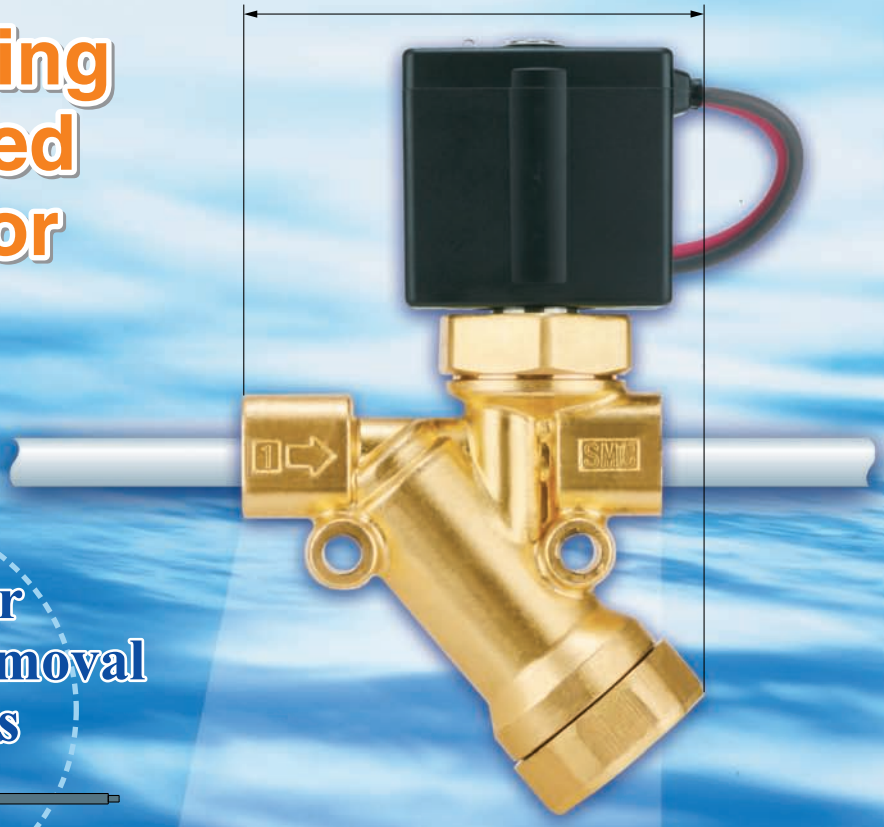
2 Port Solenoid Valve with Built-in Y-strainer

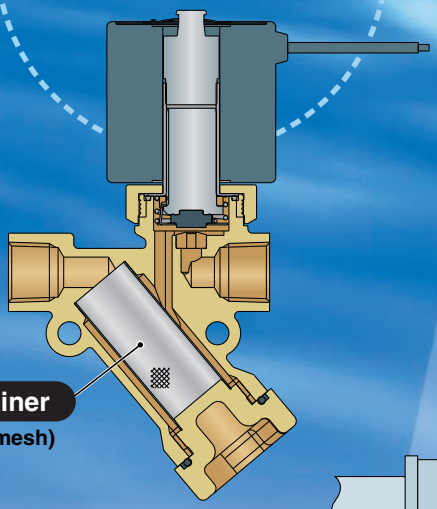
For Air, Water, Oil, Steam

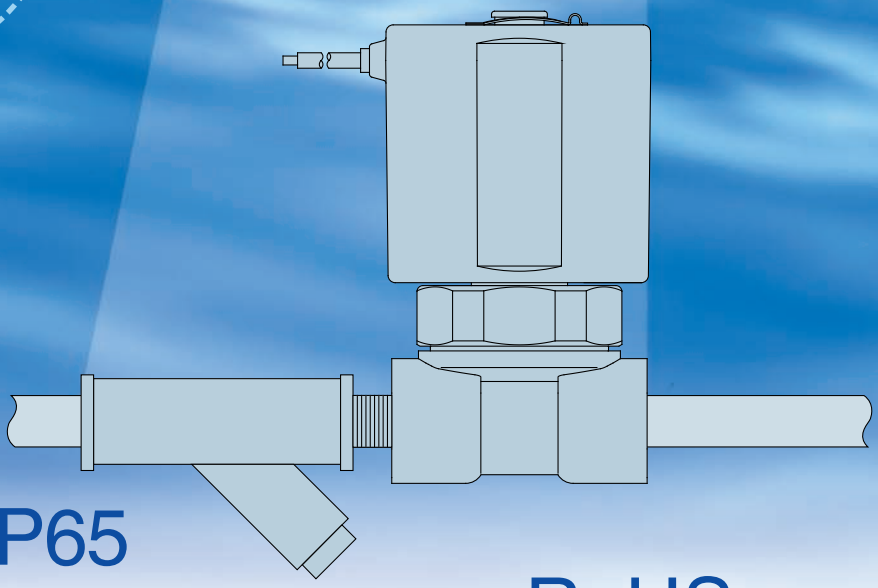
60 mm (VXK21)
63.5 mm (VXK22/23)

Space saving and reduced piping labor



Built-in strainer enabling the removal of contaminants





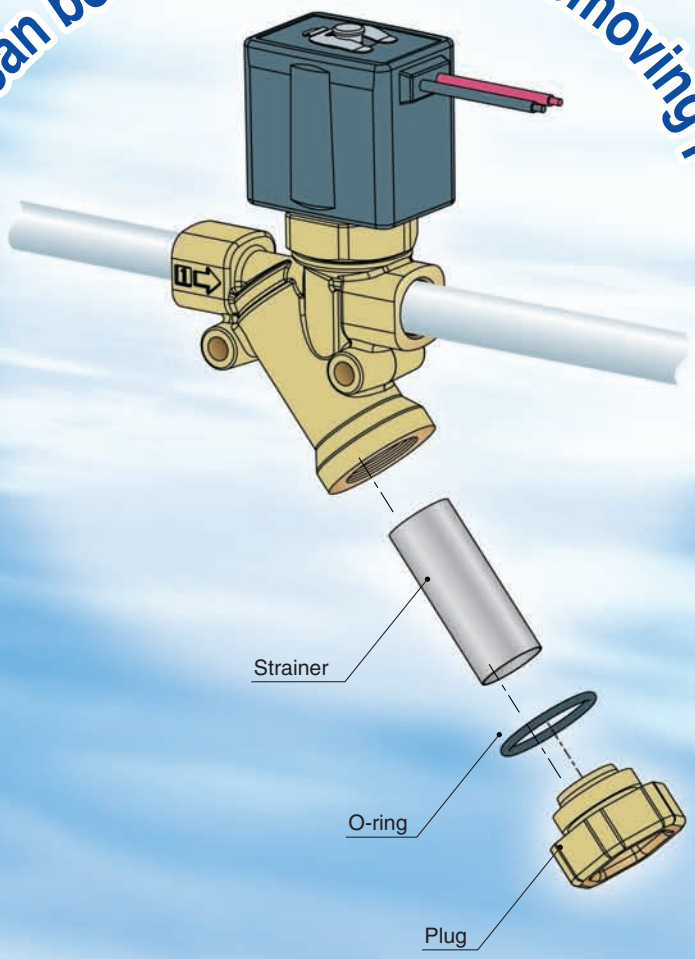
- CE
- cULus [Application pending]
- IP65
- Restriction of environmentally hazardous substances RoHS compliant

Series VXK

SMC

CAT.ES70-34B

Element can be replaced without removing piping.



Variations

Direct Operated: Series VXK21/22/23

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

Solenoid Coil
Coil: Class B, Class H

Rated Voltage
AC: 100 V, 200 V, 110 V, 220 V, 240 V
230 V, 48 V
DC: 24 V, 12 V

Material
Body: C37
Seal: NBR, FKM, EPDM, PTFE

Electrical Entry
Grommet
Conduit
DIN terminal
Conduit terminal

Normally Closed (N.C.)

Model		VXK21	VXK22	VXK23
Orifice size	2 mmø	●	—	—
	3 mmø	●	●	●
	4.5 mmø	●	●	●
	6 mmø	—	●	●
	8 mmø	—	●	●
Port size		1/8, 1/4	1/4, 3/8	1/4, 3/8

Normally Open (N.O.)

Model		VXK21	VXK22	VXK23
Orifice size	2 mmø	●	—	—
	3 mmø	●	●	●
	4.5 mmø	●	●	●
	6 mmø	—	●	●
Port size		1/8, 1/4	1/4, 3/8	1/4, 3/8

∗ Basic specifications are the same as those of the VX21/22/23 series.

Direct Operated 2 Port Solenoid Valve with Built-in Y-strainer

Series VXK21/22/23

For Air, Water, Oil, Steam

Single Unit

■ 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 — C37
Seal — NBR, FKM, EPDM, PTFE

■ Electrical Entry

- Grommet
- Conduit
- DIN terminal
- Conduit terminal

Normally Closed (N.C.)

Model		VXK21	VXK22	VXK23
Orifice size	2 mmø	●	—	—
	3 mmø	●	●	●
	4.5 mmø	●	●	●
	6 mmø	—	●	●
	8 mmø	—	●	●
Port size		1/8 1/4	1/4 3/8	1/4 3/8

Normally Open (N.O.)

Model		VXK21	VXK22	VXK23
Orifice size	2 mmø	●	—	—
	3 mmø	●	●	●
	4.5 mmø	●	●	●
	6 mmø	—	●	●
Port size		1/8 1/4	1/4 3/8	1/4 3/8

Common Specifications

Standard Specifications

Valve specifications	**Valve construction**		Direct operated poppet
	Withstand pressure	**MPa**	5.0
	Body material		C37
	Seal material		NBR, FKM, EPDM, PTFE
	Enclosure		Dust-tight, Water-jet-proof type (IP65) Note)
	Environment		Location without corrosive or explosive gases
Strainer specifications	**Mesh**		100
	Material		Stainless steel
Coil specifications	**Rated voltage**	**AC**	100 VAC, 200 VAC, 110 VAC, 220 VAC, 230 VAC, 240 VAC, 48 VAC
		DC	24 VDC, 12 VDC
	Allowable voltage fluctuation		±10% of rated voltage
	Allowable leakage voltage	**AC (Class B, Built-in full-wave rectifier type)**	10% or less of rated voltage
		AC (Class B/H)	20% or less of rated voltage
		DC (Class B 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

Normally Closed (N.C.)

DC Specification

Model	Power consumption (W)	Temperature rise (C°) Note)
VXK21	4.5	45
VXK22	7	45
VXK23	10.5	60

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

Model	Apparent power (VA)∗	Temperature rise (C°) Note)
VXK21	7	55
VXK22	9.5	60
VXK23	12	65

∗ There is no difference in the frequency and the inrush and energized apparent power because a rectifying circuit is used in the AC (Class B, Built-in full-wave rectifier type).

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

AC Specification

Model	Frequency (Hz)	Apparent power (VA)		Temperature rise (C°) Note)
		Inrush	Energized	
VXK21	50	19	10	50
	60	16	8	45
VXK22	50	43	20	65
	60	35	17	60
VXK23	50	62	32	65
	60	52	27	60

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

Normally Open (N.O.)

DC Specification

Model	Power consumption (W)	Temperature rise (C°) Note)
VXK21	4.5	45
VXK22	7	45
VXK23	10.5	60

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

Model	Apparent power (VA)∗	Temperature rise (C°) Note)
VXK21	7	55
VXK22	9.5	60
VXK23	12	65

∗ There is no difference in the frequency and the inrush and energized apparent power because a rectifying circuit is used in the AC (Class B, Built-in full-wave rectifier type).

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

AC Specification

Model	Frequency (Hz)	Apparent power (VA)		Temperature rise (C°) Note)
		Inrush	Energized	
VXK21	50	22	11	55
	60	18	8	50
VXK22	50	46	20	65
	60	38	18	60
VXK23	50	64	32	65
	60	54	27	60

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

Applicable Fluid Check List

All Options (Single Unit)

VXK2□□ 0/2 □□–□□–□□□1

Option symbol

Fluid and application	Option symbol	Seal material	Body/Shading coil material Note 5)	Coil insulation type Note 4)	Remarks
Air	**Nil**	NBR	C37/–	B	Select the built-in full-wave rectifier type for AC spec.
Medium vacuum, Non-leak, Oil-free Note 1)	**V** Note 2)	FKM	C37/–	B	Select the built-in full-wave rectifier type for AC spec.
Water	**Nil**	NBR	C37/Cu	B	
Heated water	**E**	EPDM	C37/Cu	H	
Oil Note 3)	**A**	FKM	C37/Cu	B	
	D			H	
Steam	**S**	PTFE	C37/Cu	H	
Other combinations	**B**	EPDM	C37/Cu	B	
	C	PTFE			

Note 1) The leakage amount (10^{-6} Pa·m^3/s) of the option "V" is a value when the differential pressure is 0.1 MPa.
Note 2) Option "V" is the oil-free treatment.
Note 3) The dynamic viscosity of the fluid must not exceed 50 mm^2/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 4) Coil insulation type Class H: AC spec. only
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.

For Air /Single Unit

(Inert gas, Non-leak, Medium vacuum)

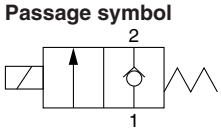
⚠ Fluid: Air

When you operate the VXK series (AC spec.) by air, the built-in full-wave rectifier type is chosen.
- **The special construction of the armature reduces abrasion, resulting in a longer service life.**
- **Noise reduction**
  Best suited for medical equipment, low-noise environments, etc.

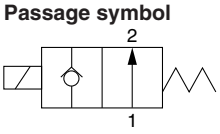
Model/Valve Specifications

N.C. **N.O.**

Passage symbol



Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics			Max. system pressure (MPa)	Note) Weight (g)
				C[dm³/(s·bar)]	b	Cv		
1/8 (6A)	2	**VXK2110-01**	1.5	0.59	0.48	0.18	3.0	480
	3	**VXK2120-01**	0.6	1.2	0.45	0.33		
	4.5	**VXK2130-01**	0.2	2.3	0.46	0.61		
1/4 (8A)	2	**VXK2110-02**	1.5	0.59	0.48	0.18		
	3	**VXK2120-02**	0.6	1.2	0.45	0.33		
		VXK2220-02	1.5					640
		VXK2320-02	3.0					790
	4.5	**VXK2130-02**	0.2	2.3	0.46	0.61		480
		VXK2230-02	0.35					640
		VXK2330-02	0.9					790
	6	**VXK2240-02**	0.15	4.0	0.30	1.10		640
		VXK2340-02	0.35					790
	8	**VXK2250-02**	0.08	4.9	0.29	1.20	1.0	640
		VXK2350-02	0.2					790
3/8 (10A)	3	**VXK2220-03**	1.5	1.2	0.45	0.33	3.0	640
		VXK2320-03	3.0					790
	4.5	**VXK2230-03**	0.35	2.3	0.46	0.61		640
		VXK2330-03	0.9					790
	6	**VXK2240-03**	0.15	4.0	0.30	1.10		640
		VXK2340-03	0.35					790
	8	**VXK2250-03**	0.08	4.9	0.29	1.20	1.0	640
		VXK2350-03	0.2					790

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 23 for details on the max. operating pressure differential and the max. system pressure.
- If you intend to use any of the solenoid valves at the rated max. operating pressure for the AC spec. with shading coil, please contact SMC beforehand.

Normally Open (N.O.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics			Max. system pressure (MPa)	Note) Weight (g)
				C[dm³/(s·bar)]	b	Cv		
1/8 (6A)	2	**VXK2112-01**	1.5	0.59	0.48	0.18	3.0	500
	3	**VXK2122-01**	0.7	1.2	0.45	0.33		
	4.5	**VXK2132-01**	0.3	2.3	0.46	0.61		
1/4 (8A)	2	**VXK2112-02**	1.5	0.59	0.48	0.18		
	3	**VXK2122-02**	0.7	1.2	0.45	0.33		
		VXK2222-02	1.0					670
		VXK2322-02	1.6					830
	4.5	**VXK2132-02**	0.3	2.3	0.46	0.61		500
		VXK2232-02	0.45					670
		VXK2332-02	0.8					830
	6	**VXK2242-02**	0.25	4.0	0.30	1.10		670
		VXK2342-02	0.45					830
3/8 (10A)	3	**VXK2222-03**	1.0	1.2	0.45	0.33		670
		VXK2322-03	1.6					830
	4.5	**VXK2232-03**	0.45	2.3	0.46	0.61		670
		VXK2332-03	0.8					830
	6	**VXK2242-03**	0.25	4.0	0.30	1.10		670
		VXK2342-03	0.45					830

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 23 for details on the max. operating pressure differential and the max. system pressure.

Ambient and Fluid Temperature

Fluid temperature (°C)		Ambient temperature (°C)
Solenoid valve option symbol		
Nil	**V**	
–10 Note) to 60	–10 Note) to 60	–20 to 60

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

Valve Leakage

Internal Leakage

Seal material	Leakage rate	
	Air	Non-leak, Medium vacuum Note)
NBR, FKM	1 cm³/min or less	10^{-6} Pa·m³/sec or less

External Leakage

Seal material	Leakage rate	
	Air	Non-leak, Medium vacuum Note)
NBR, FKM	1 cm³/min or less	10^{-6} Pa·m³/sec or less

Note) Value for option "V" (Non-leak, Medium vacuum)

How to Order (Single Unit)

AC VXK 21 2 0 ☐ ☐ – 01 ☐ – 1 G R 1 – ☐

DC VXK 21 2 0 ☐ ☐ – 01 ☐ – 5 G 1 – ☐

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.

Suffix

Nil	—
Z	Oil-free

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

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

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

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 14 for ordering a coil only.

Built-in full-wave rectifier type

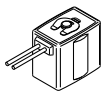
Bracket

Nil	None
B	With bracket

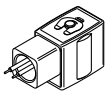
∗ Packed in the same container as the main body.
∗ Refer to the Table (4) when a bracket is ordered separately.

Electrical entry

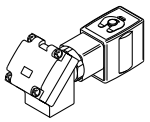
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

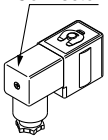


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



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.)

Connector



∗ DIN type is available with class B only.

∗ Refer to the Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.
∗ Option "S", "Z" are not available because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (1) Model/Orifice Size/Port Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (Diameter)				
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)	5 (8 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—	—
	02 (1/4)	—	—	●	●	●	—	—
	—	02 (1/4)	02 (1/4)	—	●	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (Diameter)			
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material	Body material	Coil insulation type	Remarks
Nil	NBR	C37	B	—
V	FKM			Non-leak (10^{-6} Pa·m³/sec), Oil-free, Medium vacuum (0.1 Pa.abs)

∗ When using with vacuum, consider the max. differential pressure. (0.1 MPa or more is recommended.)

Table (3) Rated Voltage/Electrical Option

Rated voltage			Class B		
			S	L	Z
AC/DC	Voltage symbol	Voltage	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	●	●	●
	6	12 V	●	—	—

∗ Option "S", "Z" are not available because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

⚠ Fluid: Air

When you operate the VX series (AC spec.) by air, the built-in full-wave rectifier type is chosen.
- **The special construction of the armature reduces abrasion, resulting in a longer service life.**
- **Noise reduction**
  Best suited for medical equipment, low-noise environments, etc.

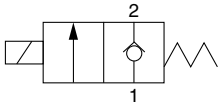
Dimensions → page 13 (Single unit)

For Water/Single Unit

Model/Valve Specifications

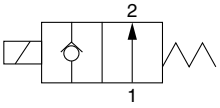
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa) AC	Max. operating pressure differential (MPa) DC AC (Built-in full-wave rectifier type)	Flow characteristics Av x 10^{-6} m^2	Flow characteristics Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VXK2110-01**	2.0	1.5	4.1	0.17	3.0	480
	3	**VXK2120-01**	0.9	0.5	7.9	0.33		
	4.5	**VXK2130-01**	0.4	0.2	15.0	0.61		
1/4 (8A)	2	**VXK2110-02**	2.0	1.5	4.1	0.17		
	3	**VXK2120-02**	0.9	0.5	7.9	0.33		
		VXK2220-02	1.7	1.5				640
		VXK2320-02	2.5	3.0				790
	4.5	**VXK2130-02**	0.4	0.2	15.0	0.61		480
		VXK2230-02	0.6	0.35				640
		VXK2330-02	0.85	0.9				790
	6	**VXK2240-02**	0.35	0.15	23.0	0.95		640
		VXK2340-02	0.55	0.3				790
	8	**VXK2250-02**	0.13	0.08	26.0	1.10	1.0	640
		VXK2350-02	0.17	0.2				790
3/8 (10A)	3	**VXK2220-03**	1.7	1.5	7.9	0.33	3.0	640
		VXK2320-03	2.5	3.0				790
	4.5	**VXK2230-03**	0.6	0.35	15.0	0.61		640
		VXK2330-03	0.85	0.9				790
	6	**VXK2240-03**	0.35	0.15	23.0	0.95		640
		VXK2340-03	0.55	0.3				790
	8	**VXK2250-03**	0.13	0.08	26.0	1.10	1.0	640
		VXK2350-03	0.17	0.2				790

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

• Refer to "Glossary of Terms" on page 23 for details on the max. operating pressure differential and the max. system pressure.

Normally Open (N.O.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics Av x 10^{-6} m^2	Flow characteristics Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VXK2112-01**	0.9	4.1	0.17	3.0	500
	3	**VXK2122-01**	0.45	7.9	0.33		
	4.5	**VXK2132-01**	0.2	15.0	0.61		
1/4 (8A)	2	**VXK2112-02**	0.9	4.1	0.17		
	3	**VXK2122-02**	0.45	7.9	0.33		
		VXK2222-02	0.8				670
		VXK2322-02	1.2				830
	4.5	**VXK2132-02**	0.2	15.0	0.61		500
		VXK2232-02	0.3				670
		VXK2332-02	0.6				830
	6	**VXK2242-02**	0.15	23.0	0.95		670
		VXK2342-02	0.35				830
3/8 (10A)	3	**VXK2222-03**	0.8	7.9	0.33		670
		VXK2322-03	1.2				830
	4.5	**VXK2232-03**	0.3	15.0	0.61		670
		VXK2332-03	0.6				830
	6	**VXK2242-03**	0.15	23.0	0.95		670
		VXK2342-03	0.35				830

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

• Refer to "Glossary of Terms" on page 23 for details on the max. operating pressure differential and the max. system pressure.

Ambient and Fluid Temperature

Fluid temperature (°C)		Ambient temperature (°C)
Solenoid valve option symbol		
Nil	**E**	
1 to 60	1 to 99	–20 to 60

Note) With no freezing

Valve Leakage

Internal Leakage

Seal material	Leakage rate (Water)
NBR, EPDM	0.1 cm^3/min or less

External Leakage

Seal material	Leakage rate (Water)
NBR, EPDM	0.1 cm^3/min or less

How to Order (Single Unit)

AC VXK 21 2 0 □ □ – 01 □ – 1 G R 1 – □

DC VXK 21 2 0 □ □ – 01 □ – 5 G 1 – □

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.

Suffix

Nil	—
Z	Oil-free

Oil-free, AC/Class B: Built-in full-wave rectifier type only. Select the built-in full-wave rectifier type.

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

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

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 14 for ordering a coil only.

Full-wave rectifier

Nil	None
R	Built-in full-wave rectifier type (Class B only)

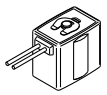
Bracket

Nil	None
B	With bracket

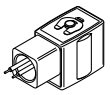
∗ Packed in the same container as the main body.
∗ Refer to the Table (4) when a bracket is ordered separately.

Electrical entry

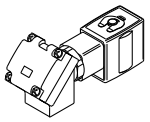
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

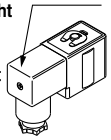


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



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.)

Connector



∗ DIN type is available with class B only.

∗ Refer to the Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.
∗ Option "S", "Z" are not available because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (1) Model/Orifice Size/Port Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (Diameter)				
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)	5 (8 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—	—
	02 (1/4)	—	—	●	●	●	—	—
	—	02 (1/4)	02 (1/4)	—	●	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (Diameter)			
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material	Body/Shading coil material	Coil insulation type	Remarks
Nil	NBR	C37/Cu	B	—
E	EPDM		H	Heated water (AC only)

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/surge voltage suppressor	With surge voltage suppressor	With light	With light/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 because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

Dimensions → page 13 (Single unit)

⚠ Fluid: Oil

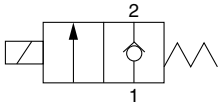
The dynamic viscosity of the fluid must not exceed 50 mm²/s.
The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON.
Select the DC spec. or AC spec. built-in full-wave rectifier type when the dynamic viscosity is higher than water or when the OFF response is prioritized.

For Oil/Single Unit

Model/Valve Specifications

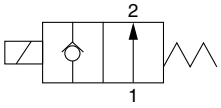
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)		Flow characteristics		Max. system pressure (MPa)	Note) Weight (g)
			AC	DC AC (Built-in full-wave rectifier type)	Av x 10^{-6} m²	Cv converted		
1/8 (6A)	2	**VXK2110-01**	1.5	1.5	4.1	0.17	3.0	480
	3	**VXK2120-01**	0.5	0.5	7.9	0.33		
	4.5	**VXK2130-01**	0.2	0.15	15.0	0.61		
1/4 (8A)	2	**VXK2110-02**	1.5	1.5	4.1	0.17		
	3	**VXK2120-02**	0.5	0.5	7.9	0.33		
		VXK2220-02	1.2	1.2				640
		VXK2320-02	1.7	2.0				790
	4.5	**VXK2130-02**	0.2	0.15	15.0	0.61		480
		VXK2230-02	0.35	0.3				640
		VXK2330-02	0.55	0.85				790
	6	**VXK2240-02**	0.2	0.1	23.0	0.95		640
		VXK2340-02	0.35	0.3				790
	8	**VXK2250-02**	0.1	0.08	26.0	1.10	1.0	640
		VXK2350-02	0.14	0.2				790
3/8 (10A)	3	**VXK2220-03**	1.2	1.2	7.9	0.33	3.0	640
		VXK2320-03	1.7	2.0				790
	4.5	**VXK2230-03**	0.35	0.3	15.0	0.61		640
		VXK2330-03	0.55	0.85				790
	6	**VXK2240-03**	0.2	0.1	23.0	0.95		640
		VXK2340-03	0.35	0.3				790
	8	**VXK2250-03**	0.1	0.08	26.0	1.10	1.0	640
		VXK2350-03	0.14	0.2				790

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, and 60 g for conduit terminal type respectively.
• Refer to "Glossary of Terms" on page 23 for details on the max. operating pressure differential and the max. system pressure.

Normally Open (N.O.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics		Max. system pressure (MPa)	Note) Weight (g)
			AC, DC	Av x 10^{-6} m²	Cv converted		
1/8 (6A)	2	**VXK2112-01**	0.8	4.1	0.17	3.0	500
	3	**VXK2122-01**	0.45	7.9	0.33		
	4.5	**VXK2132-01**	0.2	15	0.61		
1/4 (8A)	2	**VXK2112-02**	0.8	4.1	0.17		
	3	**VXK2122-02**	0.45	7.9	0.33		
		VXK2222-02	0.7				670
		VXK2322-02	1.0				830
	4.5	**VXK2132-02**	0.2	15	0.61		500
		VXK2232-02	0.3				670
		VXK2332-02	0.6				830
	6	**VXK2242-02**	0.15	23.0	0.95		670
		VXK2342-02	0.35				830
3/8 (10A)	3	**VXK2222-03**	0.7	7.9	0.33		670
		VXK2322-03	1.0				830
	4.5	**VXK2232-03**	0.3	15	0.61		670
		VXK2332-03	0.6				830
	6	**VXK2242-03**	0.15	23.0	0.95		670
		VXK2342-03	0.35				830

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, and 60 g for conduit terminal type respectively.
• Refer to "Glossary of Terms" on page 23 for details on the max. operating pressure differential and the max. system pressure.

Ambient and Fluid Temperature

Fluid temperature (°C)		Ambient temperature (°C)
Solenoid valve option symbol		
A	**D**	
–5 Note) to 60	–5 Note) to 120	–20 to 60

Note) Dynamic viscosity: 50 mm²/s or less

Valve Leakage

Internal Leakage

Seal material	Leakage rate (Oil)
FKM	0.1 cm³/min or less

External Leakage

Seal material	Leakage rate (Oil)
FKM	0.1 cm³/min or less

How to Order (Single Unit)

AC VXK 21 2 0 A □ – 01 □ – 1 G R 1 – □

DC VXK 21 2 0 A □ – 01 □ – 5 G 1 – □

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.

Suffix

Nil	—
Z	Oil-free

Oil-free, AC/Class B: Built-in full-wave rectifier type only. Select the built-in full-wave rectifier type.

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

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

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 14 for ordering a coil only.

Full-wave rectifier

Nil	None
R	Built-in full-wave rectifier type (Class B only)

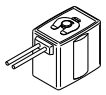
Bracket

Nil	None
B	With bracket

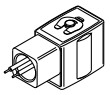
∗ Packed in the same container as the main body.
∗ Refer to the Table (4) when a bracket is ordered separately.

Electrical entry

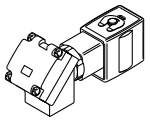
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

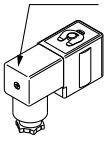


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



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.)

Connector



∗ DIN type is available with class B only.

∗ Refer to the Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.
∗ Option "S", "Z" are not available because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (1) Model/Orifice Size/Port Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (Diameter)				
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)	5 (8 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—	—
	02 (1/4)	—	—	●	●	●	—	—
	—	02 (1/4)	02 (1/4)	—	●	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (Diameter)			
Model	VXK21	VXK22	VXK23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)
Port symbol (Port size)	01 (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	02 (1/4)	02 (1/4)	—	●	●	●
	—	03 (3/8)	03 (3/8)	—	●	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material	Body/Shading coil material	Coil insulation type
A	FKM	C37/Cu	B
D			H

The additives contained in oil are different depending on the type and manufacturers, so the durability of the seal materials will vary. For details, please consult with SMC.

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/surge voltage suppressor	With surge voltage suppressor	With light	With light/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 because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

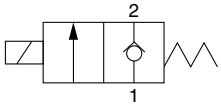
Dimensions → page 13 (Single unit)

For Steam /Single Unit

Model/Valve Specifications

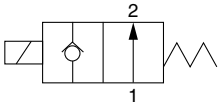
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics		Max. system pressure (MPa)	Note) Weight (g)
			AC	Av x 10^{-6} m^2	Cv converted		
1/8 (6A)	2	**VXK2110-01**	1.0	4.1	0.17	1.0	480
	3	**VXK2120-01**	1.0	7.9	0.33		
	4.5	**VXK2130-01**	0.45	15.0	0.61		
1/4 (8A)	2	**VXK2110-02**	1.0	4.1	0.17		
	3	**VXK2120-02**	1.0	7.9	0.33		
	4.5	**VXK2130-02**	0.45	15.0	0.61		
		VXK2230-02	0.75				640
		VXK2330-02	1.0				790
	6	**VXK2240-02**	0.4	23.0	0.95		640
		VXK2340-02	0.5				790
	8	**VXK2250-02**	0.15	26.0	1.10	0.5	640
		VXK2350-02	0.2				790
3/8 (10A)	3	**VXK2220-03**	1.0	7.9	0.33	1.0	640
	4.5	**VXK2230-03**	0.75	15.0	0.61		
		VXK2330-03	1.0				790
	6	**VXK2240-03**	0.4	23.0	0.95		640
		VXK2340-03	0.5				790
	8	**VXK2250-03**	0.15	26.0	1.10	0.5	640
		VXK2350-03	0.2				790

Note) Weight of grommet type. Add 60 g for conduit terminal type.
• Refer to “Glossary of Terms” on page 23 for details on the max. operating pressure differential and the max. system pressure.

Normally Open (N.O.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics		Max. system pressure (MPa)	Note) Weight (g)
			AC	Av x 10^{-6} m^2	Cv converted		
1/8 (6A)	2	**VXK2112-01**	1.0	4.1	0.17	1.0	500
	3	**VXK2122-01**	0.7	7.9	0.33		
	4.5	**VXK2132-01**	0.3	15	0.61		
1/4 (8A)	2	**VXK2112-02**	1.0	4.1	0.17		
	3	**VXK2122-02**	0.7	7.9	0.33		
		VXK2222-02	1.0				670
	4.5	**VXK2132-02**	0.3	15	0.61		500
		VXK2232-02	0.45				670
		VXK2332-02	0.8				830
	6	**VXK2242-02**	0.25	23.0	0.95		670
		VXK2342-02	0.45				830
3/8 (10A)	3	**VXK2222-03**	1.0	7.9	0.33		670
	4.5	**VXK2232-03**	0.45	15	0.61		
		VXK2332-03	0.8				830
	6	**VXK2242-03**	0.25	23.0	0.95		670
		VXK2342-03	0.45				830

Note) Weight of grommet type. Add 60 g for conduit terminal type.
• Refer to “Glossary of Terms” on page 23 for details on the max. operating pressure differential and the max. system pressure.

Ambient and Fluid Temperature

Max. fluid temperature (°C)	Ambient temperature (°C)
Solenoid valve option symbol	
S	
183	–20 to 60

Valve Leakage

Internal Leakage

Seal material	Leakage rate (Air)
PTFE	300 cm^3/min or less

External Leakage

Seal material	Leakage rate (Air)
PTFE	1 cm^3/min or less

How to Order (Single Unit)

AC **VXK** [21] [2] [0] [S] [ ] – [01] [ ] – [1] [G] 1 – [ ]

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.

Suffix

Nil	—
Z	Oil-free

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

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

Rated voltage

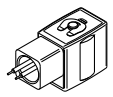
1	100 VAC 50/60 Hz	**7**	240 VAC 50/60 Hz
2	200 VAC 50/60 Hz	**8**	48 VAC 50/60 Hz
3	110 VAC 50/60 Hz	**J**	230 VAC 50/60 Hz
4	220 VAC 50/60 Hz		

∗ Refer to the Table (3) shown below for availability.

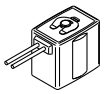
Refer to page 14 for ordering a coil only.

Electrical entry

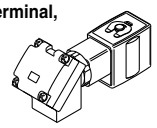
C - Conduit



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



∗ Refer to the Table (3) for the available combinations between each electrical option (S, L, Z) and rated voltage.

Bracket

Nil	None
B	With bracket

∗ Packed in the same container as the main body.
∗ Refer to the Table (4) when a bracket is ordered separately.

Table (1) Model/Orifice Size/Port Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (Diameter)				
Model	**VXK21**	**VXK22**	**VXK23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)	**5** (8 mmø)
Port symbol (Port size)	**01** (1/8)	—	—	●	●	●	—	—
	02 (1/4)	—	—	●	●	●	—	—
	—	**02** (1/4)	**02** (1/4)	—		●	●	●
	—	**03** (3/8)	**03** (3/8)	—	● (VXK22)	●	●	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (Diameter)			
Model	**VXK21**	**VXK22**	**VXK23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)
Port symbol (Port size)	**01** (1/8)	—	—	●	●	●	—
	02 (1/4)	—	—	●	●	●	—
	—	**02** (1/4)	**02** (1/4)	—	● (VXK22)	●	●
	—	**03** (3/8)	**03** (3/8)	—	● (VXK22)	●	●

Table (2) Solenoid Valve Option

Option symbol	Seal material	Body/Shading coil material	Coil insulation type
S	PTFE	C37/Cu	H

Solenoid coil: AC/Class H only

Table (3) Rated Voltage/Electrical Option

Rated voltage			Class H		
			S	**L**	**Z**
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light/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			

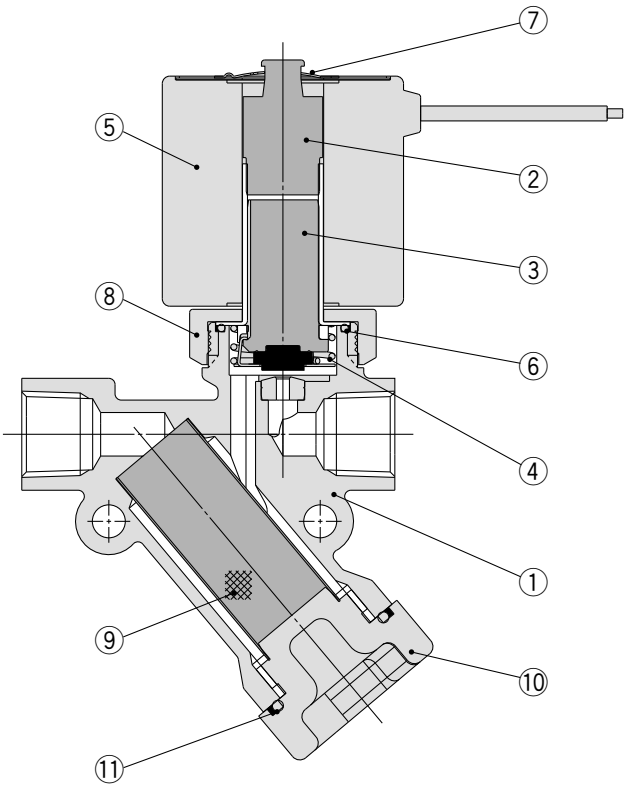
Table (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

Dimensions → page 13 (Single unit)

Construction: Single Unit

Normally closed (N.C.)
Body material: C37

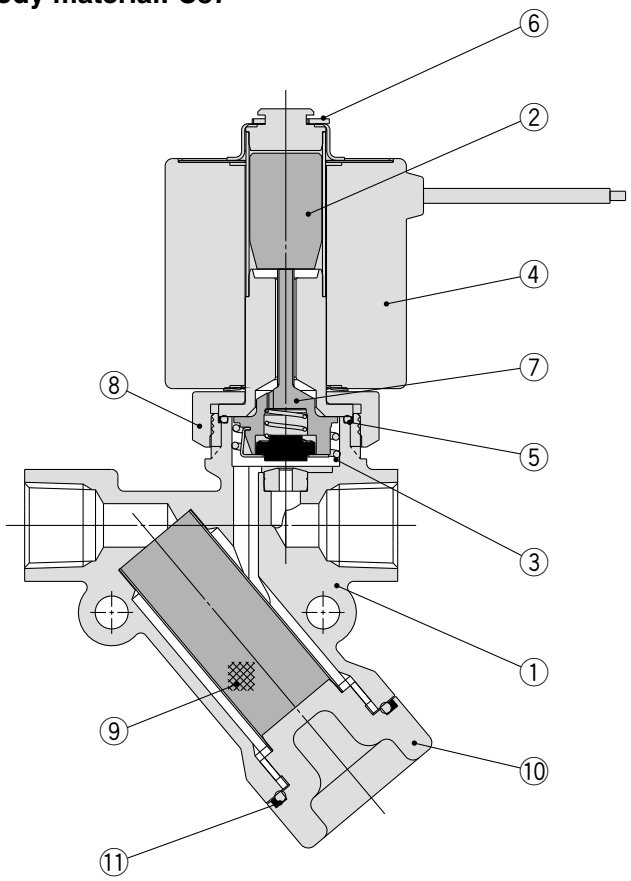


Component Parts

No.	Description	Material
1	**Body**	C37
2	**Tube assembly** Note 2)	Stainless steel, Cu
3	**Armature assembly**	Stainless steel, PPS, NBR (FKM, EPDM, PTFE)
4	**Return spring**	Stainless steel
5	**Solenoid coil**	—
6	**O-ring**	NBR (FKM, EPDM, PTFE)
7	**Clip**	SK
8	**Nut**	C37
9	**Strainer**	Stainless steel
10	**Plug**	C37
11	**O-ring**	NBR (FKM, EPDM, PTFE)

Note 1) The seal materials shown in ( ) are available depending on the option selected.
Note 2) "Cu" is not available with the DC spec. and AC spec. built-in full-wave rectifier type.

Normally open (N.O.)
Body material: C37



Component Parts

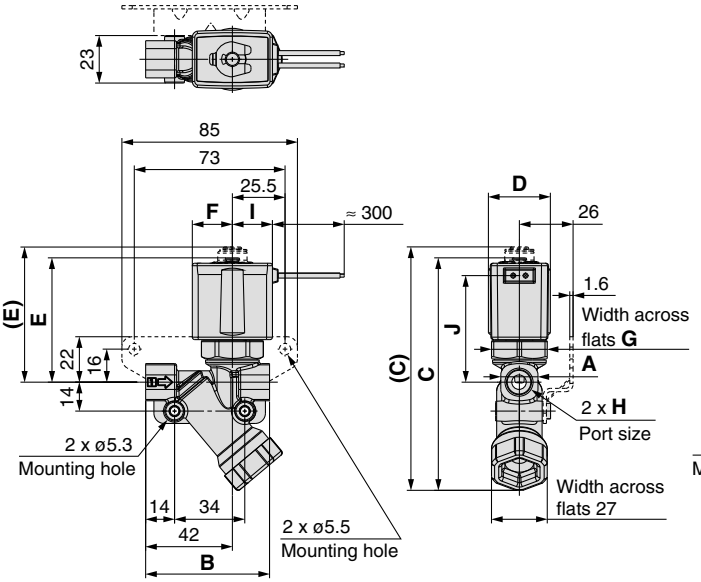
No.	Description	Material
1	**Body**	C37
2	**Tube assembly** Note 2)	Stainless steel, Cu
3	**Return spring**	Stainless steel
4	**Solenoid coil**	—
5	**O-ring**	NBR (FKM, EPDM, PTFE)
6	**E stop ring**	Stainless steel
7	**Push rod assembly**	Stainless steel, PPS, NBR (FKM, EPDM, PTFE)
8	**Nut**	C37
9	**Strainer**	Stainless steel
10	**Plug**	C37
11	**O-ring**	NBR (FKM, EPDM, PTFE)

Note 1) The seal materials shown in ( ) are available depending on the option selected.
Note 2) "Cu" is not available with the DC spec. and AC spec. built-in full-wave rectifier type.

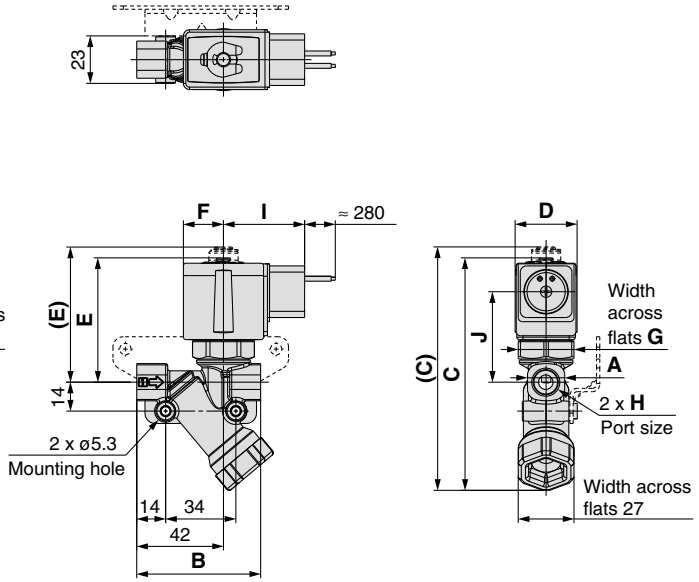
Dimensions

Normally closed (N.C.): VXK21□0/VXK22□0/VXK23□0
Normally open (N.O.): VXK21□2/VXK22□2/VXK23□2

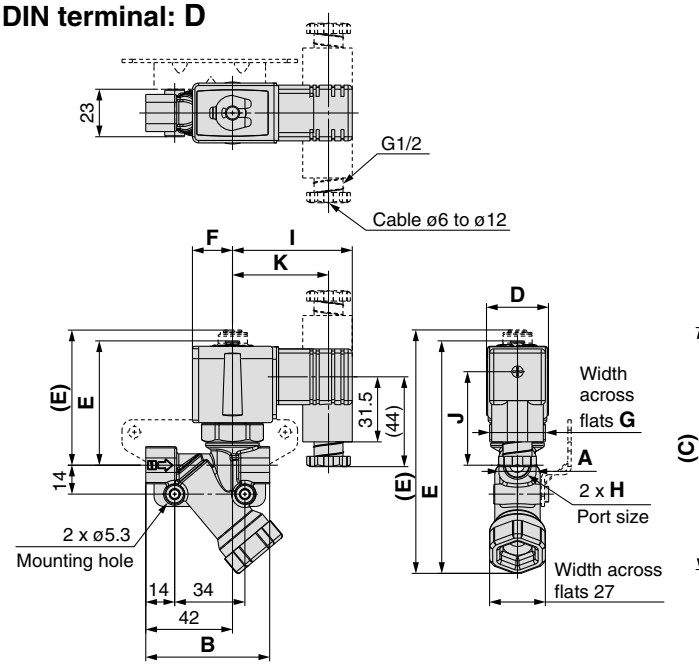
Grommet: G



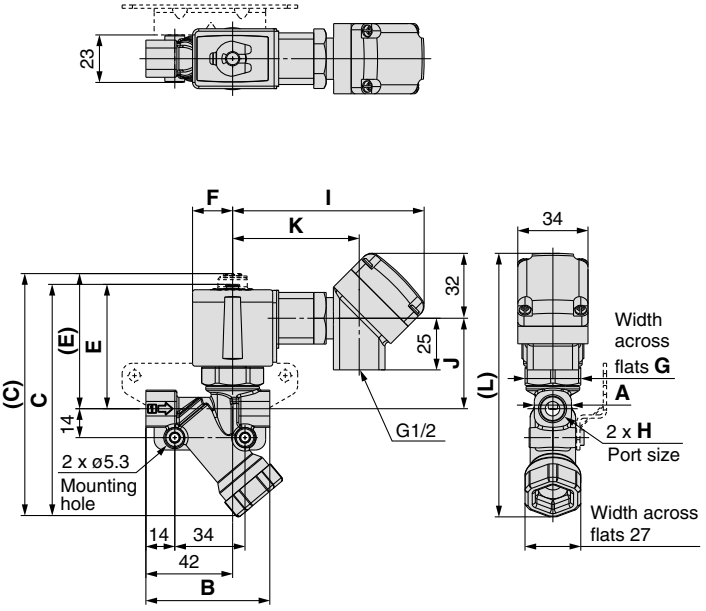
Conduit: C



DIN terminal: D



Conduit terminal: T



(mm)

Model		Orifice size	Port size H	A	B	C	(C) Note 2)	D	E	(E) Note 2)	F	G
Normally closed (N.C.)	Normally open (N.O.)											
VXK21□0	**VXK21□2**	ø2, ø3, ø4.5	1/8, 1/4	18	60	(112)	(119)	30	60	67	19.5	27
VXK22□0	**VXK22□2**	ø3, ø4.5, ø6, ø8 Note 1)	1/4, 3/8	22	63.5	(121.5)	(128.5)	35	69	76.5	22.5	32
VXK23□0	**VXK23□2**	ø3, ø4.5, ø6, ø8 Note 1)	1/4, 3/8	22	63.5	(127.5)	(135)	40	75.5	83.5	25	36

(mm)

Model		Orifice size	Port size H	Electrical entry Note 3)											Built-in full-wave rectifier type Electrical entry Note 3)										
				Grommet		Conduit		DIN terminal			Conduit terminal				Grommet		Conduit		DIN terminal			Conduit terminal			
Normally closed (N.C.)	Normally open (N.O.)			I	J	I	J	I	J	K	I	J	K	L	I	J	I	J	I	J	K	I	J	K	L
VXK21□0	**VXK21□2**	ø2, ø3, ø4.5	1/8, 1/4	19.5	52	40	44.5	58.5	44	46.5	(92)	44.5	(61)	(129)	30	48	48.5	43	65.5	44	53.5	(100.5)	43	(69.5)	(127)
VXK22□0	**VXK22□2**	ø3, ø4.5, ø6, ø8 Note 1)	1/4, 3/8	22.5	61	43	53.5	61.5	53	49.5	(95)	53.5	(64)	(138)	33	57	51.5	52	68.5	53	56.5	(103.5)	52	(72.5)	(136.5)
VXK23□0	**VXK23□2**	ø3, ø4.5, ø6, ø8 Note 1)	1/4, 3/8	25.5	67.5	46	60	64	59.5	52	(98)	60	(66.5)	(143.5)	36	63.5	54	58.5	71	59.5	59	(106)	58.5	(75)	(142.5)

Note 1) An orifice size of ø8 is only available with the N.C. spec.
Note 2) (C)(E): N.O. spec. dimensions
Note 3) Add 1.5 mm to "J" and "L" dimensions for the N.O. spec.

Replacement Parts

● Solenoid Coil Assembly Part No.

VX02 [1] N – [1] [G] – [ ] – [ ]

Model

1	VXK21□□
2	VXK22□□
3	VXK23□□

Valve

Nil	N.C.
2	N.O.

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
5	24 VDC
6	12 VDC
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.

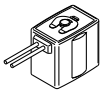
Coil insulation type Note)

Nil	Class B
H*	Class H

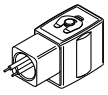
* DIN terminal and DC spec. are not available.

Electrical entry

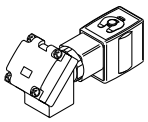
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

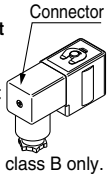


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



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)

Connector



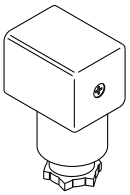
* DIN type is available with class B only.

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

● DIN Connector Part No.

Without electrical option **GDM2A**

With electrical option **GDM2A – [ ] [ ]**



Electrical option

S	With surge voltage suppressor
L	With light
Z	With light/surge voltage suppressor

* 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

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

VX02 [1] N – [1] [G] R – [ ]

Model

1	VXK21□□
2	VXK22□□
3	VXK23□□

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

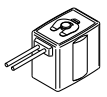
Note) Refer to the Table (1) for the available combinations.

Valve

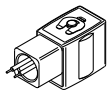
Nil	N.C.
2	N.O.

Electrical entry

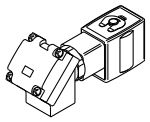
G - Grommet



C - Conduit

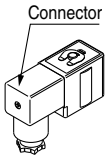


T - With conduit terminal
TL - With conduit terminal and light



D - DIN terminal
DL - DIN terminal with light
DO - For DIN terminal (without connector, gasket is included.)

Connector



* Refer to the Table (1) for the available combinations between each electrical option and rated voltage.
* Surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (1) 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/surge voltage suppressor	With surge voltage suppressor	With light	With light/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 because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.
* Replacement of solenoid coil
  - Cannot be changed between DC and AC.
  - Cannot be changed between DC and AC (built-in full-wave rectifier type).
  - Can be changed from DC to DC.
  - Can be changed from AC to AC.

● **Name Plate Part No.**

AZ-T- Valve model

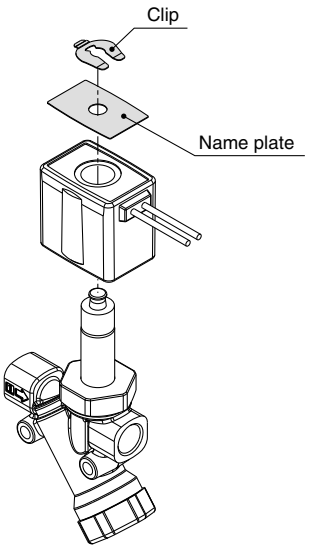
↑ Enter by referring to "How to Order" (Single Unit).

● **Clip Part No. (For N.C.)**

For VX21: VX021N-10
For VX22: VX022N-10
For VX23: VX023N-10

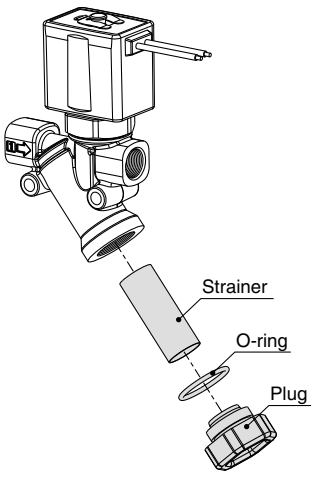
● **Clip Part No. (For N.O.)**

For VX21: ETW-7
For VX22: ETW-8
For VX23: ETW-9



● **Strainer Part No.**

Strainer	**VXK021N-4-1**
Plug assembly (Plug + O-ring)	**VXK021N-3CA (NBR)** **VXK021N-3CA-F (FKM)** **VXK021N-3CA-E (EPDM)** **VXK021N-3CA-P (PTFE)**
O-ring ∗ Part numbers are for a set of ten O-rings.	**VXK-OR (NBR)** **VXK-OR-F (FKM)** **VXK-OR-E (EPDM)** **VXK-OR-P (PTFE)**



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 the 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
		Cv	ANSI/(NFPA)T3.21.3: 1990
Process fluid control equipment	*Av*	—	IEC60534-2-3: 1997 JIS B 2005: 1995 Equipment: JIS B 8471, 8472, 8473
	—	*Cv*	

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

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

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

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

Q : Air flow rate [dm³/min (ANR)], dm³ (Cubic decimeter) of SI unit are also allowed to be described by ℓ (liter). 1 dm³ = 1 ℓ

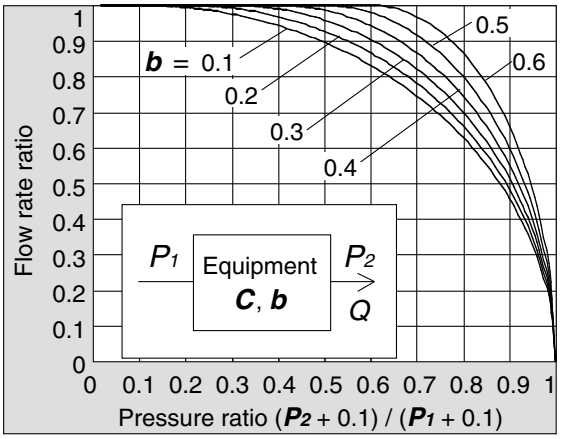
C : Sonic conductance [dm³/(s·bar)]
b : Critical pressure ratio [—]
P₁ : Upstream pressure [MPa]
P₂ : Downstream pressure [MPa]
t : Temperature [°C]
Note) Formula of subsonic flow is the elliptic analogous curve.
Flow characteristics are shown in Graph (1) For details, please make use of SMC's "Energy Saving Program".

Example)
Obtain the air flow rate for P_1 = 0.4 [MPa], P_2 = 0.3 [MPa], t = 20 [°C] when a solenoid valve is performed in C = 2 [dm³/(s·bar)] and b = 0.3.

According to formula 1, the maximum flow rate = $600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}} = 600$ [dm³/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 rate ratio to be b = 0.3.
Hence, flow rate = maximum flow rate x flow rate ratio = 600 x 0.7 = 420 [dm³/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.

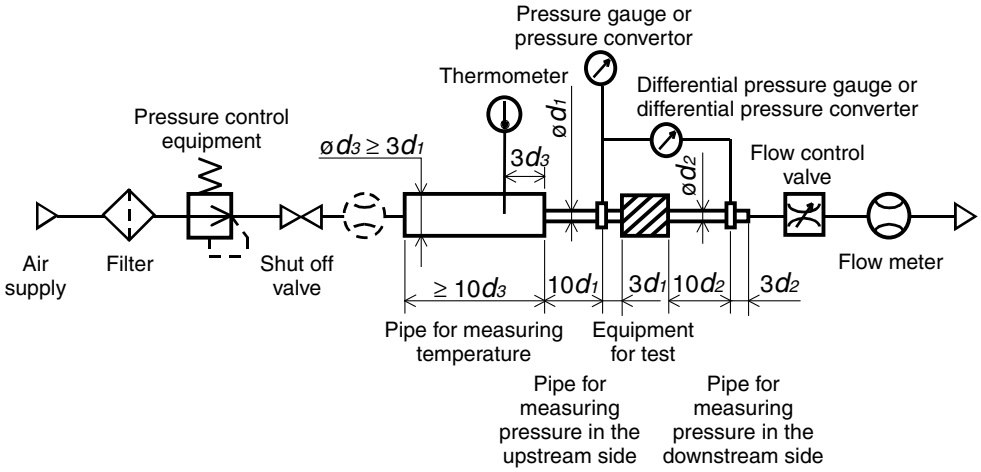


Fig. (1) Test circuit based on ISO 6358, JIS B 8390

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

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

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

When

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

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

Conversion with sonic conductance ***C***:

$$S = 5.0 \times C \quad \cdots\cdots(5)$$

Q : Air flow rate[dm³/min(ANR)], dm³ (cubic decimeter) of SI unit are also allowed to be described by ℓ (liter). 1 dm³ = 1 ℓ
S : Effective area [mm²]
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.

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

S : Effective area [mm²]
V : Air tank capacity [dm³]
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]

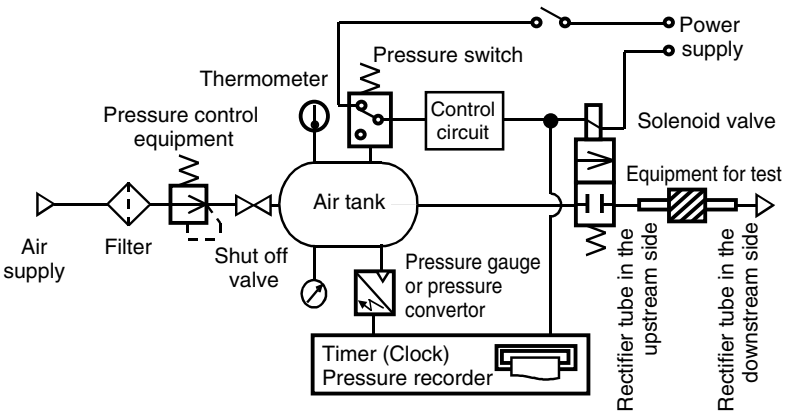


Fig. (2) Test circuit based on JIS B 8390

2.3 Flow coefficient *Cv* 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 ***Cv*** factor of flow coefficient by the following formula which is based on the test conducted by the test circuit analogous to ISO 6358.

$$Cv = \frac{Q}{114.5\sqrt{\frac{\Delta P\,(P_2 + P_a)}{T_1}}} \quad \cdots\cdots(7)$$

ΔP : 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 [dm³/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 bar $\leq \Delta P \leq$ 0.14 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 characteristics

Av factor: Value of the clean water flow rate represented by m³/s which runs through a valve (equipment for test) when the pressure difference is 1 Pa. It is calculated using the following formula.

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

Av : Flow coefficient [m²]
Q : Flow rate [m³/s]
ΔP : Pressure difference [Pa]
ρ : Density of fluid [kg/m³]

(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:

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

Q : Flow rate [ℓ/min]
Av : Flow coefficient [m²]
ΔP : Pressure difference [MPa]
G : Specific gravity [water = 1]

In the case of saturated steam:

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

Q : Flow rate [kg/h]
Av : Flow coefficient [m²]
ΔP : Pressure difference [MPa]
P_1 : Upstream pressure [MPa]: $\Delta P = P_1 - P_2$
P_2 : Downstream pressure [MPa]

Solenoid Valve Flow Characteristics

Conversion of flow coefficient:

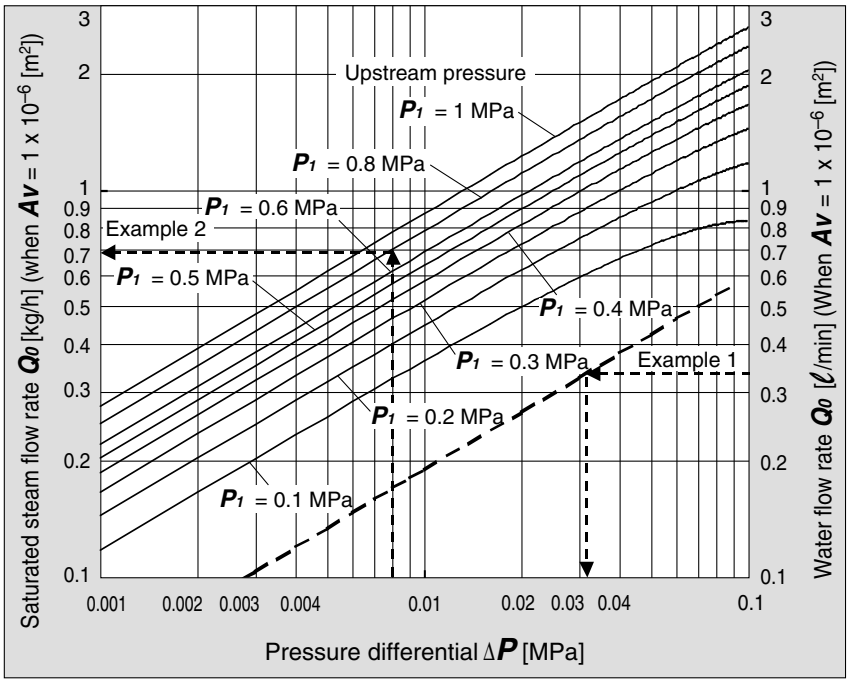
$Av = 28 \times 10^{-6}\ Kv = 24 \times 10^{-6}\ Cv$ ·····(11)

Here,

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

Cv factor (Reference values): Value of the clean water flow rate represented by US gal/min which runs through a valve at 60°F, when the pressure difference is 1 lbf/in^2 (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 $Q_0 = 15/45 = 0.33$ [ℓ/min], according to Graph (2), if reading ΔP when Q_0 is 0.33, it will be 0.031 [MPa].

Example 2)

Obtain the saturated steam flow rate when $P_1 = 0.8$ [MPa], $\Delta P = 0.008$ [MPa] with a solenoid valve with an $Av = 1.5 \times 10^{-6}$ [m^2].

According to Graph (2), if reading Q_0 when P_1 is 0.8 and ΔP is 0.008, it is 0.7 [kg/h]. Hence, the flow rate $Q = 0.7 \times 1.5 = 1.05$ [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 4×10^4.

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

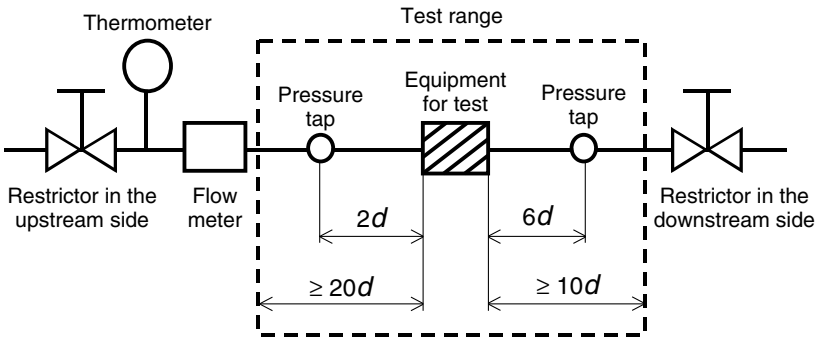
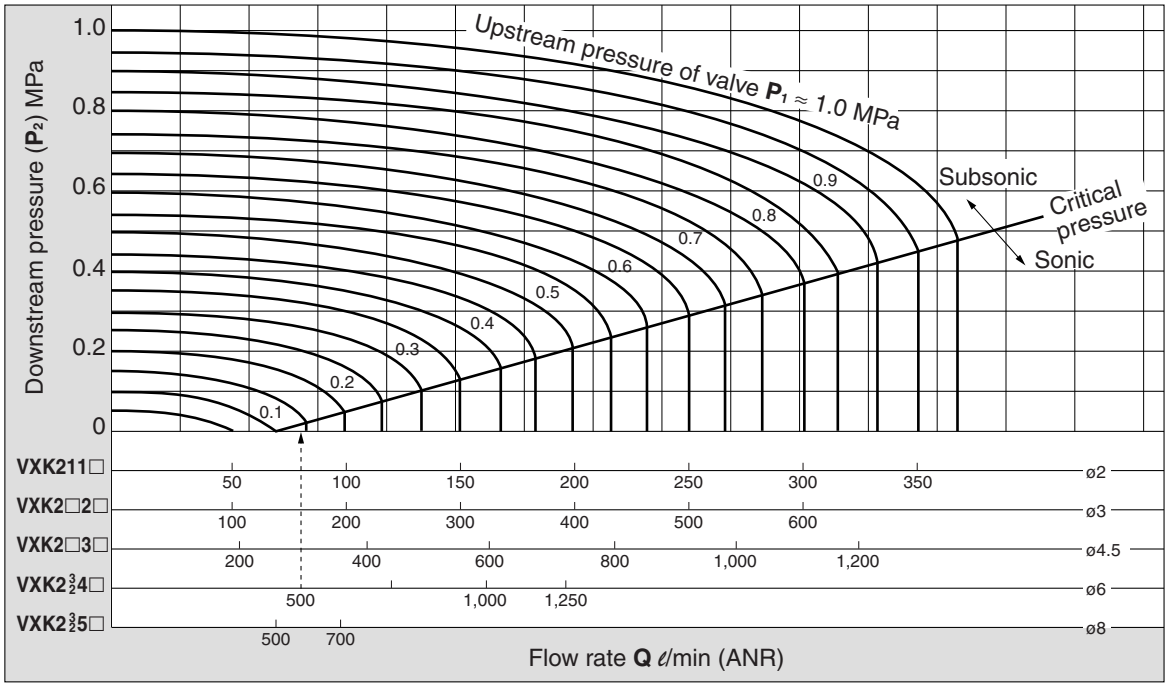


Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005

Flow Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to pages 16 to 20.

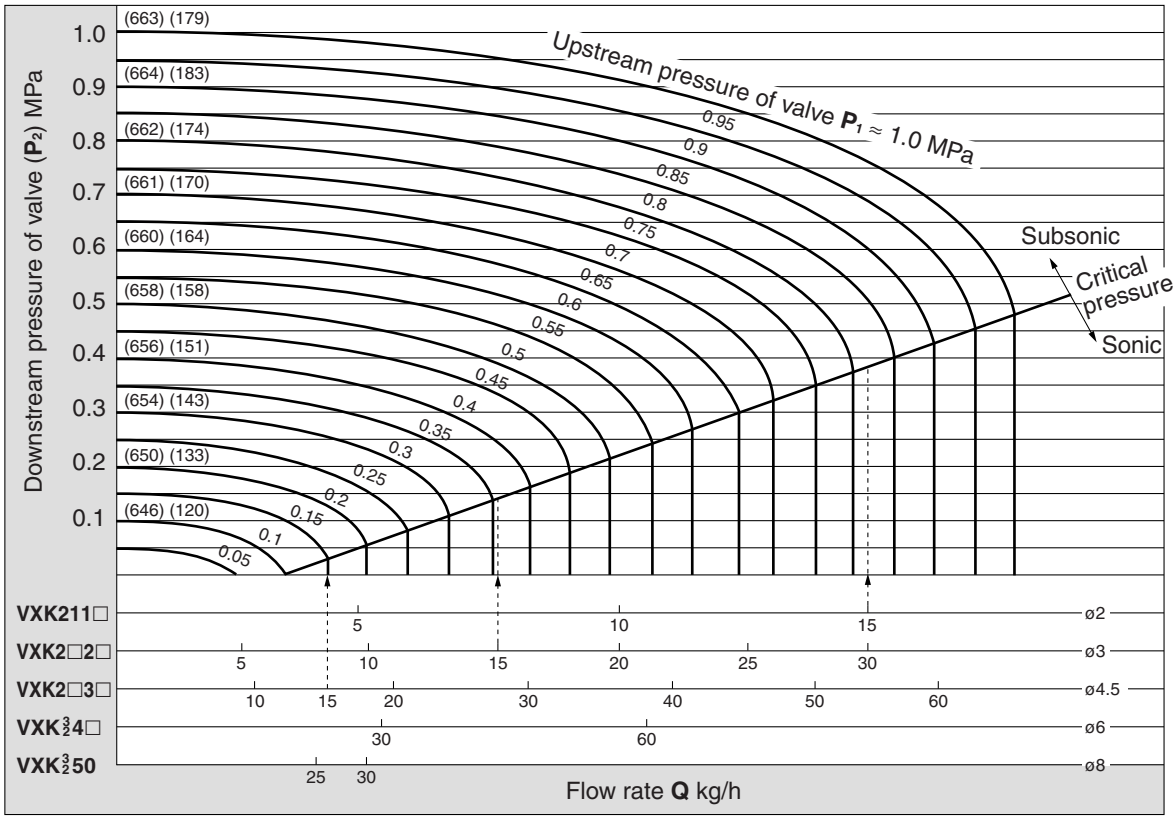
Air



How to read the graph

The sonic range pressure to generate a flow rate of 500 ℓ/min (ANR) is
$P_1 \approx 0.14$ MPa for a ø6 orifice (VXK2 3 2 4□) and
$P_1 \approx 0.3$ MPa for a ø4.5 orifice (VX2□3□).

Saturated Steam



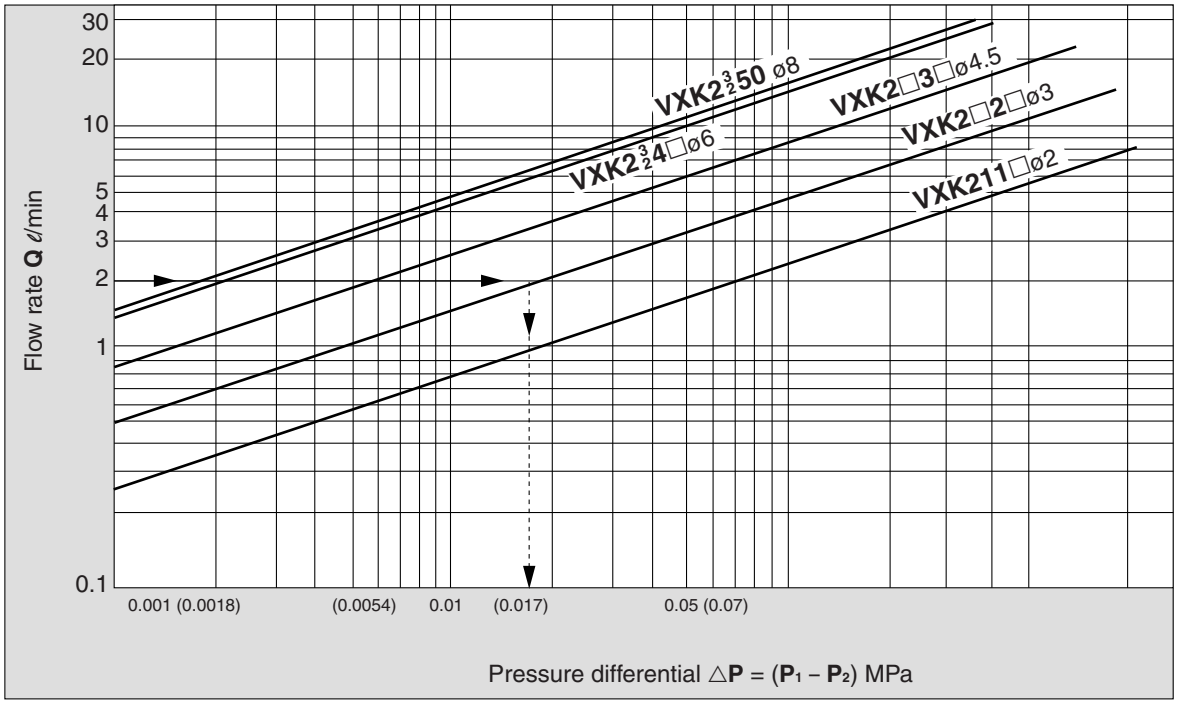
( ): Saturated steam holding heat (kcal/kg) ( ): Saturation temperature (°C)

How to read the graph

The sonic range pressure to generate a flow rate of 15 kg/h is
$P_1 \approx 0.15$ MPa for ø4.5 orifice (VXK2□3□S), $P_1 \approx 0.37$ MPa for ø3 orifice (VXK2□2□S), and
$P_1 \approx 0.82$ MPa for ø2 orifice (VXK211□S). The holding heat slightly differs depending on the pressure P_1, but at 15 kg/h it is approx. 9700 kcal/h.

Flow Characteristics

Water



How to read the graph

When a water flow of 2 ℓ/min is generated, △P ≈ 0.017 MPa for a valve with ø3 orifice (VXK212□, 222□, 232□).

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 stably operating.

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)

5. 100 mesh
The number of meshes over a length of 25.4 mm (1 inch).

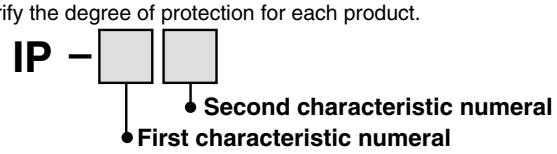
Electrical Terminology

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".

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 mm ø and greater
2	Protected against solid foreign objects of 12 mm ø and greater
3	Protected against solid foreign objects of 2.5 mm ø and greater
4	Protected against solid foreign objects of 1.0 mm ø and greater
5	Dust-protected
6	Dusttight

● **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	Low jetproof type
6	Protected against powerful water jets	Strong jetproof 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: 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 constantly.

Others

1. Material
NBR: Nitrile rubber
FKM: Fluororubber – Trade names: Viton®, Dai-el®, etc.
EPDM: Ethylene propylene rubber
PTFE: Polytetrafluoroethylene resin – Trade names: Teflon®, Polyflon®, etc.

2. Oil-free treatment
The degreasing and washing of wetted parts.

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

Series VXK
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) for 2 Port Solenoid Valves for Fluid Control Precautions.

Replacement of Strainer

⚠ Warning

1. The valve will reach high temperatures from high temperature fluids such as steam. Confirm that the valve has cooled sufficiently before performing works.
If touched inadvertently, there is a danger of being burned.

2. Shut off the fluid supply and release the fluid pressure in the system.

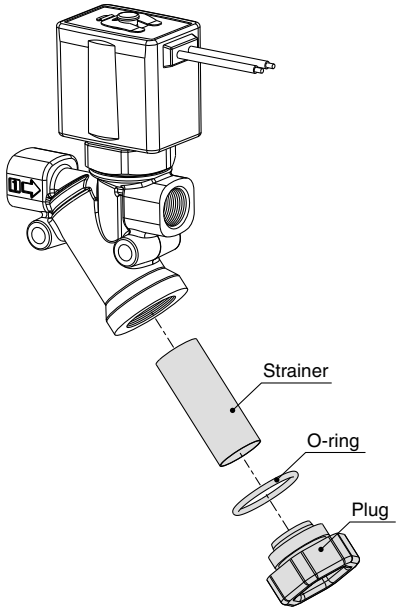
3. Shut off the power supply.

1) Turn and remove the plug (width across flats of 27 mm).

2) Remove the strainer, and clean or replace it.

3) Mount the O-ring on the plug and insert the strainer to the end of the plug.

4) Screw the plug into the body.
(Recommended tightening torque: 23 to 27 N·m)

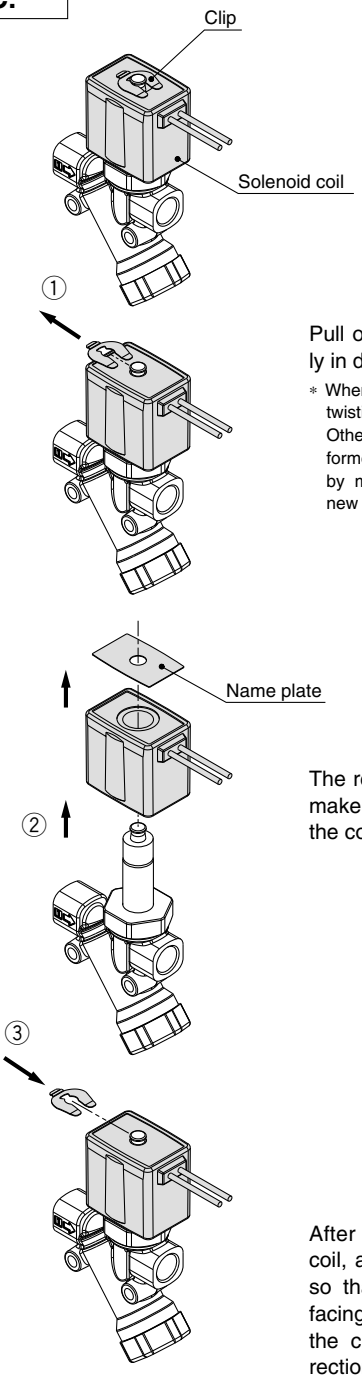


Series VXK
Specific Product Precautions 2

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

Replacement of Solenoid Coil

N.C.



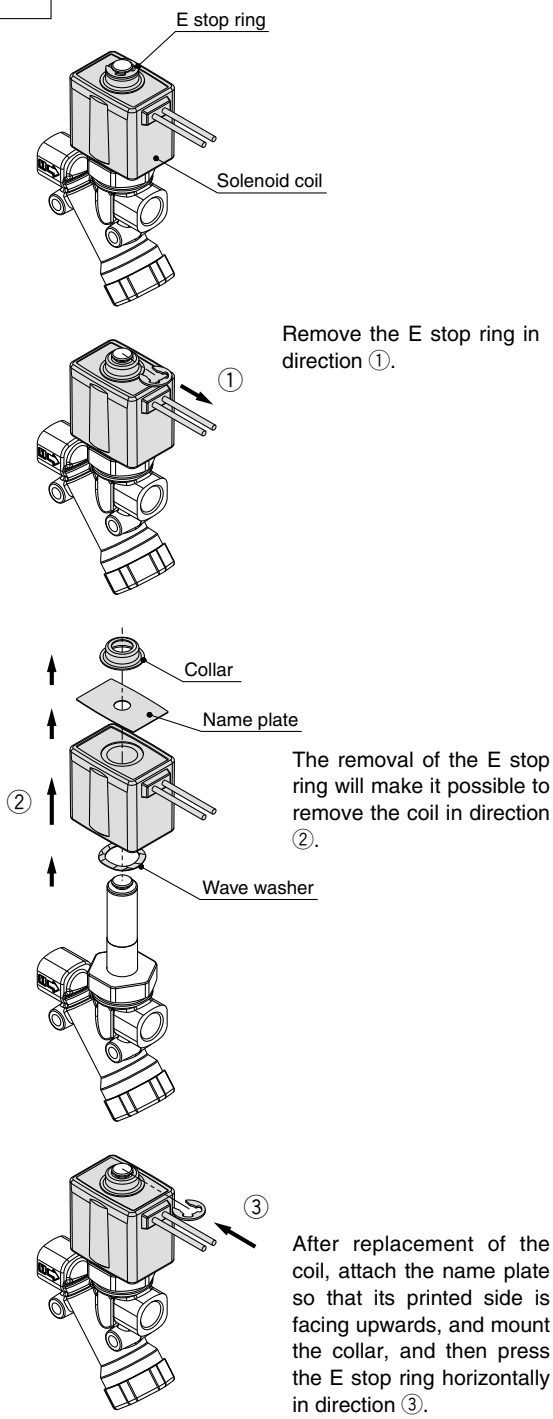
Pull out the clip horizontally in direction ①.

* When doing this, do not apply twisting or torsion to the clip. Otherwise, the clip may be deformed. If the clip is deformed by mistake, replace it with a new one.

The removal of the clip will make it possible to remove the coil in direction ②.

After replacement of the coil, attach the name plate so that its printed side is facing upwards, and press the clip horizontally in direction ③.

N.O.



Remove the E stop ring in direction ①.

The removal of the E stop ring will make it possible to remove the coil in direction ②.

After replacement of the coil, attach the name plate so that its printed side is facing upwards, and mount the collar, and then press the E stop ring horizontally in direction ③.

⚠ Warning

1. When replacing the solenoid coil, turn off the power supply.

2. Be careful for possible high temperature of the solenoid coil due to the fluid temperature and operating conditions.

3. Check the type of the solenoid coil (size, rated voltage, voltage specification, insulation specification).

* Replacement of solenoid coil
- Cannot be changed between DC and AC.
- Cannot be changed between DC and AC (built-in full-wave rectifier type).
- Can be changed from DC to DC.
- Can be changed from AC to AC.

⚠ 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.*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.

Revision history

Edition B ∗ Addition of plug assembly part no. to strainer part no.
∗ Change of O-ring part no. in strainer part no.

OZ

⚠ Safety Instructions	Be sure to read "Handling Precautions for SMC Products" (M-E03-3) before using.

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1st printing MY printing OZ 12450SZ Printed in Japan.