.

Note 2) DIN connector insulation class is Class "B".

Note 3) Faston terminal is not available.

For other special options,  
refer to pages 20 and 21.

Special voltage	24 VAC
	48 VAC
	220 VAC
	240 VAC
DIN terminal with light	
Conduit terminal with light	
Oil-free	
G thread	
NPT thread	
With bracket	
Special electrical entry direction	

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

# Series VXZ



## For High Temperature Oil

\* Can be used with air (up to 99°C), water (up to 99°C) and oil. Note that the maximum operating pressure differential and flow-rate characteristics should be within the specifications of the fluid used.

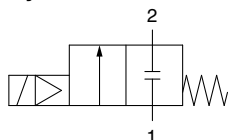
### ⚠ When the fluid is oil.

The kinematic viscosity must not exceed 50 mm<sup>2</sup>/s. The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON.

## Flow-rate Characteristics

N.C.

### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Closed (N.C.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential <sup>Note 1)</sup> (MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight <sup>Note 2)</sup> (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	VXZ236	0	0.7		46	1.9	1.5	600
	3/8 (10A)						58	2.4		
	1/2 (15A)	15	VXZ246				130	5.3		720
	3/4 (20A)	20	VXZ256				220	9.2		1100
	1 (25A)	25	VXZ266				245	10.2		1300

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-5 <sup>Note)</sup> to 100	-20 to 60

Note) Kinematic viscosity: 50 mm<sup>2</sup>/s or less

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Oil) <sup>Note)</sup>
FKM	0.1 cm <sup>3</sup> /min or less

### External Leakage

Seal material	Leakage rate (Oil) <sup>Note)</sup>
FKM	0.1 cm <sup>3</sup> /min or less

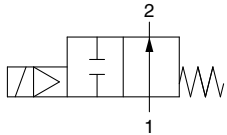
Note) Leakage is the value at ambient temperature 20°C.



## Flow-rate Characteristics

**N.O.**

### Symbol



When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.



### Normally Open (N.O.)

Body material	Port size (Nominal diameter)	Orifice diameter (mmø)	Model	Min. operating pressure differential (Note 1)(MPa)	Max. operating pressure differential (MPa)		Flow-rate characteristics		Max. system pressure (MPa)	Weight (Note 2) (g)
					AC	DC	Av x 10 <sup>-6</sup> m <sup>2</sup>	Cv		
C37, Stainless steel	1/4 (8A)	10	<b>VXZ2A6</b>	0	0.7	0.6	46	1.9	1.5	630
	3/8 (10A)						58	2.4		
	1/2 (15A)	15	<b>VXZ2B6</b>				130	5.3		750
	3/4 (20A)	20	<b>VXZ2C6</b>				220	9.2		1150
	1 (25A)	25	<b>VXZ2D6</b>				245	10.2		1350

Note 1) The operation of the valve may be unstable due to the capacity of the pressure supply source such as pumps and compressors or the pressure loss by the orifice of piping. Please contact SMC to check if the required valve size can be used in the application. Please contact SMC for the compatibility of the circuit flow and valve size. (Refer to page 23.)

Note 2) Weight of grommet type. Add 10 g for conduit, 30 g for DIN terminal, and 60 g for conduit terminal type respectively.

• Refer to "Glossary of Terms" on page 30 for details on the max. operating pressure differential.

## Fluid and Ambient Temperature

Fluid temperature (°C)	Ambient temperature (°C)
-5 (Note) to 100	-20 to 60

Note) Kinematic viscosity: 50 mm<sup>2</sup>/s or less

## Valve Leakage Rate

### Internal Leakage

Seal material	Leakage rate (Oil) (Note)
FKM	0.1 cm <sup>3</sup> /min or less

### External Leakage

Seal material	Leakage rate (Oil) (Note)
FKM	0.1 cm <sup>3</sup> /min or less

Note) Leakage is the value at ambient temperature 20°C.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions



## How to Order (Single Unit)



**VXZ2 3 6 A B**

Fluid •

6 For High temperature oil

### • Size/Valve type

Symbol	Body size	Valve type
3	10A	N.C.
A		N.O.

### • Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
A	C37	1/4	10
B		3/8	
C	Stainless steel	1/4	
D		3/8	

4	15A	N.C.
B		N.O.

F	C37	1/2	15
G	Stainless steel		

5	20A	N.C.
C		N.O.

H	C37	3/4	20
J	Stainless steel		

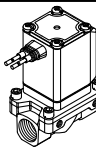
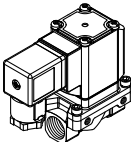
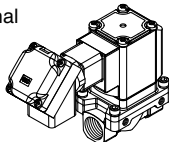
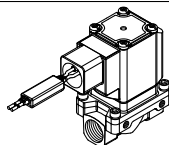
6	25A	N.C.
D		N.O.

K	C37	1	25
L	Stainless steel		

### Common Specifications

Seal material	FKM
Coil insulation type	Class H
Thread type	Rc

### • Voltage/Electrical entry

Symbol	Voltage	Electrical entry <sup>Note 3)</sup>
A	24 VDC	Grommet 
B	100 VAC	Grommet (With surge voltage suppressor)
C	110 VAC	
D	200 VAC	
E	230 VAC	
G	24 VDC	DIN terminal (With surge voltage suppressor <sup>Note 1) 2)</sup> 
H	100 VAC	
J	110 VAC	
K	200 VAC	
L	230 VAC	
N	100 VAC	Conduit terminal (With surge voltage suppressor) 
P	110 VAC	
Q	200 VAC	
R	230 VAC	
T	100 VAC	Conduit (With surge voltage suppressor) 
U	110 VAC	
V	200 VAC	
W	230 VAC	
Z	Other voltages	

Note 1) AC voltage coil for "H" of DIN terminal type does not have full-wave rectifier.

Full-wave rectifier is built on the DIN connector side. Please refer to page 29 to order it as an accessory.

Note 2) DIN connector insulation class is Class "B".

Note 3) Faston terminal is not available.

### For other special options, refer to pages 20 and 21.

Special voltage	24 VAC
	48 VAC
	220 VAC
	240 VAC
DIN terminal with light	
Conduit terminal with light	
Oil-free	
G thread	
NPT thread	
With bracket	
Special electrical entry direction	

# Series VXZ

## Other Special Options

### Electrical options

VXZ2 3 0 A Z 1A

Enter standard product number.

Electrical option

Special voltage/Electrical entry/Electrical option

Specification	Symbol	Class H*	Voltage	Electrical entry
Special voltage	1A	●	48 VAC	Grommet (With surge voltage suppressor)
	1B	●	220 VAC	
	1C	●	240 VAC	
	1U	●	24 VAC	
	1D	—	12 VDC	Grommet
	1E	—	12 VDC	Grommet (With surge voltage suppressor)
	1F	●	48 VAC	DIN terminal (With surge voltage suppressor)
	1G	●	220 VAC	
	1H	●	240 VAC	
	1V	●	24 VAC	
	1J	—	12 VDC	Conduit terminal (With surge voltage suppressor)
	1K	●	48 VAC	
	1L	●	220 VAC	
	1M	●	240 VAC	
	1W	●	24 VAC	Conduit (With surge voltage suppressor)
	1N	—	12 VDC	
	1P	●	48 VAC	
	1Q	●	220 VAC	
	1R	●	240 VAC	Faston terminal
	1Y	●	24 VAC	
	1S	—	12 VDC	
	1T	—	12 VDC	

With light	2A	●	24 VDC	DIN terminal (With surge voltage suppressor)
	2B	●	100 VAC	
	2C	●	110 VAC	
	2D	●	200 VAC	
	2E	●	230 VAC	
	2F	●	48 VAC	
	2G	●	220 VAC	Conduit terminal (With surge voltage suppressor)
	2H	●	240 VAC	
	2V	●	24 VAC	
	2J	—	12 VDC	
	2K	—	24 VDC	
	2L	●	100 VAC	
	2M	●	110 VAC	
	2N	●	200 VAC	
	2P	●	230 VAC	
	2Q	●	48 VAC	
	2R	●	220 VAC	
	2S	●	240 VAC	
	2W	●	24 VAC	
	2T	—	12 VDC	

Without DIN connector	3A	—	24 VDC	DIN terminal (With surge voltage suppressor)
	3B	—	100 VAC	
	3C	—	110 VAC	
	3D	—	200 VAC	
	3E	—	230 VAC	
	3F	—	48 VAC	
	3G	—	220 VAC	
	3H	—	240 VAC	
	3V	—	24 VAC	
	3J	—	12 VDC	

Options marked with ● are available for Class "H" coil.  
Applicable for all when the coil insulation class is Class "B".

### Other options (Low concentration ozone resistant and applicable to deionized water, Oil-free, Port thread)

VXZ2 3 0 A A Z

Enter standard product number.

Other option

Low concentration ozone resistant and applicable to deionized water/Oil-free/Port thread

Symbol	Low concentration ozone resistant and applicable to deionized water*1 (Seal material: FKM)	Oil-free	Port thread
Nil	—	—	Rc, One-touch fitting*2
A	—	—	G
B	—	—	NPT
C	○	—	Rc, One-touch fitting*2
D	—	○	G
E	—	○	NPT
F	○	—	G
G	○	—	NPT
H	—	○	Rc, One-touch fitting*2
K	○	○	G
L	—	○	NPT
Z	—	○	Rc, One-touch fitting*2

\*1 Applicable to air (VXZ2□0) and water (VXZ2□2).

\*2 When the body is resin, One-touch fittings are equipped as standard.

### With bracket (shipped together)

VXZ2 □ □ □ □ XB

Enter standard product number.

With bracket

\* Enter symbols in the order below when ordering a combination of electrical option, other option, etc.

Example) VXZ2 3 2 A Z 1A Z XB A

Electrical option

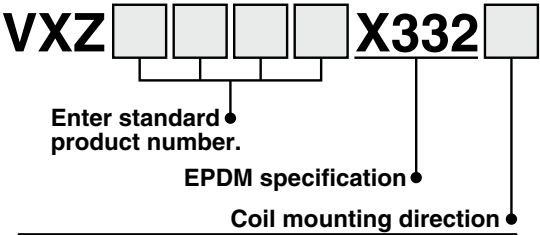
Other option

Special electrical entry direction

With bracket



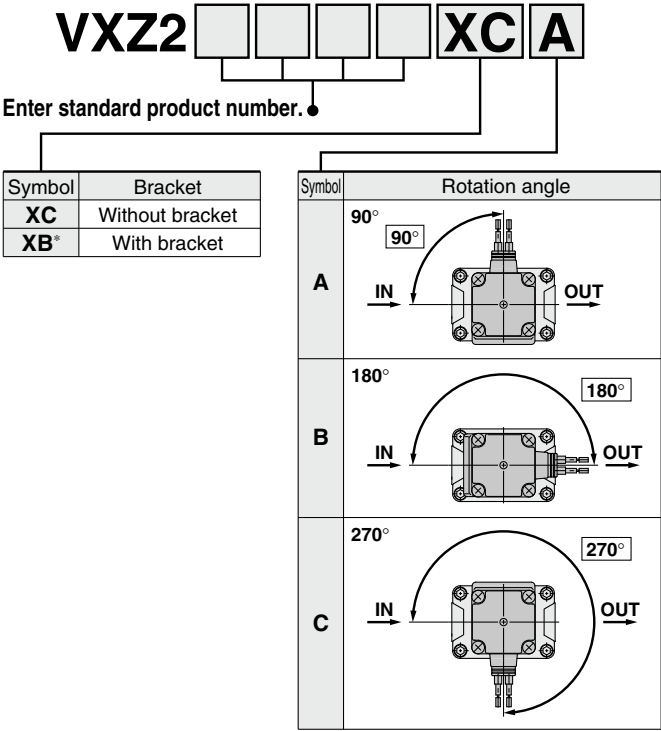
**EPDM specification**



Symbol	Specifications	
	Electrical entry direction	Bracket
Nil	IN side (Standard)	None
A	90°	
B	180°	
C	270°	
D	IN side (Standard)	With bracket *1
E	90°	
F	180°	
G	270°	

\*1 Resin body is not available.  
\*2 "Other options" (refer to page 20), which can be combined, are Nil, A, B, D, E, Z.  
\*3 Available for air and water.

**Special electrical entry direction**



\*1 Available for the VXZ<sub>A</sub><sup>3</sup>A to 2<sub>D</sub><sup>6</sup>.  
\*2 Bracket is attached as standard with the resin body type (VXZ2<sub>A</sub><sup>3</sup>0<sub>E</sub><sup>C</sup>□), so it is no necessary to add XB to the part number.  
\*3 Bracket is packed in the same container as the main body.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

\* Enter symbols in the order below when ordering a combination of electrical option, other option, etc.

Example) **VXZ2** 3 2 A Z 1A Z XB A

Electrical option •

Other option •

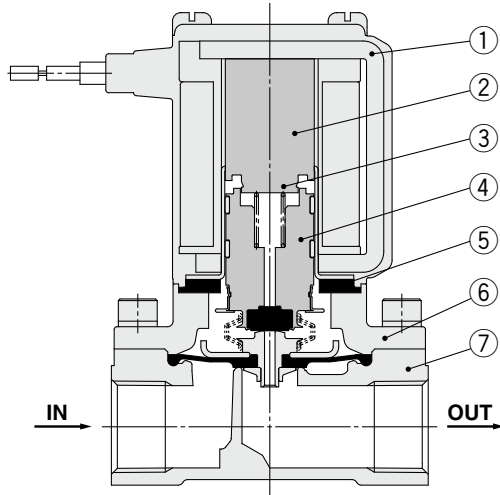
Special electrical entry direction •

With bracket •

# Series VXZ Construction

## Normally Closed (N.C.)

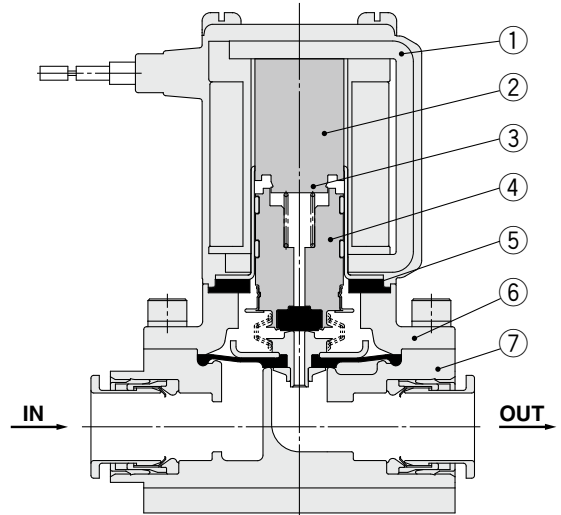
Body material: Aluminum, C37, Stainless steel



### Component Parts

No.	Description	Material
1	Solenoid coil	Cu + Fe + Resin
2	Tube assembly	Stainless steel
3	Return spring	Stainless steel
4	Armature/Diaphragm assembly	Stainless steel, NBR, FKM, EPDM
5	Stopper	NBR, FKM, EPDM
6	Bonnet	C37, Stainless steel, Aluminum
7	Body	C37, Stainless steel, Aluminum

Body material: Resin

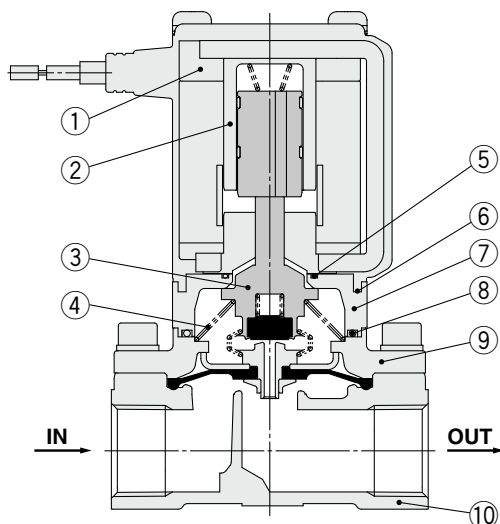


### Component Parts

No.	Description	Material
1	Solenoid coil	Cu + Fe + Resin
2	Tube assembly	Stainless steel
3	Return spring	Stainless steel
4	Armature/Diaphragm assembly	Stainless steel, NBR, FKM
5	Stopper	NBR, FKM
6	Bonnet	Aluminum
7	Body	Resin (PBT)

## Normally Open (N.O.)

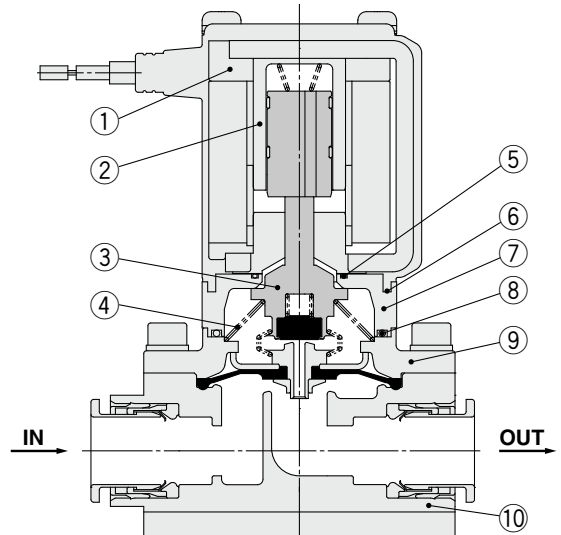
Body material: Aluminum, C37, Stainless steel



### Component Parts

No.	Description	Material
1	Solenoid coil	Cu + Fe + Resin
2	Sleeve assembly	Stainless steel, Resin (PPS)
3	Push rod/Diaphragm assembly	Stainless steel, NBR, FKM, EPDM
4	Spring	Stainless steel
5	O-ring A	NBR, FKM, EPDM
6	O-ring B	NBR, FKM, EPDM
7	Adapter	Resin (PPS)
8	O-ring C	NBR, FKM, EPDM
9	Bonnet	Aluminum, C37, Stainless steel
10	Body	Aluminum, C37, Stainless steel

Body material: Resin



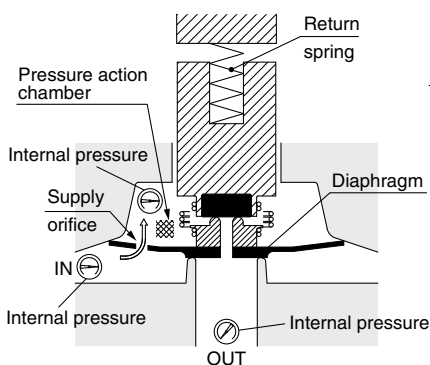
### Component Parts

No.	Description	Material
1	Solenoid coil	Cu + Fe + Resin
2	Sleeve assembly	Stainless steel, Resin (PPS)
3	Push rod/Diaphragm assembly	Stainless steel, NBR, FKM
4	Spring	Stainless steel
5	O-ring A	NBR, FKM
6	O-ring B	NBR, FKM
7	Adapter	Resin (PPS)
8	O-ring C	NBR, FKM
9	Bonnet	Aluminum
10	Body	Resin (PBT)

## Working Principle

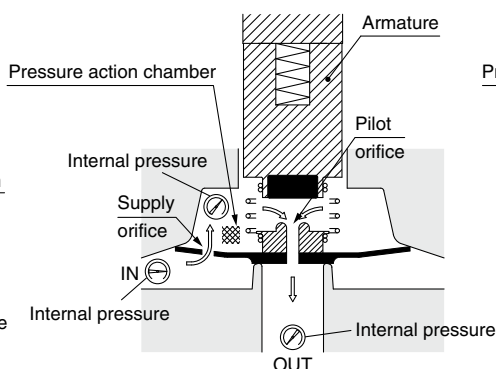
### De-energized

The fluid enters from the IN goes through the supply orifice to fill the pressure action chamber. Main valve is closed by the pressure in the pressure action chamber and the reaction force of the return spring.



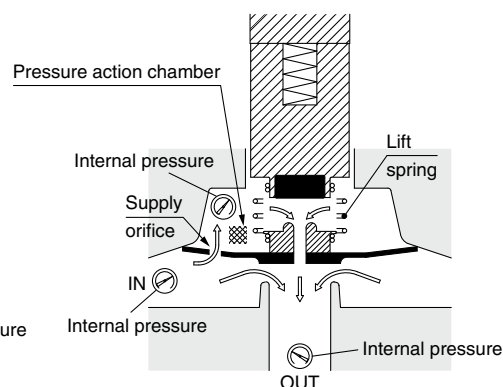
### Right after energized (Pilot valve open)

When the coil is energized, the armature is attracted causing the pilot orifice to opening. The fluid filling the pressure action chamber flows to the OUT side through the pilot orifice.



### Energized (Main valve side)

The pressure in the pressure action chamber decreases by discharging fluid through the pilot orifice. Because the force which pushes down the valve is reduced by the discharge of the fluid, the force that pushes up the main valve overcomes the push down force and opens the main valve. The main valve opens by the lift spring reaction force even if pressure on the IN side is 0 MPa or very low pressure.



## Warning

Unstable flow may occur with the product under the following conditions: • low flow from the pump or compressor, etc. • use of several elbows or tees in the circuit, or • thin nozzles installed at the end of the piping etc. This can cause valve opening/closing failure, or oscillation, and cause a valve malfunction. If products are used with vacuum, then the vacuum level can be unstable due to these conditions. Please contact SMC to check if the valve can be used in the application by providing the relevant fluid circuit.

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

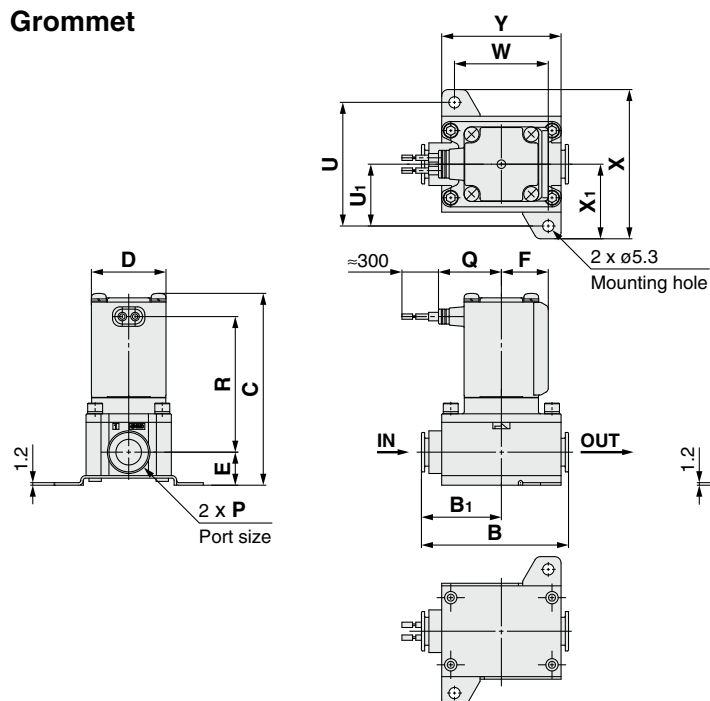
Construction

Dimensions

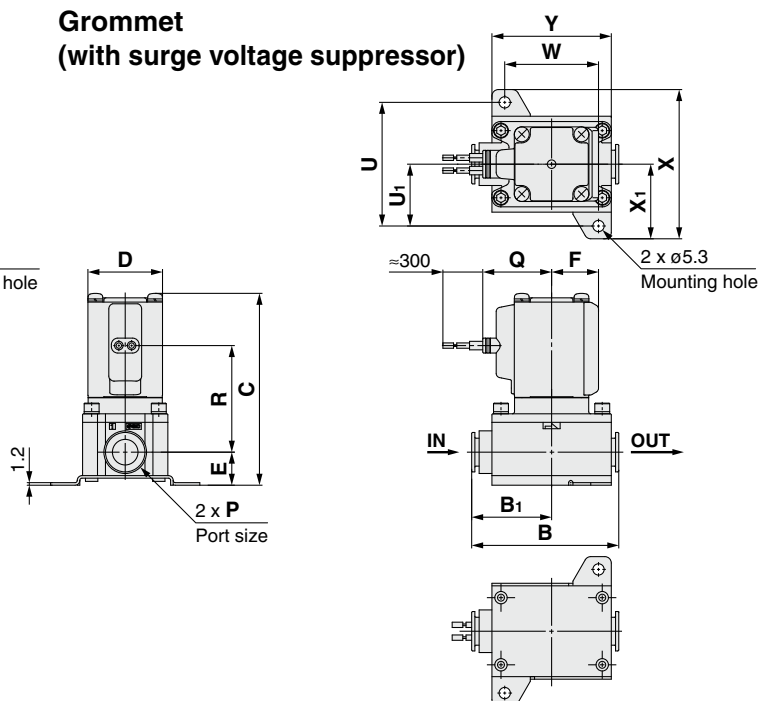


## Dimensions/Body Material: Resin (One-touch Fitting Type)

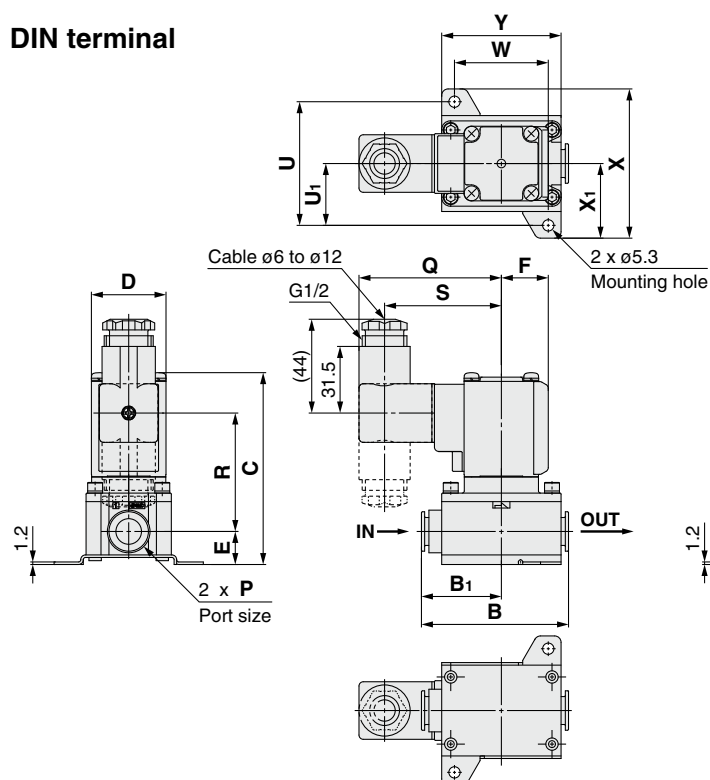
### Grommet



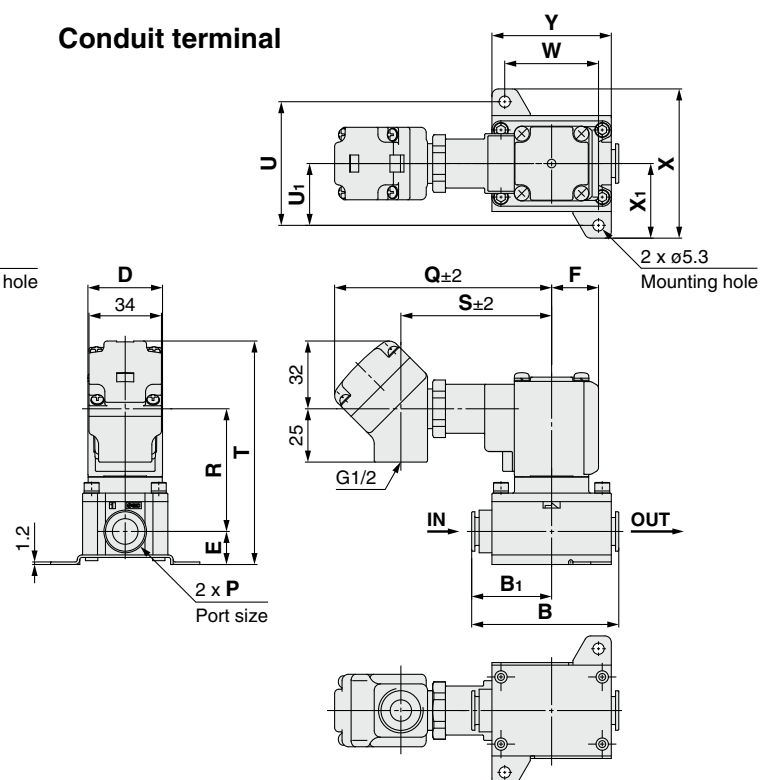
### Grommet (with surge voltage suppressor)



### DIN terminal



### Conduit terminal



For information on handling One-touch fittings and appropriate tubing, refer to page 39 and KQ2 series One-touch fittings in Best Pneumatics No. 6. The KQ2 series information can be downloaded from the following SMC website, <http://www.smcworld.com>

(mm)

Model	One-touch fitting P	B	B <sub>1</sub>	C	D	E	F	Bracket mounting					
								U	U <sub>1</sub>	W	X	X <sub>1</sub>	Y
VXZ <sup>3</sup> <sub>A</sub>	ø10, ø3/8", ø12	69	37.5	90 (96.5)	35	15.5	22	54	27	44	65	32.5	56

Model	One-touch fitting P	Electrical entry											
		Grommet		Grommet (with surge voltage suppressor)		DIN terminal			Conduit terminal				
		Q	R	Q	R	Q	R	S	Q	R	S	T	
VXZ <sup>3</sup> <sub>A</sub>	ø10, ø3/8", ø12	29.5	63.5 (70)	32.5	50 (56.5)	67	55.5 (62)	55	102	57.5 (64)	71	105 (111.5)	

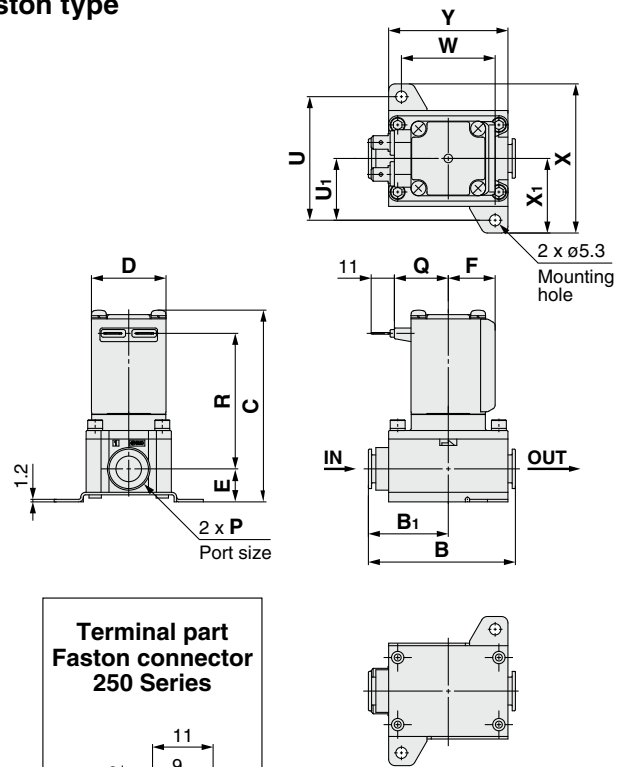
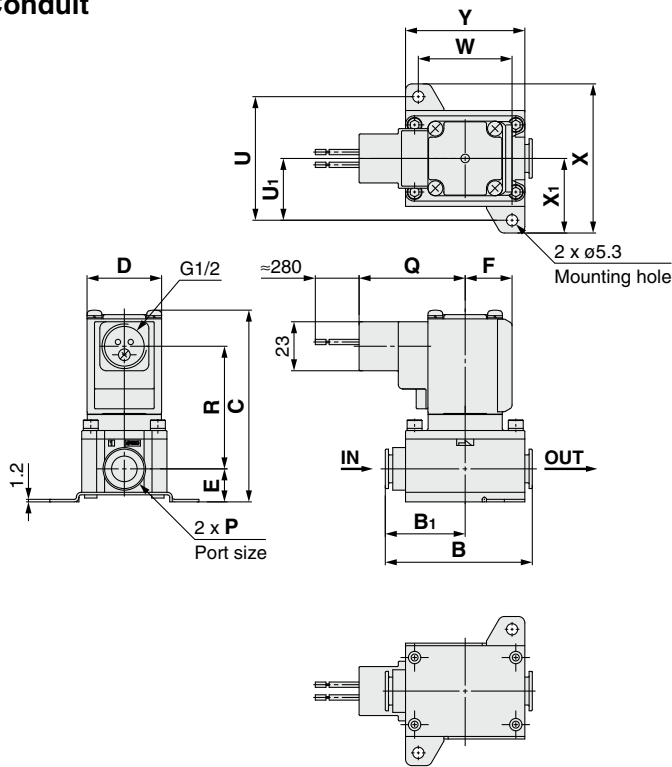
( ) are the dimensions of Normally Open (N.O.).



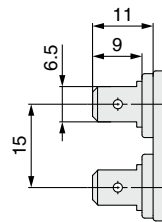
## Dimensions/Body Material: Resin (One-touch Fitting Type)

### Conduit

### Faston type



### Terminal part Faston connector 250 Series



													(mm)
Model	One-touch fitting P	B	B <sub>1</sub>	C	D	E	F	Bracket mounting					
								U	U <sub>1</sub>	W	X	X <sub>1</sub>	Y
VXZ <sup>3</sup> <sub>A</sub>	ø10, ø3/8", ø12	69	37.5	90 (96.5)	35	15.5	22	54	27	44	65	32.5	56

Model	One-touch fitting P	Electrical entry			
		Conduit		Faston	
		Q	R	Q	R
VXZ <sup>3</sup> <sub>A</sub>	ø10, ø3/8", ø12	50	57.5 (64)	25.5	63.5 (70)

( ) are the dimensions of Normally Open (N.O.).

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions



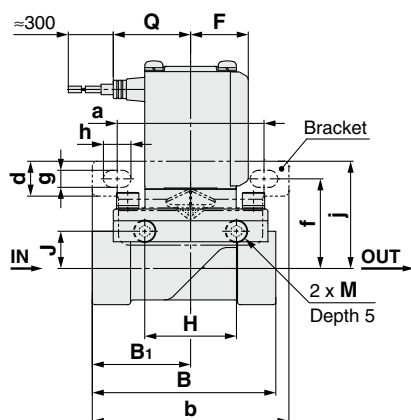
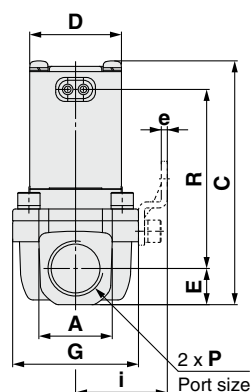
# Series VXZ



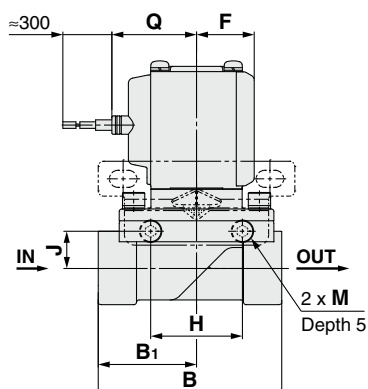
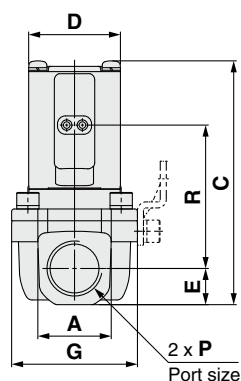
For Air, Water, Oil

## Dimensions/Body Material: Aluminum, C37, Stainless Steel

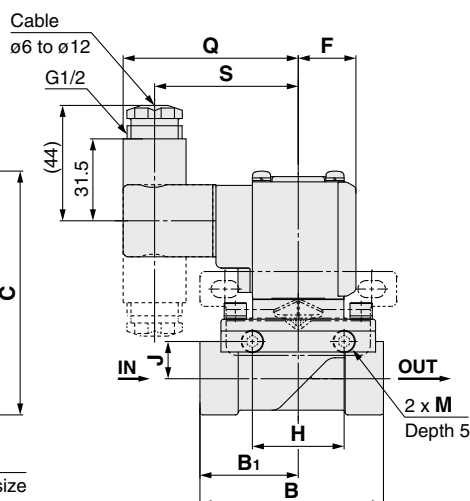
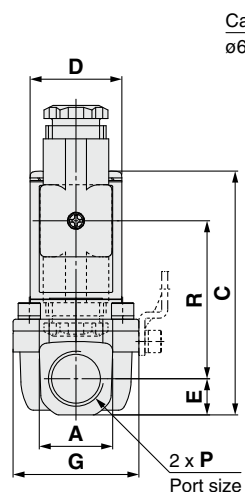
### Grommet



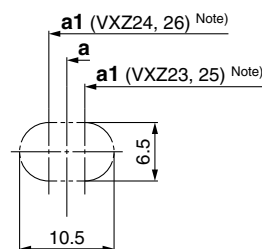
### Grommet (with surge voltage suppressor)



### DIN terminal



#### Bracket mounting hole dimensions



(mm)

Model	Port size P	A	B	B <sub>1</sub>	C	D	E	F	G	H	J	M
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	21 <22>	57	28.5	85 (91.5)	35	10.5	22	40	35	10	M5
VXZ <sup>4</sup> <sub>B</sub>	1/2	28	70	37.5	93 (99.5)	35	14	22	48	35	14.2	M5
VXZ <sup>5</sup> <sub>C</sub>	3/4	33.5	71	38.5	104 (110.5)	40	17	24.5	62	33	15.2	M6
VXZ <sup>6</sup> <sub>D</sub>	1	42	95	49.5	110 (116)	40	20	24.5	66	37	17.2	M6

Model	Port size P	Bracket mounting									
		a	a <sup>(Note)</sup>	b	d	e	f	g	h	i	j
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	56	52	75	13.5	2.3	30	6.5	10.5	31	37
VXZ <sup>4</sup> <sub>B</sub>	1/2	56	60	75		2.3	34.5	6.5	10.5	35	41
VXZ <sup>5</sup> <sub>C</sub>	3/4	70.5	68	92		2.3	39	6.5	10.5	43	46
VXZ <sup>6</sup> <sub>D</sub>	1	70.5	73	92		2.3	41	6.5	10.5	45	48

Model	Port size P	Electrical entry						
		Grommet		Grommet (with surge voltage suppressor)		DIN terminal		
		Q	R	Q	R	Q	R	S
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	29.5	63.5 (70)	32.5	50 (56.5)	67	55.5 (62)	55
VXZ <sup>4</sup> <sub>B</sub>	1/2	29.5	68.5 (74.5)	32.5	55 (61)	67	60.5 (66.5)	55
VXZ <sup>5</sup> <sub>C</sub>	3/4	32	76.5 (83)	35	63 (69.5)	69.5	68.5 (75)	57.5
VXZ <sup>6</sup> <sub>D</sub>	1	32	79.5 (85)	35	66 (71.5)	69.5	71.5 (77)	57.5

( ) are the dimensions of Normally Open (N.O.). < > are the dimensions of aluminum body.

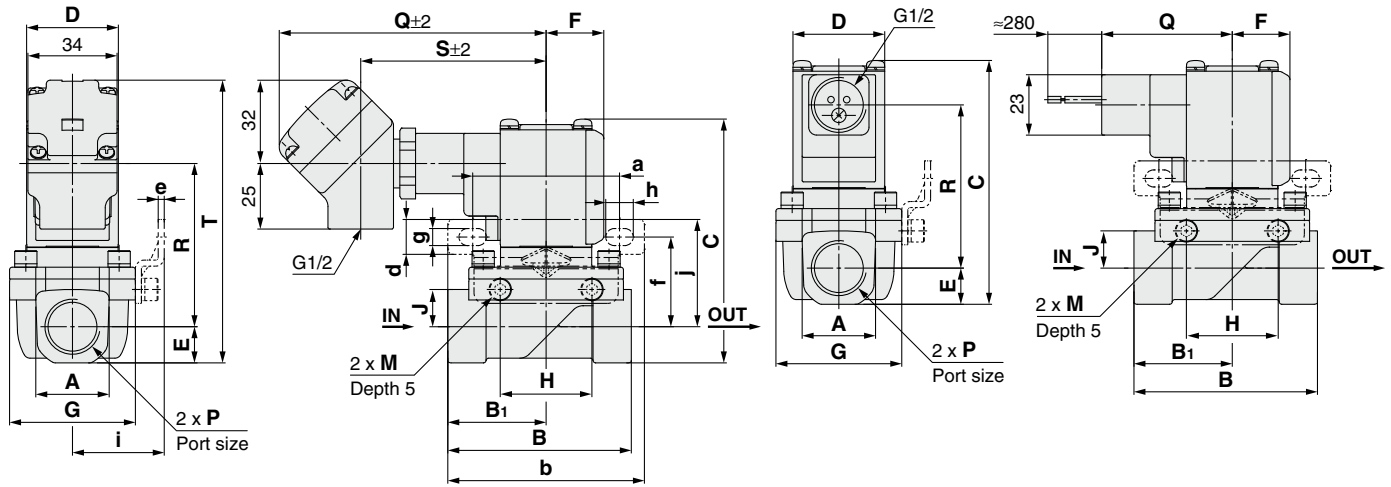
Note) Old VXZ bracket mounting hole center position



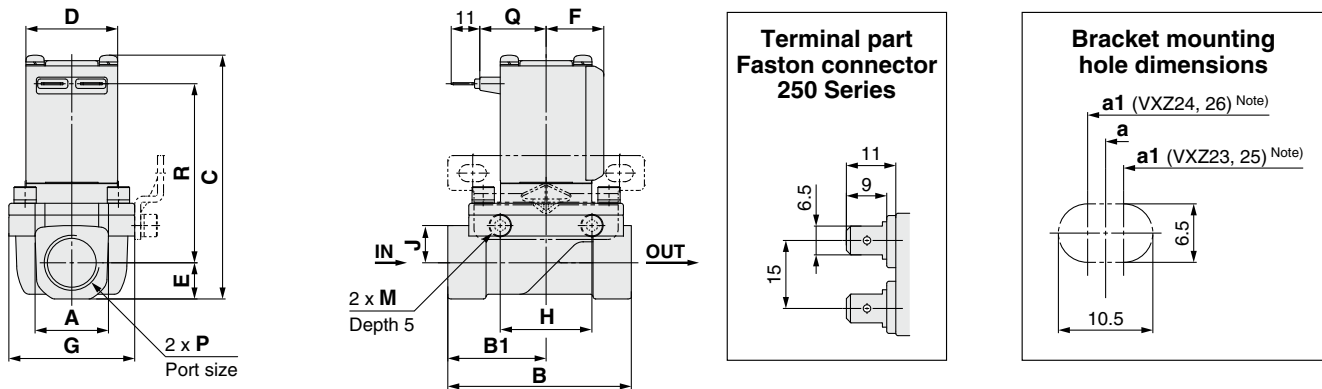
## Dimensions/Body Material: Aluminum, C37, Stainless Steel

### Conduit terminal

### Conduit



### Faston type



Model	Port size P	A	B	B <sub>1</sub>	C	D	E	F	G	H	J	M
VXZ2 <sup>3</sup> <sub>A</sub>	1/4, 3/8	21 <22>	57	28.5	85 (91.5)	35	10.5	22	40	35	10	M5
VXZ2 <sup>4</sup> <sub>B</sub>	1/2	28	70	37.5	93 (99.5)	35	14	22	48	35	14.2	M5
VXZ2 <sup>5</sup> <sub>C</sub>	3/4	33.5	71	38.5	104 (110.5)	40	17	24.5	62	33	15.2	M6
VXZ2 <sup>6</sup> <sub>D</sub>	1	42	95	49.5	110 (116)	40	20	24.5	66	37	17.2	M6

Model	Port size P	Bracket mounting									
		a	a <sub>1</sub> (Note)	b	d	e	f	g	h	i	j
VXZ2 <sup>3</sup> <sub>A</sub>	1/4, 3/8	56	52	75	13.5	2.3	30	6.5	10.5	31	37
VXZ2 <sup>4</sup> <sub>B</sub>	1/2	56	60	75		2.3	34.5	6.5	10.5	35	41
VXZ2 <sup>5</sup> <sub>C</sub>	3/4	70.5	68	92		2.3	39	6.5	10.5	43	46
VXZ2 <sup>6</sup> <sub>D</sub>	1	70.5	73	92		2.3	41	6.5	10.5	45	48

Model	Port size P	Electrical entry							
		Conduit terminal				Conduit		Faston	
		Q	R	S	T	Q	R	Q	R
VXZ2 <sup>3</sup> <sub>A</sub>	1/4, 3/8	102	57.5 (64)	71	100 (106.5)	50	57.5 (64)	25.5	63.5 (70)
VXZ2 <sup>4</sup> <sub>B</sub>	1/2	102	62.5 (68.5)	71	108 (114.5)	50	62.5 (68.5)	25.5	68.5 (74.5)
VXZ2 <sup>5</sup> <sub>C</sub>	3/4	104.5	70.5 (77)	73.5	119 (126)	52.5	70.5 (77)	28	76.5 (82.5)
VXZ2 <sup>6</sup> <sub>D</sub>	1	104.5	73.5 (79)	73.5	125 (131)	52.5	73.5 (79)	28	79.5 (85)

( ) are the dimensions of Normally Open (N.O.). < > are the dimensions of aluminum body.  
Note) Old VXZ bracket mounting hole center position

Specifications

For Air

For Water

For Oil

For Heated Water

For High Temperature Oil

Options

Construction

Dimensions

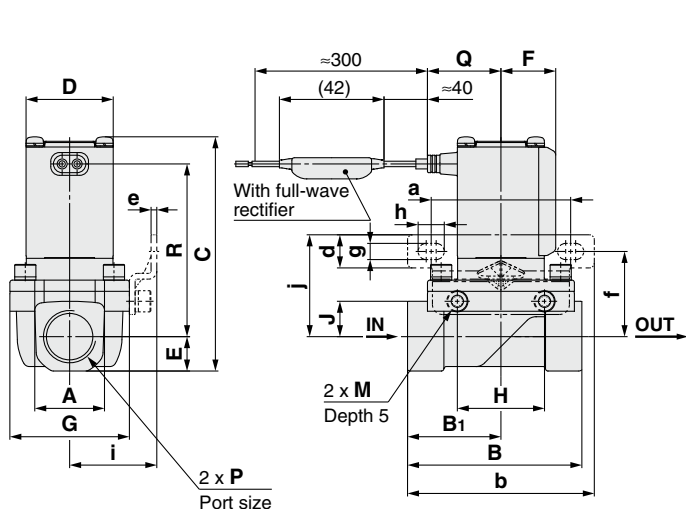
# Series VXZ



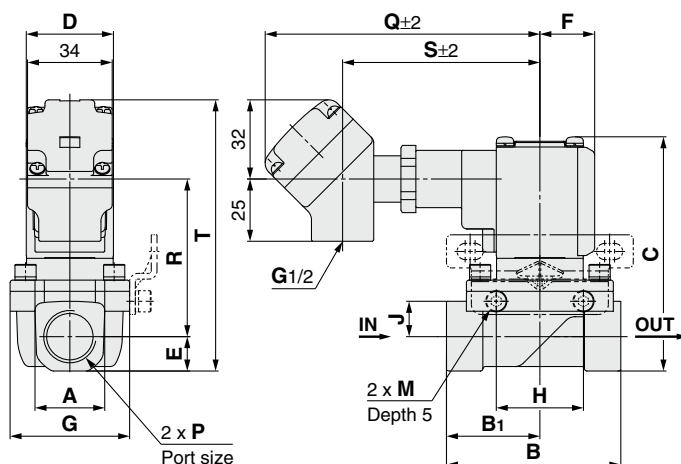
For Heated Water, High Temperature Oil

## Dimensions/Body Material: C37, Stainless Steel

### Grommet

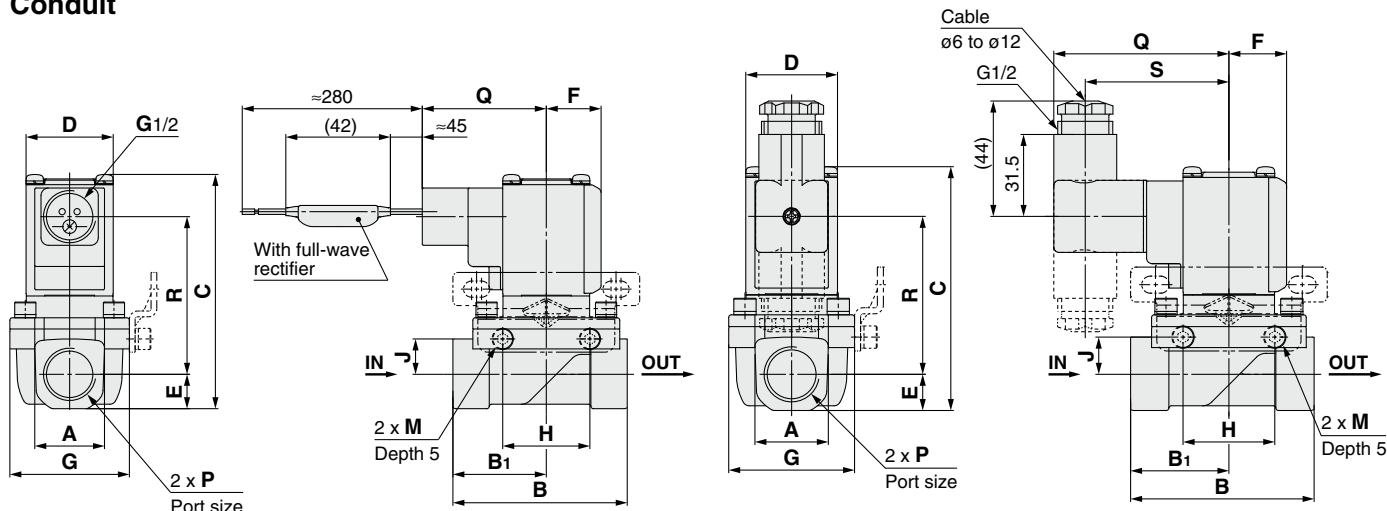


### Conduit terminal



### DIN terminal

### Conduit



Model	Port size P	A	B	B <sub>1</sub>	C	D	E	F	G	H	J	M
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	21	57	28.5	85 (91.5)	35	10.5	22	40	35	10	M5
VXZ <sup>4</sup> <sub>B</sub>	1/2	28	70	37.5	93 (99.5)	35	14	22	48	35	14.2	M5
VXZ <sup>5</sup> <sub>C</sub>	3/4	33.5	71	38.5	104 (110.5)	40	17	24.5	62	33	15.2	M6
VXZ <sup>6</sup> <sub>D</sub>	1	42	95	49.5	110 (116)	40	20	24.5	66	37	17.2	M6

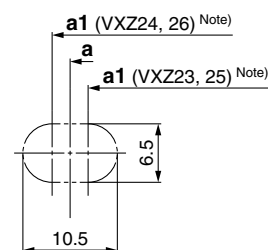
Model	Port size P	Bracket mounting									
		a	a <sub>1</sub> (Note)	b	d	e	f	g	h	i	j
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	56	52	75	13.5	2.3	30	6.5	10.5	31	37
VXZ <sup>4</sup> <sub>B</sub>	1/2	56	60	75		2.3	34.5	6.5	10.5	35	41
VXZ <sup>5</sup> <sub>C</sub>	3/4	70.5	68	92		2.3	39	6.5	10.5	43	46
VXZ <sup>6</sup> <sub>D</sub>	1	70.5	73	92		2.3	41	6.5	10.5	45	48

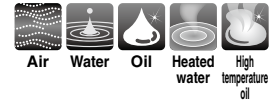
Model	Port size P	Electrical entry										
		Grommet		Conduit terminal				Conduit		DIN terminal		
		Q	R	Q	R	S	T	Q	R	Q	R	S
VXZ <sup>3</sup> <sub>A</sub>	1/4, 3/8	29.5	63.5 (70)	110.5	57.5 (64)	79.5	100 (106.5)	50	57.5 (64)	67	55.5 (62)	55
VXZ <sup>4</sup> <sub>B</sub>	1/2	29.5	68.5 (74.5)	110.5	62.5 (68.5)	79.5	108 (114.5)	50	62.5 (68.5)	67	60.5 (66.5)	55
VXZ <sup>5</sup> <sub>C</sub>	3/4	32	76.5 (83)	113	70.5 (77)	82	119 (126)	52.5	70.5 (77)	69.5	68.5 (75)	57.5
VXZ <sup>6</sup> <sub>D</sub>	1	32	79.5 (85)	113	73.5 (79)	82	125 (131)	52.5	73.5 (79)	69.5	71.5 (77)	57.5

( ) are the dimensions of Normally Open (N.O.).

Note) Old VXZ bracket mounting hole center position

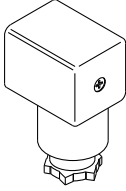
### Bracket mounting hole dimensions





## Replacement Parts

### • DIN Connector Part No.



#### <Coil Insulation Type/For Class B>

Electrical option	Rated voltage	Connector part no.
None	24 VDC	<b>C18312G6GCU</b>
	12 VDC	
	100 VAC	
	110 VAC	
	200 VAC	
	220 VAC	
	230 VAC	
	240 VAC	
	24 VAC	
	48 VAC	
With light	24 VDC	<b>GDM2A-L5</b>
	12 VDC	<b>GDM2A-L6</b>
	100 VAC	<b>GDM2A-L1</b>
	110 VAC	<b>GDM2A-L1</b>
	200 VAC	<b>GDM2A-L2</b>
	220 VAC	<b>GDM2A-L2</b>
	230 VAC	<b>GDM2A-L2</b>
	240 VAC	<b>GDM2A-L2</b>
	24 VAC	<b>GDM2A-L5</b>
	48 VAC	<b>GDM2A-L15</b>

#### <Coil Insulation Type/For Class H>

Electrical option	Rated voltage	Connector part no.
None	24 VDC	<b>GDM2A-G-S2</b>
	100 VAC	<b>GDM2A-R</b>
	110 VAC	
	200 VAC	
	220 VAC	
	230 VAC	
	240 VAC	
	24 VAC	
	48 VAC	
With light	24 VDC	<b>GDM2A-G-Z5</b>
	100 VAC	<b>GDM2A-R-L1</b>
	110 VAC	<b>GDM2A-R-L1</b>
	200 VAC	<b>GDM2A-R-L2</b>
	220 VAC	<b>GDM2A-R-L2</b>
	230 VAC	<b>GDM2A-R-L2</b>
	240 VAC	<b>GDM2A-R-L2</b>
	24 VAC	<b>GDM2A-R-L5</b>
	48 VAC	<b>GDM2A-R-L5</b>

### • Gasket Part No. for DIN Connector

**VCW20-1-29-1 (For Class B)**

**VCW20-1-29-1-F (For Class H)**

### • Lead Wire Assembly for Faston Terminal (Set of 2 pcs.)

**VX021S-1-16FB**

### • Bracket Assembly Part No. (for Metal Body)

**VXZ 3 0S - 14A - 1**

<b>3</b>	For VXZ2 $\frac{4}{3}A$ <input type="checkbox"/>
<b>5</b>	For VXZ2 $\frac{6}{5}C$ <input type="checkbox"/>

\* 2 mounting screws are shipped together with the bracket assembly.

# 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. 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 fully opened.

### 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. Withstand pressure

The pressure in which the valve must be withstood without a drop in performance after holding for one minute under prescribed pressure and returning to the operating pressure range. [value under the prescribed conditions]

## Electrical Terminology

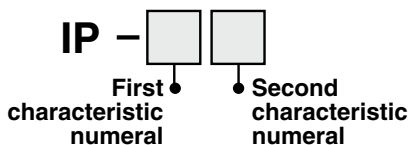
### 1. Surge voltage

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

### 2. Degree of protection

A degree defined in the "JIS C 0920: Waterproof test of electric machinery/appliance and the degree of protection against the intrusion of solid foreign objects."

Verify the degree of protection for each product.



#### ●First Characteristics:

##### Degrees of protection against solid foreign objects

0	Non-protected
1	Protected against solid foreign objects of 50 mmø and greater
2	Protected against solid foreign objects of 12 mmø and greater
3	Protected against solid foreign objects of 2.5 mmø and greater
4	Protected against solid foreign objects of 1.0 mmø and greater
5	Dust-protected
6	Dust-tight

## Electrical Terminology

### ●Second Characteristics:

#### Degrees of protection against water

0	Non-protected	—
1	Protected against vertically falling water drops	Dripproof type 1
2	Protected against vertically falling water drops when enclosure tilted up to 15°	Dripproof type 2
3	Protected against rainfall when enclosure tilted up to 60°	Rainproof type
4	Protected against splashing water	Splashproof type
5	Protected against water jets	Water-jet-proof type
6	Protected against powerful water jets	Powerful water-jet-proof type
7	Protected against the effects of temporary immersion in water	Immersible type
8	Protected against the effects of continuous immersion in water	Submersible type

Example) IP65: Dust-tight, Water-jet-proof type

"Water-jet-proof type" 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 constantly.

## Others

### 1. Material

NBR: Nitrile rubber

FKM: Fluoro rubber

EPDM: Ethylene propylene rubber

### 2. Oil-free treatment

The degreasing and washing of wetted parts

### 3. Symbol

When the valve is closed, flow is blocked from port 1 to port 2. However, if the pressure in port 2 is higher than port 1, the valve will not be able to block the fluid and it will flow from port 2 to port 1.

## Faston Terminal

1. Faston™ is a trademark of Tyco Electronics Corp.

2. For electrical connection of the Faston terminal and molded coil, please use Tyco's "Amp/Faston connector/250 Series" or the equivalent.

# 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 as shown in Table (1).

Table (1) Indication of Flow-rate Characteristics

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

### 2. Pneumatic equipment

#### 2.1 Indication according to the international standards

(1) Conformed standard

ISO 6358: 1989 : Pneumatic fluid power—Components using compressible fluids—  
Determination of flow-rate characteristics

JIS B 8390: 2000 : Pneumatic fluid power—Components using compressible fluids—  
How to test flow-rate characteristics

(2) Definition of flow-rate characteristics

The flow-rate characteristics are indicated as a result of a comparison between sonic conductance **C** and critical pressure ratio **b**.

Sonic conductance **C** : Value which divides the passing mass flow rate of an equipment in a choked flow condition by the product of the upstream absolute pressure and the density in a standard condition.

Critical pressure ratio **b** : Pressure ratio (downstream pressure/upstream pressure) which will turn to a choked flow when the value is smaller than this ratio.

Choked flow : The flow in which the upstream pressure is higher than the downstream pressure and where sonic speed in a certain part of an equipment is reached.  
Gaseous mass flow rate is in proportion to the upstream pressure and not dependent on the downstream pressure.

Subsonic flow : Flow greater than the critical pressure ratio

Standard condition : Air in a temperature state of 20°C, absolute pressure 0.1 MPa (= 100 kPa = 1 bar), relative humidity 65%.

It is stipulated by adding the “(ANR)” after the unit depicting air volume.  
(standard reference atmosphere)

Conformed standard: ISO 8778: 1990 Pneumatic fluid power—Standard reference atmosphere, JIS B 8393: 2000: Pneumatic fluid power—Standard reference atmosphere

(3) Formula for flow rate

It is described by the practical units as following.

When  $\frac{P_2 + 0.1}{P_1 + 0.1} \leq b$ , choked flow

$$Q = 600 \times C (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \dots\dots\dots(1)$$

When  $\frac{P_2 + 0.1}{P_1 + 0.1} > b$ , subsonic flow

$$Q = 600 \times C (P_1 + 0.1) \sqrt{1 - \left[ \frac{\frac{P_2 + 0.1}{P_1 + 0.1} - b}{1 - b} \right]^2} \sqrt{\frac{293}{273 + t}} \dots\dots\dots(2)$$

**Q** : Air flow rate [dm<sup>3</sup>/min (ANR)], dm<sup>3</sup> (Cubic decimeter) of SI unit are also allowed to be described by L (liter).  
1 dm<sup>3</sup> = 1 L



**C** : Sonic conductance [ $\text{dm}^3/(\text{s}\cdot\text{bar})$ ]

**b** : Critical pressure ratio [—]

**P<sub>1</sub>** : Upstream pressure [MPa]

**P<sub>2</sub>** : Downstream pressure [MPa]

**t** : Temperature [ $^{\circ}\text{C}$ ]

Note) Formula of subsonic flow is the elliptic analogous curve.

Flow-rate characteristics are shown in Graph (1) For details, please make use of SMC's "Energy Saving Program".

Example)

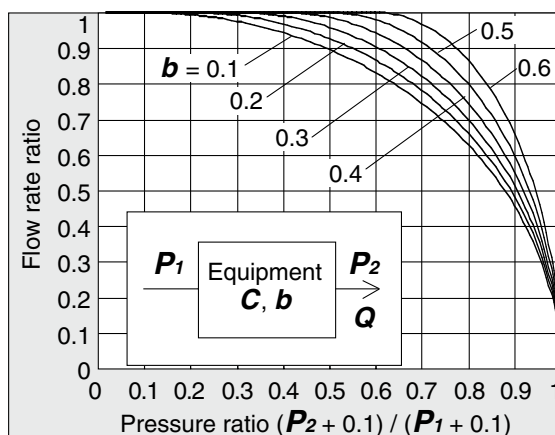
Obtain the air flow rate for **P<sub>1</sub>** = 0.4 [MPa], **P<sub>2</sub>** = 0.3 [MPa], **t** = 20 [ $^{\circ}\text{C}$ ] when a solenoid valve is performed in **C** = 2 [ $\text{dm}^3/(\text{s}\cdot\text{bar})$ ] and **b** = 0.3.

According to formula 1, the maximum flow rate =  $600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}} = 600$  [ $\text{dm}^3/\text{min}$  (ANR)]

$$\text{Pressure ratio} = \frac{0.3 + 0.1}{0.4 + 0.1} = 0.8$$

Based on Graph (1), the flow rate will be 0.7 when the pressure ratio is 0.8 and **b** = 0.3.

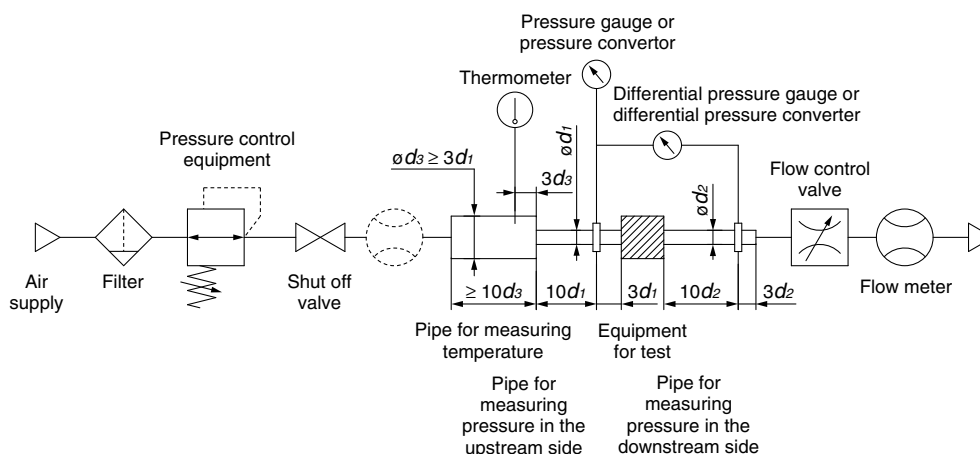
Hence, flow rate = Maximum flow rate x flow rate ratio =  $600 \times 0.7 = 420$  [ $\text{dm}^3/\text{min}$  (ANR)]



**Graph (1) Flow-rate characteristics**

#### (4) Test method

Attach a test equipment with the test circuit shown in Fig. (1) while maintaining the upstream pressure to a certain level which does not go below 0.3 MPa. Next, measure the maximum flow to be saturated in the first place, then measure this flow rate at 80%, 60%, 40%, 20% and the upstream and downstream pressure. And then, obtain the sonic conductance **C** from this maximum flow rate. Besides that, substitute each data of others for the subsonic flow formula to find **b**, then obtain the critical pressure ratio **b** from that average.



**Fig. (1) Test circuit based on ISO 6358, JIS B 8390**

## 2.2 Effective area **S**

### (1) Conformed standard

**JIS B 8390: 2000: Pneumatic fluid power—Components using compressible fluids—Determination of flow rate characteristics**

**Equipment standards: JIS B 8373: 2 port solenoid valve for pneumatics**

**JIS B 8374: 3 port solenoid valve for pneumatics**

**JIS B 8375: 4 port, 5 port solenoid valve for pneumatics**

**JIS B 8379: Silencer for pneumatics**

**JIS B 8381: Fittings of flexible joint for pneumatics**

### (2) Definition of flow-rate characteristics

Effective area **S**: The cross-sectional area having an ideal throttle without friction deduced from the calculation of the pressure changes inside an air tank or without reduced flow when discharging the compressed air in a choked flow, from an equipment attached to the air tank. This is the same concept representing the “easy to run through” as sonic conductance **C**.

### (3) Formula for flow rate

When  $\frac{P_2 + 0.1}{P_1 + 0.1} \leq 0.5$ , **choked flow**

$$Q = 120 \times S (P_1 + 0.1) \sqrt{\frac{293}{273 + t}} \quad \text{.....(3)}$$

When  $\frac{P_2 + 0.1}{P_1 + 0.1} > 0.5$ , **subsonic flow**

$$Q = 240 \times S \sqrt{(P_2 + 0.1) (P_1 - P_2)} \sqrt{\frac{293}{273 + t}} \quad \text{.....(4)}$$

Conversion with sonic conductance **C**:

$$S = 5.0 \times C \quad \text{.....(5)}$$

**Q** : Air flow rate[dm<sup>3</sup>/min(ANR)], dm<sup>3</sup> (cubic decimeter) of SI unit are also allowed to be described by L (liter)  
1 dm<sup>3</sup> = 1 L

**S** : Effective area [mm<sup>2</sup>]

**P<sub>1</sub>** : Upstream pressure [MPa]

**P<sub>2</sub>** : Downstream pressure [MPa]

**t** : Temperature [°C]

Note) Formula for subsonic flow (4) is only applicable when the critical pressure ratio **b** is the unknown equipment. In the formula (2) by the sonic conductance **C**, it is the same formula as when **b** = 0.5.

### (4) Test method

Attach a test equipment with the test circuit shown in Fig. (2) in order to discharge air into the atmosphere until the pressure inside the air tank goes down to 0.25 MPa (0.2 MPa) from an air tank filled with the compressed air at a certain pressure level (0.5 MPa) which does not go below 0.6 MPa. At this time, measure the discharging time and the residual pressure inside the air tank which had been left until it turned to be the normal values to determine the effective area **S**, using the following formula. The volume of an air tank should be selected within the specified range by corresponding to the effective area of an equipment for test. In the case of JIS B 8373, 8374, 8375, 8379, 8381, the pressure values are in parentheses and the coefficient of the formula is 12.9.

$$S = 12.1 \frac{V}{t} \log_{10} \left( \frac{P_s + 0.1}{P + 0.1} \right) \sqrt{\frac{293}{T}} \quad \text{.....(6)}$$

**S** : Effective area [mm<sup>2</sup>]

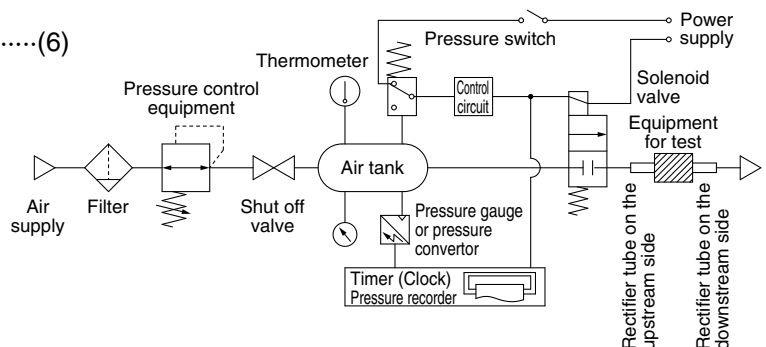
**V** : Air tank capacity [dm<sup>3</sup>]

**t** : Discharging time [s]

**P<sub>s</sub>** : Pressure inside air tank before discharging [MPa]

**P** : Residual pressure inside air tank after discharging [MPa]

**T** : Temperature inside air tank before discharging [K]



**Fig. (2) Test circuit based on JIS B 8390**

## 2.3 Flow coefficient $C_v$ factor

The United States Standard ANSI/(NFPA)T3.21.3: 1990: Pneumatic fluid power—Flow rating test procedure and reporting method for fixed orifice components

Defines the  $C_v$  factor of flow coefficient by the following formula which is based on the test conducted by the test circuit analogous to ISO 6358.

$$C_v = \frac{Q}{114.5 \sqrt{\frac{\Delta P (P_2 + P_a)}{T_1}}} \quad \text{.....(7)}$$

$\Delta P$  : Pressure drop between the static pressure tapping ports [bar]

$P_1$  : Pressure of the upstream tapping port [bar gauge]

$P_2$  : Pressure of the downstream tapping port [bar gauge]:  $P_2 = P_1 - \Delta P$

$Q$  : Flow rate [dm<sup>3</sup>/s standard condition]

$P_a$  : Atmospheric pressure [bar absolute]

$T_1$  : Upstream absolute temperature [K]

Test conditions are  $< P_1 + P_a = 6.5 \pm 0.2$  bar absolute,  $T_1 = 297 \pm 5$  K,  $0.07 \text{ bar} \leq \Delta P \leq 0.14 \text{ bar}$ .

This is the same concept as effective area  $A$  which ISO 6358 stipulates as being applicable only when the pressure drop is smaller than the upstream pressure and the compression of air does not become a problem.

## 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<sup>3</sup>/s which runs through a valve (equipment for test) when the pressure difference is 1 Pa. It is calculated using the following formula.

$$Av = Q \sqrt{\frac{\rho}{\Delta P}} \quad \text{.....(8)}$$

**$Av$ :** Flow coefficient [m<sup>2</sup>]

**$Q$ :** Flow rate [m<sup>3</sup>/s]

**$\Delta P$ :** Pressure difference [Pa]

**$\rho$ :** Fluid density [kg/m<sup>3</sup>]

### (3) Formula of flow rate

It is described by the practical units. Also, the flow-rate characteristics are shown in Graph (2).

In the case of liquid:

$$Q = 1.9 \times 10^6 Av \sqrt{\frac{\Delta P}{G}} \quad \text{.....(9)}$$

**$Q$ :** Flow rate [L/min]

**$Av$ :** Flow coefficient [m<sup>2</sup>]

**$\Delta P$ :** Pressure difference [MPa]

**$G$ :** Relative density [water = 1]

In the case of saturated aqueous vapor:

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

**$Q$ :** Flow rate [kg/h]

**$Av$ :** Flow coefficient [m<sup>2</sup>]

**$\Delta P$ :** Pressure difference [MPa]

**$P_1$ :** Upstream pressure [MPa]:  $\Delta P = P_1 - P_2$

**$P_2$ :** Downstream pressure [MPa]

Conversion of flow coefficient:

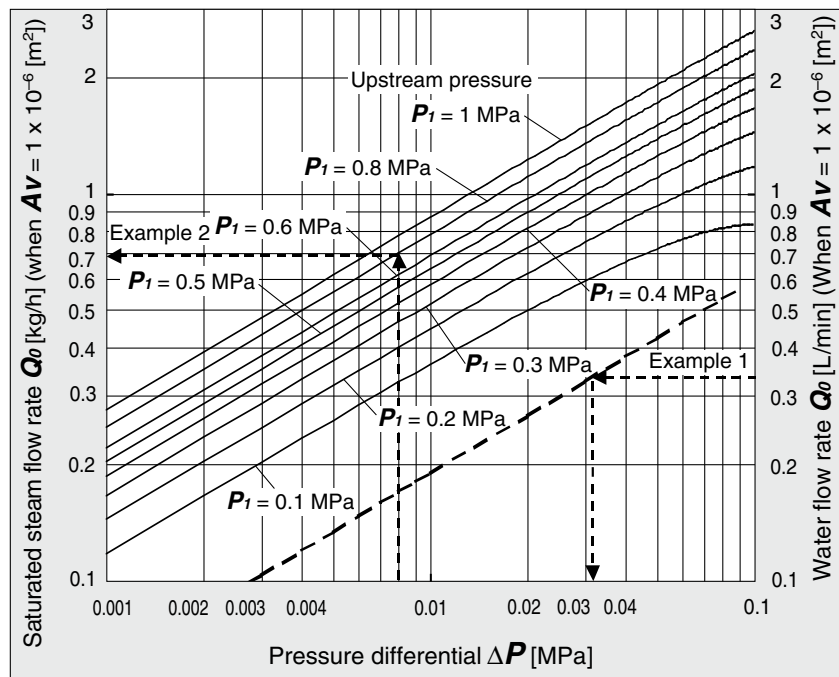
$$\mathbf{A}v = 28 \times 10^{-6} \mathbf{K}v = 24 \times 10^{-6} \mathbf{C}v \dots\dots\dots(11)$$

Here,

**Kv** factor : Value of the clean water flow rate represented by m<sup>3</sup>/h which runs through a valve at 5 to 40°C, when the pressure difference 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 difference is 1 lbf/in<sup>2</sup> (psi).

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



**Graph (2) Flow-rate characteristics**

Example 1)

Obtain the pressure difference when water 15 [L/min] runs through a solenoid valve with an **Av** = 45 × 10<sup>-6</sup> [m<sup>2</sup>]. Since **Q<sub>0</sub>** = 15/45 = 0.33 [L/min], according to Graph (2), if reading **ΔP** when **Q<sub>0</sub>** is 0.33, it will be 0.031 [MPa].

Example 2)

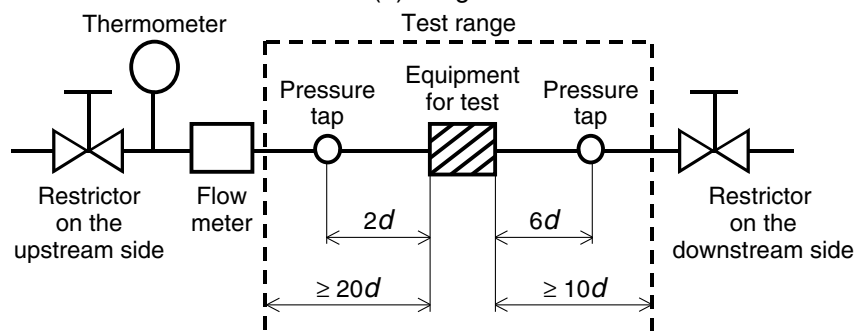
Obtain the saturated steam flow rate when **P<sub>1</sub>** = 0.8 [MPa], **ΔP** = 0.008 [MPa] with a solenoid valve with an **Av** = 1.5 × 10<sup>-6</sup> [m<sup>2</sup>].

According to Graph (2), if reading **Q<sub>0</sub>** when **P<sub>1</sub>** is 0.8 and **ΔP** is 0.008, it is 0.7 [kg/h]. Hence, the flow rate **Q** = 0.7 × 1.5 = 1.05 [kg/h].

#### (4) Test method

Attach a test equipment with the test circuit shown in Fig. (3). Next, pour water at 5 to 40°C, then measure the flow rate with a pressure difference of 0.075 MPa. However, the pressure difference needs to be set with a large enough difference so that the Reynolds number does not go below a range of 4 × 10<sup>4</sup>.

By substituting the measurement results for formula (8) to figure out **Av**.



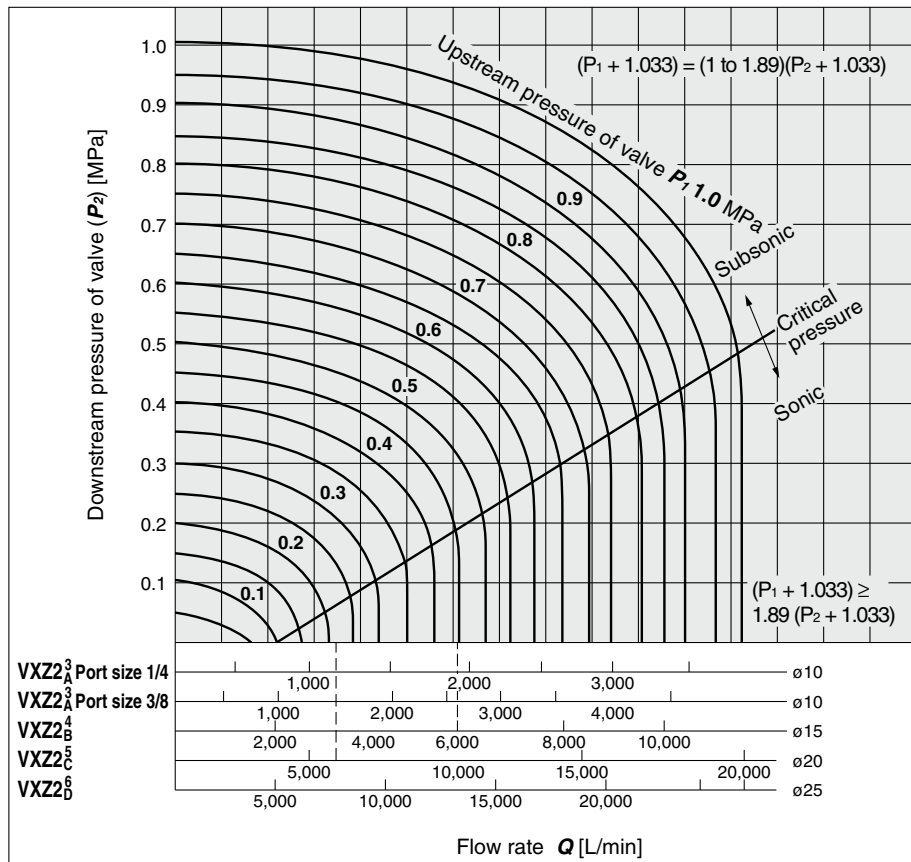
**Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005**

## Series VXZ

# Flow-rate Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to pages 31 through to 35.

### For Air

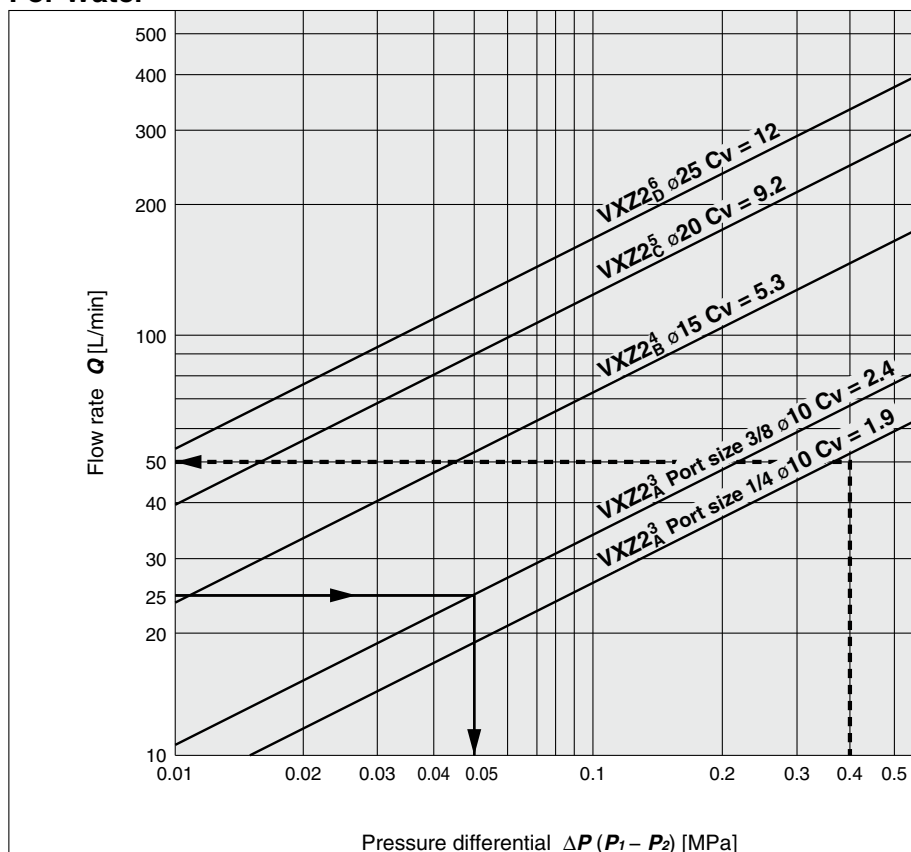


### How to read the graph

The sonic range pressure to generate a flow of 6,000 L/min (ANR) is  $P_1 \approx 0.47$  MPa for a  $\phi 15$  orifice (VXZ2<sup>4</sup><sub>B</sub>) and  $P_1 \approx 0.23$  MPa for a  $\phi 20$  orifice (VXZ2<sup>5</sup><sub>C</sub>).

The optimum size for an upstream pressure  $P_1 = 0.45$  MPa and a flow of 6,000 L/min will be the VXZ2<sup>4</sup><sub>B</sub> ( $\phi 15$  orifice, port size 1/2).

### For Water



### How to read the graph

The pressure differential for a  $\phi 10$  orifice to supply a flow of 25 L/min (VXZ2<sup>3</sup><sub>A</sub>, port size 3/8) will be  $\Delta P \approx 0.05$  MPa.

The optimum size for a pressure differential of  $\Delta P \approx 0.4$  MPa and a flow of 50 L/min will be the VXZ2<sup>3</sup><sub>A</sub> ( $\phi 10$  orifice, port size 1/4).





## Series VXZ

# Specific Product Precautions 1

Be sure to read before handling. Refer to back cover for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

### Design

## Warning

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

The valves presented in this catalog 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 energization

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

#### 3. Liquid rings

In cases with a flowing liquid, provide a bypass valve in the system to prevent the liquid from entering the liquid seal circuit.

#### 4. 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.

#### 5. 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.

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

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

### Selection

## Warning

#### 1. Usage with low flow

Unstable flow may occur with the product under the following conditions: • low flow from the pump or compressor, etc. • use of several elbows or tees in the circuit, or • thin nozzles installed at the end of the piping etc. This can cause valve opening/closing failure, or oscillation, and cause a valve malfunction.

Please check the pressure differential and flow to select the appropriate size of the valve referring to the Flow-rate Characteristics on page 36. Ensure that pressure differential does not become lower than 0.01 MPa during ON (N.C.: Valve open).

### Selection

## Warning

#### 2. Fluid

##### 1) Type of fluid

Select an appropriate valve with reference to the table below for the general fluid. Before using a fluid, check whether it is compatible with the materials of each model by referring to the fluids listed in this catalog. Use a fluid with a kinematic viscosity of 50 mm<sup>2</sup>/s or less.

If there is something you do not know, please contact SMC.

##### Applicable Fluid

For Air	Air
For Water	Air, Water
For Oil	Air, Water, Oil
For Heated water	Air(up to 99°C), Water, Heated water
For High temperature oil	Air(up to 99°C), Water, Oil, High temperature oil

##### 2) Flammable oil, Gas

"Confirm the specification for leakage in the interior and/or exterior area."

##### 3) Corrosive gas

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

##### 4) When a brass body is used, then depending on water quality, corrosion and internal leakage may occur. If such abnormalities occur, exchange the product for a stainless steel body.

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

##### 6) 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. Air quality

##### <Air>

##### 1) 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.

##### 2) Install an air filter.

Install air filters close to valves at their upstream side. filtration degree of 5 μm or less should be selected.

##### 3) Install an aftercooler or air dryer, etc.

Compressed air that contains excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an aftercooler or air dryer, etc.

##### 4) If excessive carbon powder is generated, eliminate it by installing mist separators at the upstream side of valves.

If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

Refer to Best Pneumatics No.5 for further details on compressed air quality.



## Series VXZ

# Specific Product Precautions 2

Be sure to read before handling. Refer to back cover for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

## Selection

### Warning

#### <Water>

The use of a fluid that contains foreign objects 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 100 mesh.

The supply water includes materials that create a hard sediment or sludge such as calcium and magnesium. 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.

#### Tap water pressure:

The water pressure for tap water is normally 0.4 MPa or less. However, in places like a high-rise building, the pressure may be 1.0 MPa. When selecting tap water, be careful of the maximum operating pressure differential.

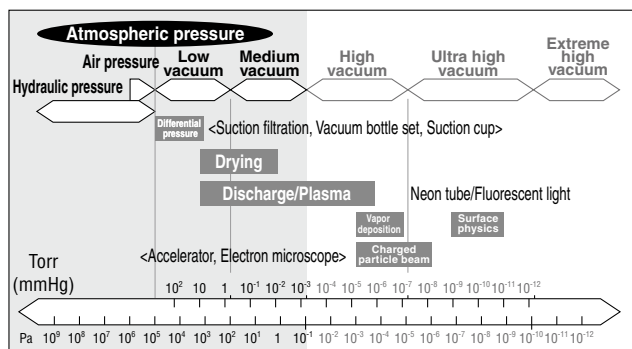
When using water or heated water, poor operation or leaks may be caused by dezincification, erosion, corrosion, etc. The brass (C37) body of this product uses dezincification resistant material as a standard. We also offer a stainless steel body type with improved corrosion resistance. Please use the one that fits your needs.

#### <Oil>

Generally, FKM is used as seal material, as it is resistant to oil. The resistance of the seal material may deteriorate depending on the type of oil, manufacturer or additives. Check the resistance before using.

#### <Vacuum>

Please be aware that there is a range of pressure that can be used.



Vacuum piping direction: if the system uses a vacuum pump, we ask that you install the vacuum pump on the secondary side.

Also, install a filter on the primary side, and be careful that no foreign object is picked up.

Please replace the valve after operating the device approximately 300,000 times.

#### 4. Ambient environment

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

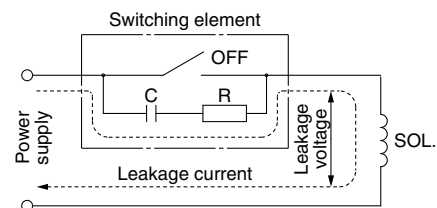
#### 5. Countermeasures against static electricity

Take measures to prevent static electricity since some fluids can cause static electricity.

### 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.



AC/Class B built-in full-wave rectifier coil: 10% or less of rated voltage  
DC coil: 2% or less of rated voltage

#### 2. Selecting model

Material depends on fluid. Select optimal models for the fluid.

#### 3. When the fluid is oil.

The kinematic viscosity must not exceed 50 mm<sup>2</sup>/s.

## 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. Mount a valve with its coil position upward, not downward.

When mounting a valve with its coil positioned downward, foreign objects in the fluid will adhere to the iron core leading to a malfunction.

#### 4. 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.

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



## Series VXZ

# Specific Product Precautions 3

Be sure to read before handling. Refer to back cover for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

### Mounting

#### ⚠ Warning

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

#### ⚠ Warning

1. During use, deterioration of the tube or damage to the fittings could cause tubes to come loose from their fittings and thrash about.

To prevent uncontrolled tube movement, install protective covers or fasten tubes securely in place.

2. For piping the tube, fix the product securely using the mounting holes so that the product is not in the air.

#### ⚠ 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. Avoid pulling, compressing, or bending the valve body when piping.

2. Avoid connecting ground lines to piping, as this may cause electric corrosion of the system.

3. Always tighten threads with the proper tightening torque.

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

Lower tightening torque will lead into fluid leakage.

#### Tightening Torque for Piping

Connection threads	Proper tightening torque N·m
Rc1/8	3 to 5
Rc1/4	8 to 12
Rc3/8	15 to 20
Rc1/2	20 to 25
Rc3/4	
Rc1	36 to 38

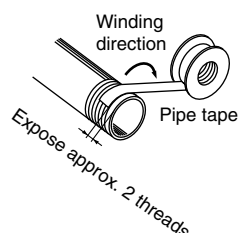
#### 4. Connection of piping to products

When connecting piping to a product, avoid mistakes regarding the supply port etc.

#### 5. 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.



### Piping

#### ⚠ Caution

6. If a regulator and valve are connected directly, they may vibrate together and cause chattering. Do not connect directly.

7. If the cross-sectional area of piping for the fluid supply side is restricted, operation will become unstable due to inadequate pressure differential during valve operation. Use piping size for the fluid supply side that is suited to the port size.

### Recommended Piping Conditions

1. When connecting tubes using One-touch fittings, provide some spare tube length shown in Fig. 1, recommended piping configuration.

Also, do not apply external force to the fittings when binding tubes with bands etc. (see Fig. 2.)

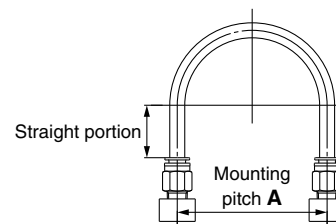


Fig. 1 Recommended piping configuration

Unit: mm

Tubing size	Mounting pitch A			Straight portion length
	Nylon tubing	Soft nylon tubing	Polyurethane tubing	
ø1/8"	44 or more	29 or more	25 or more	16 or more
ø6	84 or more	39 or more	39 or more	30 or more
ø1/4"	89 or more	56 or more	57 or more	32 or more
ø8	112 or more	58 or more	52 or more	40 or more
ø10	140 or more	70 or more	69 or more	50 or more
ø12	168 or more	82 or more	88 or more	60 or more

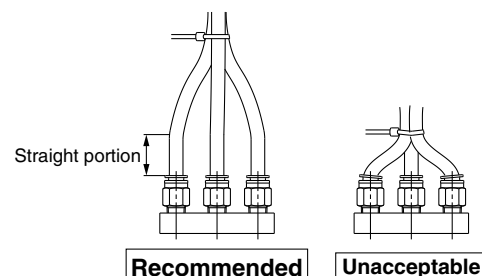


Fig. 2 Binding tubes with bands



## Series VXZ

# Specific Product Precautions 4

Be sure to read before handling. Refer to back cover for Safety Instructions, “Handling Precautions for SMC Products” (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

### Wiring

#### Warning

1. Do not apply AC voltage to Class “H” coil AC type unless it is built in full-wave rectifier, or the coil will be damaged.

#### Caution

1. As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25 mm<sup>2</sup> 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  $\pm 10\%$  of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within  $\pm 5\%$  of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
4. When a surge from the solenoid affects the electrical circuitry, install a surge voltage suppressor etc., in parallel with the solenoid. Or, adopt an option that comes with the surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with SMC.)

### Operating Environment

#### Warning

1. Do not use 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.

### 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.

#### Caution

##### 1. Filters and strainers

- 1) Be careful regarding clogging of filters and strainers.
- 2) Replace filter elements after one year of use, or earlier if the pressure drop reaches 0.1 MPa.
- 3) Clean strainers when the pressure drop reaches 0.1 MPa.

##### 2. Lubrication

When using after lubricating, never forget to lubricate continuously.

##### 3. Storage

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

##### 4. Exhaust the drain from an air filter periodically.

### Operating Precautions

#### Warning

1. If there is a possibility of reverse pressure being applied to the valve, take countermeasures such as mounting a check valve on the downstream side of the valve.
2. When problems are caused by a water hammer, install water hammer relief equipment (accumulator etc.), or use an SMC water hammer relief valve (Series VXR). Please consult with SMC for details.
3. For pilot type 2-port solenoid valves, when the valve is closed, sudden pressure resulting from the startup of the fluid supply source (pump, compressor, etc.) may cause the valve momentarily to open and leakage to occur, so please exercise caution.
4. If the product is used in the conditions in which rapid decrease in the inlet pressure of the valve and rapid increase in the outlet pressure of the valve are repeated, excessive stress will be applied to the diaphragm, which causes the diaphragm to be damaged and dropped, leading to the operation failure of the valve. Check the operating conditions before use.



# Series VXZ

## Specific Product Precautions 5

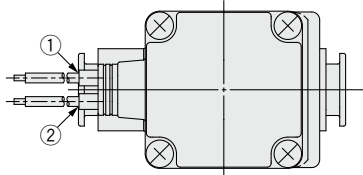
Be sure to read before handling. Refer to back cover for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

### Electrical Connections

#### Caution

##### Grommet

Class B coil: AWG20 Insulator O.D. 2.5 mm  
Class H coil: AWG18 Insulator O.D. 2.1 mm

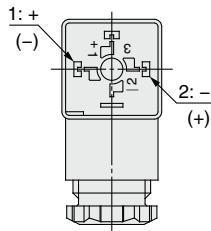


Rated voltage	Lead wire color	
	①	②
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

\* There is no polarity.

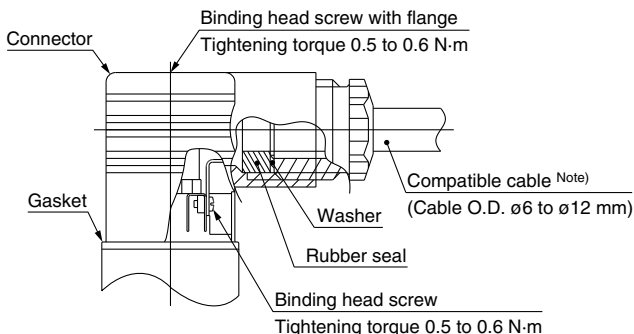
##### DIN terminal

Since internal connections are as shown below for the DIN terminal, make connections to the power supply accordingly.



Terminal no.	1	2
DIN terminal	+ (-)	- (+)

\* There is no polarity.  
· Use compatible heavy duty cords with cable O.D. of  $\phi 6$  to 12 mm.  
· Use the tightening torques below for each section.



Note) For an outside cable diameter of  $\phi 9$  to 12 mm, remove the internal parts of the rubber seal before using.

#### [Change of electrical entry]

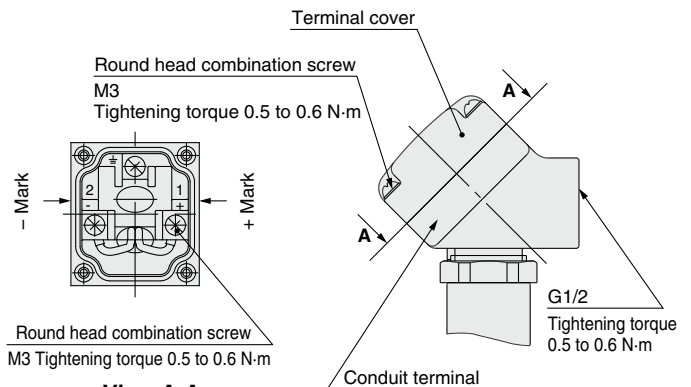
Wire entry can be changed by mounting the housing in either direction (four directions at every 90°) after dividing the terminal block and the housing.

\* For the indicator lighted style, be careful not to damage the light with the lead wire of the cable.

##### Conduit terminal

In the case of the conduit terminal, make connections according to the marks shown below.

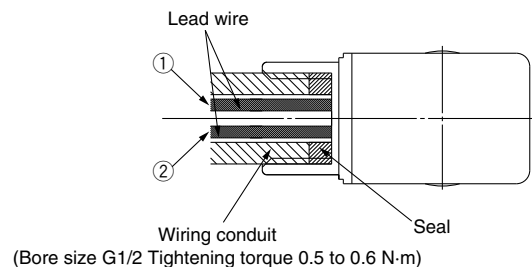
- Use the tightening torques below for each section.
- Properly seal the terminal connection (G1/2) with the special wiring conduit etc.



##### Conduit

When used as an IP65 equivalent, use seal to install the wiring conduit. Also, use the tightening torque below for the conduit.

Class B coil: AWG20 Insulator O.D. 2.5 mm  
Class H coil: AWG18 Insulator O.D. 2.1 mm



Rated voltage	Lead wire color	
	①	②
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

\* There is no polarity.  
(For the power saving type, there is polarity.)

Description	Part no.
Seal	VCW20-15-6

Note) Please order separately.





## Series VXZ

# Specific Product Precautions 6

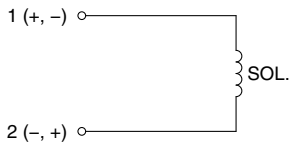
Be sure to read before handling. Refer to back cover for Safety Instructions, "Handling Precautions for SMC Products" (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website, <http://www.smcworld.com>

### Electrical Circuits

## ⚠ Caution

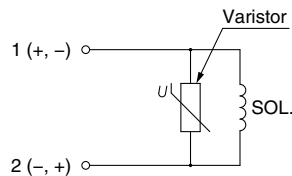
### [DC circuit]

Grommet, Faston terminal



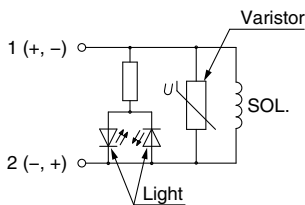
Without electrical option

Grommet, DIN terminal,  
Conduit terminal, Conduit



With surge voltage suppressor

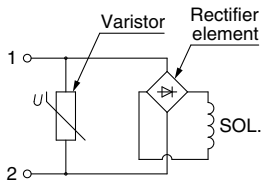
DIN terminal, Conduit terminal



With light/surge voltage suppressor

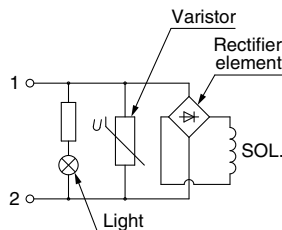
### [AC circuit]

Grommet, DIN terminal,  
Conduit terminal, Conduit



Without electrical option

DIN terminal, Conduit terminal



With light/surge voltage suppressor




### One-touch Fitting

## ⚠ Caution

For information on handling One-touch fittings and appropriate tubing, refer to page 39 and the KQ2 series One-touch fittings in Best Pneumatics No. 6. The KQ2 series information can be downloaded from the following SMC website, <http://www.smcworld.com>

## 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.

-  **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.

- \*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.

### 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 catalog 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 catalog.
  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.

### 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, whichever is first.\*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 catalog for the particular products.  
**\*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.

## Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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