

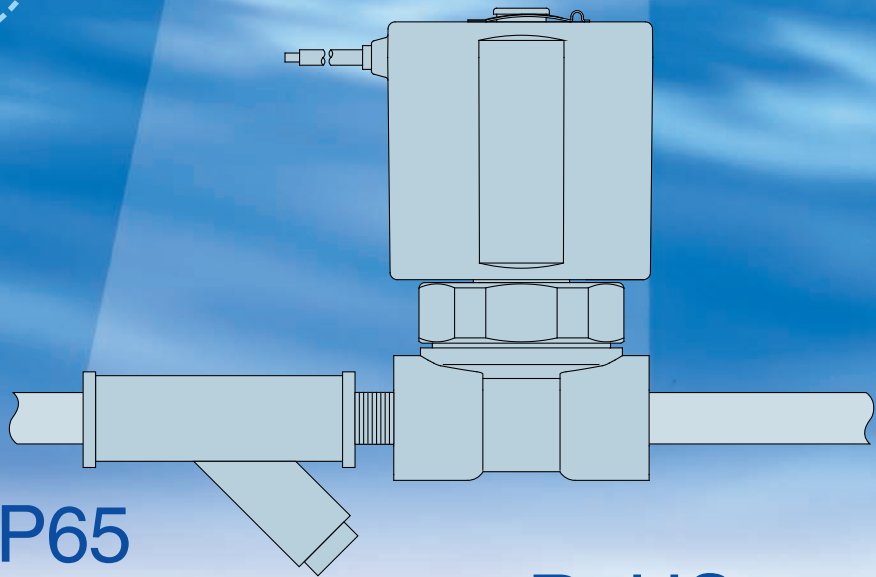
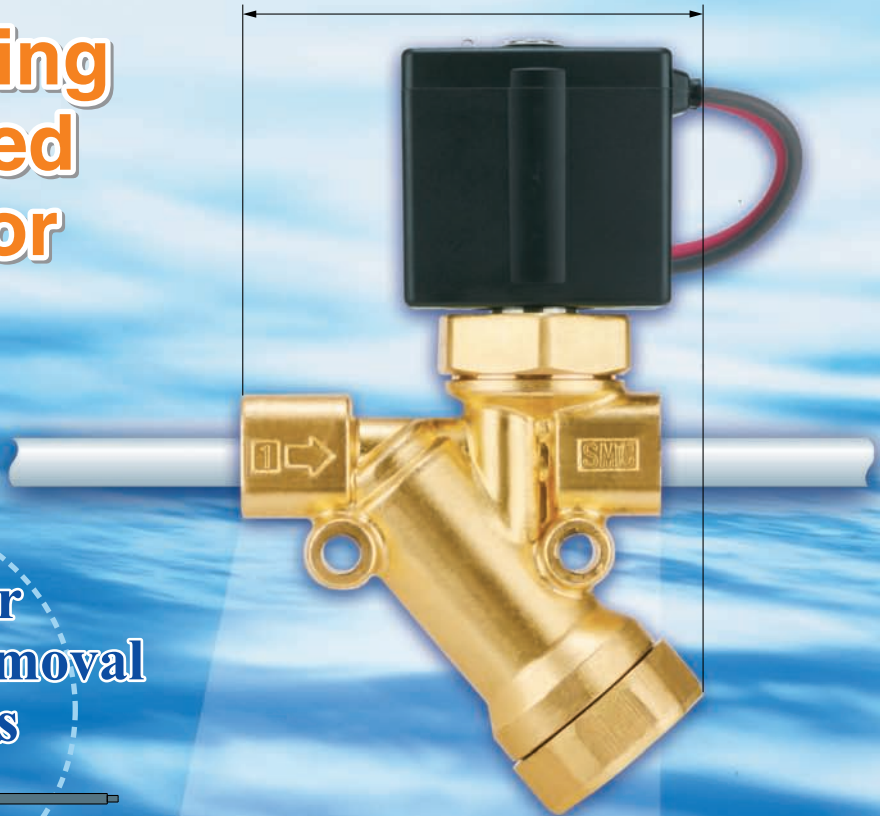
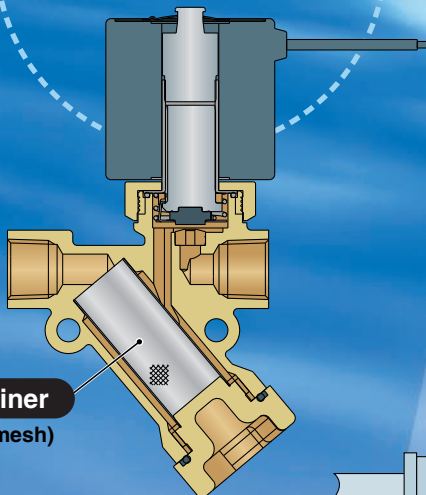
2 Port Solenoid Valve with Built-in Y-strainer

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 •  [Application pending] • IP65

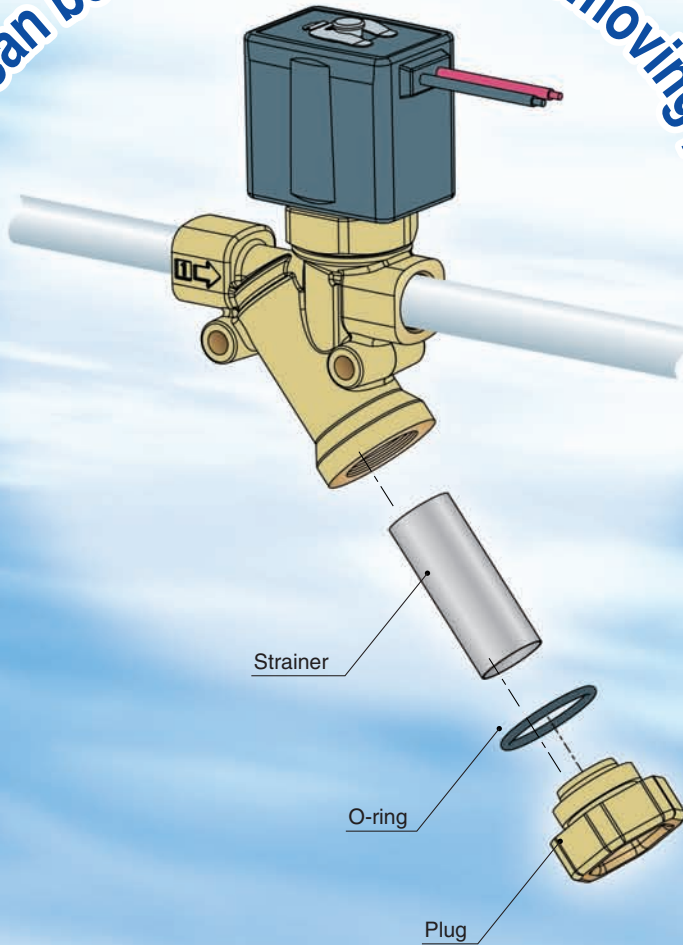
• Restriction of environmentally hazardous substances **RoHS** compliant

Series VXK



CAT.ES70-34B

Element can be replaced without removing piping.



Variations

Direct Operated: Series VVK21/22/23

● 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	VVK21	VVK22	VVK23
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	VVK21	VVK22	VVK23
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

Specifications



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

For Air

For Water

For Oil

For Steam

Construction

Dimensions

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 - - 1

● Option symbol

Fluid and application	Option symbol	Seal material	Body/Shading coil material <small>Note 5)</small>	Coil insulation type <small>Note 4)</small>	Remarks
Air	Nil	NBR	C37/-	B	Select the built-in full-wave rectifier type for AC spec.
Medium vacuum, Non-leak, Oil-free <small>Note 1)</small>	V <small>Note 2)</small>	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 <small>Note 3)</small>	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·m³/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 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.

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.

Specifications

For Air

For Water

For Oil

For Steam

Construction

Dimensions

Series VXK21/22/23

⚠ Fluid: Air

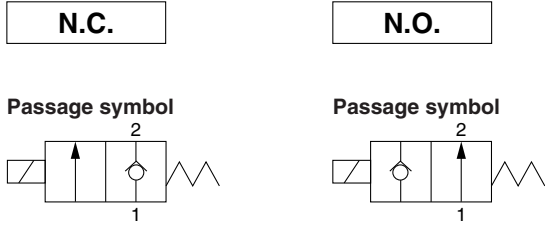
For Air / Single Unit

(Inert gas, Non-leak, Medium vacuum)

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



Normally Closed (N.C.)

Port size	Orifice size (mm)	Model	Max. operating pressure differential (MPa)	Flow characteristics			Max. system pressure (MPa)	Note) Weight (g)
				C[dm ³ /(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	3.0	640
		VXK2120-02	0.6	1.2	0.45	0.33		
		VXK2220-02	1.5					
	3	VXK2220-02	1.5	1.2	0.45	0.33	3.0	790
		VXK2320-02	3.0					
	4.5	VXK2130-02	0.2	2.3	0.46	0.61	3.0	480
		VXK2230-02	0.35					
	6	VXK2230-02	0.35	2.3	0.46	0.61	3.0	640
		VXK2330-02	0.9					
	8	VXK2240-02	0.15	4.0	0.30	1.10	1.0	790
VXK2340-02		0.35						
3/8 (10A)	3	VXK2250-02	0.08	4.9	0.29	1.20	3.0	640
		VXK2350-02	0.2					
		VXK2220-03	1.5					
	4.5	VXK2220-03	1.5	1.2	0.45	0.33	3.0	790
		VXK2320-03	3.0					
	6	VXK2230-03	0.35	2.3	0.46	0.61	3.0	640
		VXK2330-03	0.9					
	8	VXK2240-03	0.15	4.0	0.30	1.10	1.0	790
		VXK2340-03	0.35					
	3/8 (10A)	8	VXK2250-03	0.08	4.9	0.29	1.20	3.0
VXK2350-03			0.2					

- 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.

Ambient and Fluid Temperature

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

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

Normally Open (N.O.)

Port size	Orifice size (mm)	Model	Max. operating pressure differential (MPa)	Flow characteristics			Max. system pressure (MPa)	Note) Weight (g)
				C[dm ³ /(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	3.0	670
		VXK2122-02	0.7	1.2	0.45	0.33		
		VXK2222-02	1.0					
	3	VXK2222-02	1.0	1.2	0.45	0.33	3.0	830
		VXK2322-02	1.6					
	4.5	VXK2132-02	0.3	2.3	0.46	0.61	3.0	500
		VXK2232-02	0.45					
	6	VXK2232-02	0.45	2.3	0.46	0.61	3.0	670
		VXK2332-02	0.8					
	3/8 (10A)	8	VXK2242-02	0.25	4.0	0.30	1.10	1.0
VXK2342-02			0.45					
3/8 (10A)	3	VXK2222-03	1.0	1.2	0.45	0.33	3.0	670
		VXK2322-03	1.6					
		VXK2232-03	0.45					
	4.5	VXK2232-03	0.45	2.3	0.46	0.61	3.0	670
		VXK2332-03	0.8					
	6	VXK2242-03	0.25	4.0	0.30	1.10	1.0	830
VXK2342-03		0.45						

- 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.

Valve Leakage

Internal Leakage

Seal material	Leakage rate	
	Air	Non-leak, Medium vacuum Note)
NBR, FKM	1 cm ³ /min or less	10 ⁻⁶ Pa·m ³ /sec or less

External Leakage

Seal material	Leakage rate	
	Air	Non-leak, Medium vacuum Note)
NBR, FKM	1 cm ³ /min or less	10 ⁻⁶ Pa·m ³ /sec or less

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

How to Order (Single Unit)

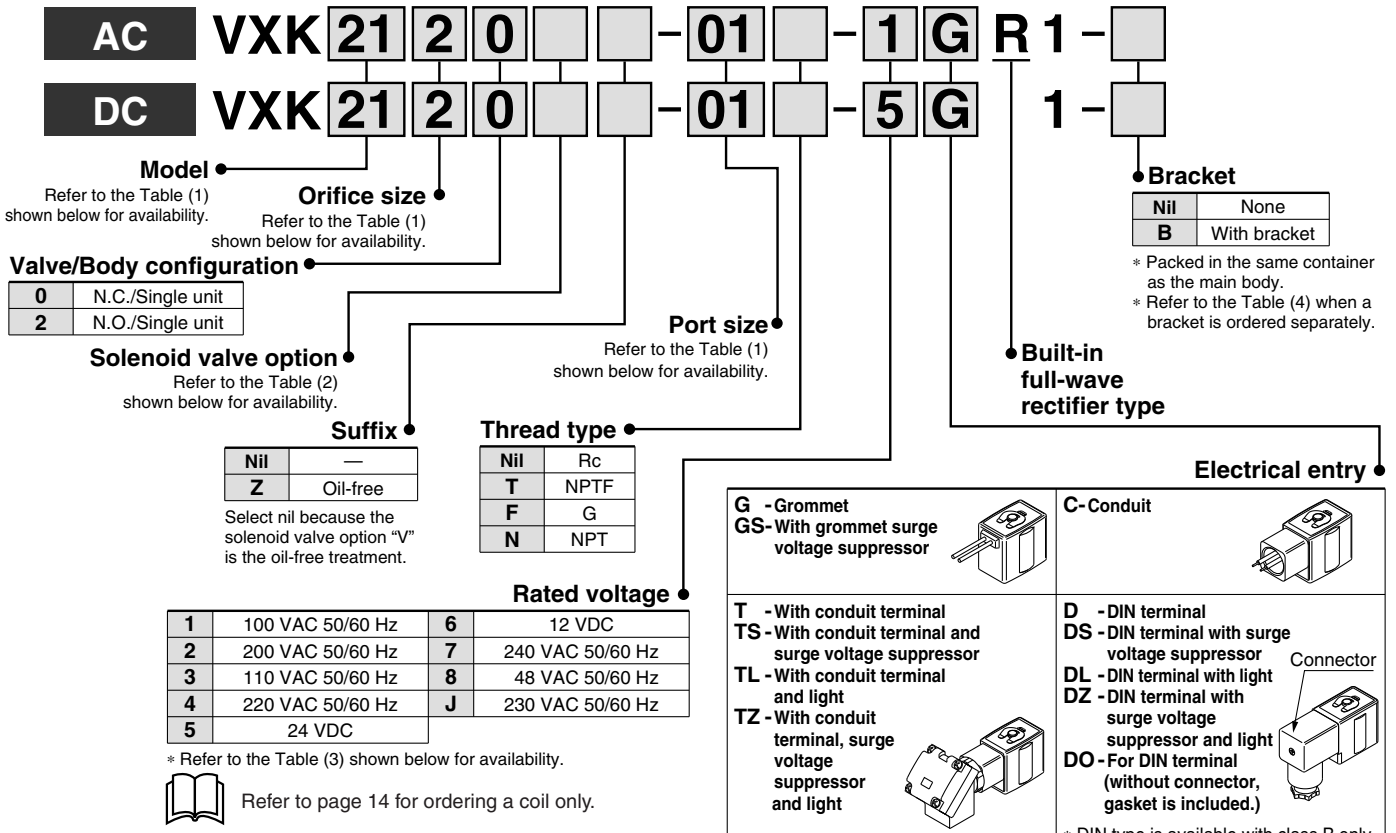


Table (1) Model/Orifice Size/Port Size Normally Closed (N.C.)

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)				
	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.)

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)			
	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 · m ³ /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.)

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)

Table (3) Rated Voltage/Electrical Option

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

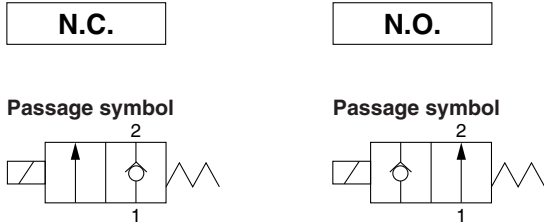
* Option "S", "Z" are not available because a surge voltage suppressor is integrated into the AC/Class B, built-in full-wave rectifier type as a standard.

Table (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

For Water /Single Unit

Model/Valve Specifications



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 (Built-in full-wave rectifier type)	$Av \times 10^{-6} \text{ m}^2$	$Cv \text{ converted}$				
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	3.0	640		
	3	VXK2120-02	0.9	0.5	7.9	0.33				
		VXK2220-02	1.7	1.5						
	4.5	VXK2320-02	2.5	3.0	15.0	0.61			3.0	790
		VXK2130-02	0.4	0.2						
		VXK2230-02	0.6	0.35						
	6	VXK2330-02	0.85	0.9	23.0	0.95			1.0	640
		VXK2240-02	0.35	0.15						
	8	VXK2340-02	0.55	0.3	26.0	1.10			1.0	790
		VXK2250-02	0.13	0.08						
3/8 (10A)	3	VXK2350-02	0.17	0.2	7.9	0.33	3.0	640		
		VXK2220-03	1.7	1.5						
	4.5	VXK2320-03	2.5	3.0	15.0	0.61	3.0	790		
		VXK2230-03	0.6	0.35						
	6	VXK2330-03	0.85	0.9	23.0	0.95	1.0	640		
		VXK2240-03	0.35	0.15						
	8	VXK2340-03	0.55	0.3	26.0	1.10	1.0	790		
		VXK2250-03	0.13	0.08						
		VXK2350-03	0.17	0.2				640		

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)		
				$Av \times 10^{-6} \text{ m}^2$	$Cv \text{ converted}$				
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	3.0	670		
	3	VXK2122-02	0.45	7.9	0.33				
		VXK2222-02	0.8						
	4.5	VXK2322-02	1.2	15.0	0.61			3.0	830
		VXK2132-02	0.2						
		VXK2232-02	0.3						
	6	VXK2332-02	0.6	23.0	0.95			1.0	670
		VXK2242-02	0.15						
	8	VXK2342-02	0.35	26.0	1.10			1.0	830
		VXK2252-02	0.13						
3/8 (10A)	3	VXK2222-03	0.8	7.9	0.33	3.0	670		
		VXK2322-03	1.2						
	4.5	VXK2232-03	0.3	15.0	0.61			1.0	830
		VXK2332-03	0.6						
	6	VXK2242-03	0.15	23.0	0.95			1.0	670
		VXK2342-03	0.35						

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	-20 to 60
1 to 60	1 to 99	

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.

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

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

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.

Electrical entry

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

* 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.

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.

Full-wave rectifier

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

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

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)				
	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.)

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)			
	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 (3) Rated Voltage/Electrical Option

AC/DC	Voltage symbol	Voltage	Class B			Class H		
			S	L	Z	S	L	Z
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	●	—	—	DC spec. is not available.		

* 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 (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 (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

Dimensions → page 13 (Single unit)

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.

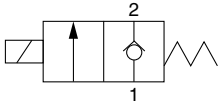
For Oil /Single Unit

Model/Valve Specifications

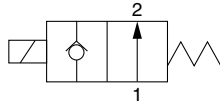
N.C.

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)
			AC	DC (Built-in full-wave rectifier type)	Av x 10 ⁻⁶ m ²	Cv converted		
1/8 (6A)	2	VXK2110-01	1.5	1.5	4.1	0.17	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	3.0	
		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		640
VXK2350-02		0.14	0.2	790				
3/8 (10A)	3	VXK2220-03	1.2	1.2	7.9	0.33	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	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 m ²		
1/8 (6A)	2	VXK2112-01	0.8	4.1	0.17	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	3.0	
		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
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	-20 to 60
-5 Note) to 60	-5 Note) to 120	

 Note) Dynamic viscosity: 50 mm²/s or less

Valve Leakage

Internal Leakage

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

External Leakage

Seal material	Leakage rate (Oil)
FKM	0.1 cm ³ /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.

Thread type

Nil	Rc
T	NPTF
F	G
N	NPT

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

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.

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.

Full-wave rectifier

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

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.

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

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)				
	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.)

Model	Solenoid valve (Port size)			Orifice symbol (Diameter)			
	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 (3) Rated Voltage/Electrical Option

AC/DC	Rated voltage		Class B			Class H		
	Voltage symbol	Voltage	S	L	Z	S	L	Z
			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	●	—	—	DC spec. is not available.		

* 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 (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 (4) Bracket Part No.

Model	Part no.
VXK21	VXK021N-5A
VXK22	
VXK23	

Dimensions → page 13 (Single unit)

Series VVK21/22/23

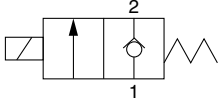
For Steam /Single Unit

Model/Valve Specifications

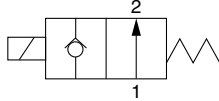
N.C.

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)
			AC	Av x 10 ⁻⁶ m ²	Cv converted	Av x 10 ⁻⁶ m ²	Cv converted		
1/8 (6A)	2	VVK2110-01	1.0	4.1	0.17	1.0	480		
	3	VVK2120-01	1.0	7.9	0.33				
	4.5	VVK2130-01	0.45	15.0	0.61				
1/4 (8A)	2	VVK2110-02	1.0	4.1	0.17				
	3	VVK2120-02	1.0	7.9	0.33				
		VVK2130-02	0.45	15.0	0.61				
	4.5	VVK2230-02	0.75						
		VVK2330-02	1.0						
	6	VVK2240-02	0.4	23.0	0.95				
	VVK2340-02	0.5							
3/8 (10A)	3	VVK2220-03	1.0	7.9	0.33		1.0	640	
		VVK2230-03	0.75						
	4.5	VVK2330-03	1.0	15.0	0.61	790			
		VVK2240-03	0.4						
	6	VVK2340-03	0.5	23.0	0.95	790			
		VVK2250-03	0.15						
	8	VVK2250-03	0.15	26.0	1.10	0.5		640	
		VVK2350-03	0.2						
	VVK2220-03	1.0	7.9	0.33	1.0	640			
	VVK2232-03	0.45							
	VVK2332-03	0.8	15.0	0.61	0.5	790			
	VVK2242-03	0.25							
	VVK2342-03	0.45	23.0	0.95	0.5	640			
	VVK2250-03	0.15							
	VVK2350-03	0.2	26.0	1.10	0.5	790			
	VVK2222-03	1.0							



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	Av x 10 ⁻⁶ m ²	Cv converted		
1/8 (6A)	2	VVK2112-01	1.0	4.1	0.17	1.0	500		
	3	VVK2122-01	0.7	7.9	0.33				
	4.5	VVK2132-01	0.3	15	0.61				
1/4 (8A)	2	VVK2112-02	1.0	4.1	0.17				
	3	VVK2122-02	0.7	7.9	0.33				
		VVK2222-02	1.0						
	4.5	VVK2132-02	0.3	15	0.61				
		VVK2232-02	0.45						
	6	VVK2332-02	0.8	23.0	0.95				
VVK2242-02		0.25							
3/8 (10A)	3	VVK2222-03	1.0	7.9	0.33		1.0	670	
		VVK2232-03	0.45						
	4.5	VVK2332-03	0.8	15	0.61	830			
		VVK2242-03	0.25						
	6	VVK2342-03	0.45	23.0	0.95	830			
		VVK2250-03	0.15						
	VVK2342-03	0.45	23.0	0.95	830				
	VVK2222-03	1.0							



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	-20 to 60
183	

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 VXX2120S - 01 - 1G1 -

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.

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

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.

Specifications
For Air
For Water
For Oil
For Steam

Table (1) Model/Orifice Size/Port Size

Normally Closed (N.C.)

Solenoid valve (Port size)			Orifice symbol (Diameter)					
Model	VXX21	VXX22	VXX23	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)	—	● (VXX22)	●	●	●

Normally Open (N.O.)

Solenoid valve (Port size)			Orifice symbol (Diameter)				
Model	VXX21	VXX22	VXX23	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)	—	● (VXX22)	●	●
	—	03 (3/8)	03 (3/8)	—	● (VXX22)	●	●

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		
AC/DC	Voltage symbol	Voltage	S With surge voltage suppressor	L With light	Z With light/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	DC spec. is not available.		

Table (4) Bracket Part No.

Model	Part no.
VXX21	VXX021N-5A
VXX22	
VXX23	

Construction
Dimensions

Dimensions → page 13 (Single unit)

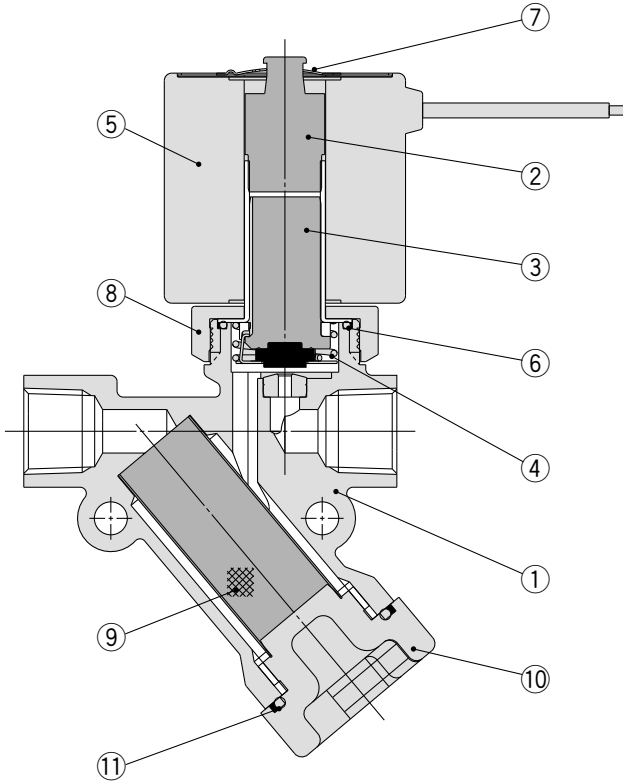
Series VXK21/22/23

For Air, Water, Oil, Steam

Construction: Single Unit

Normally closed (N.C.)

Body material: C37



Component Parts

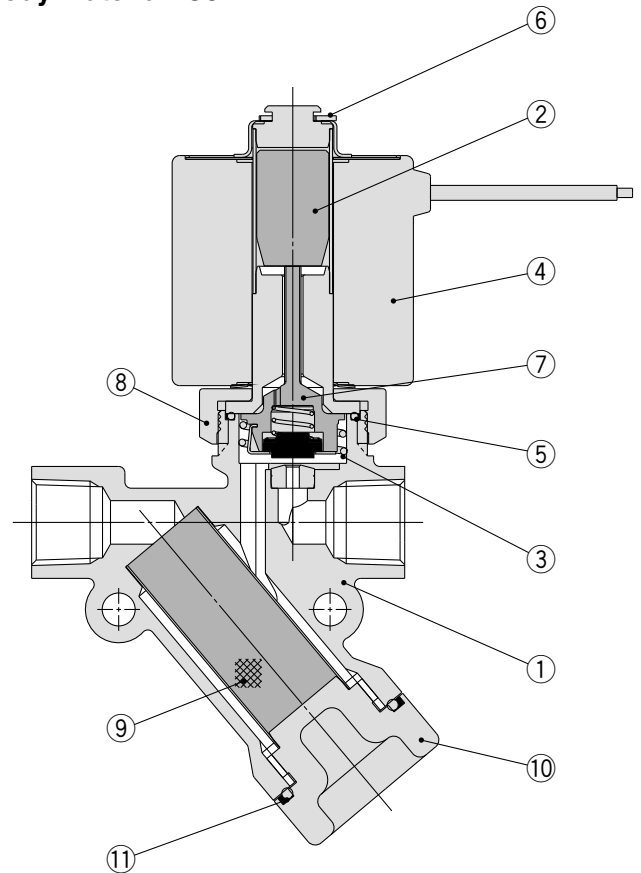
No.	Description	Material
1	Body	C37
2	Tube assembly ^{Note 2)}	Stainless steel, Cu
3	Armature assembly	Stainless steel, PPS, NBR (FKM, EPDM, PTFE)
4	Return spring	Stainless steel
5	Solenoid coil	—
6	O-ring	NBR (FKM, EPDM, PTFE)
7	Clip	SK
8	Nut	C37
9	Strainer	Stainless steel
10	Plug	C37
11	O-ring	NBR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

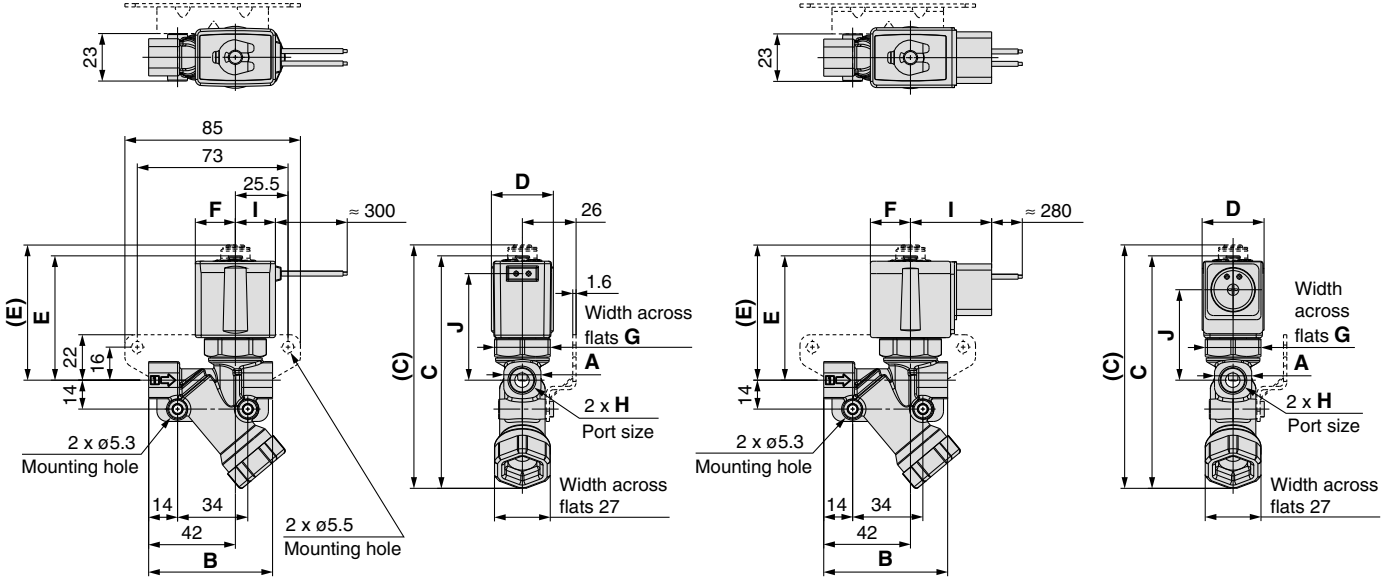
Dimensions

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

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

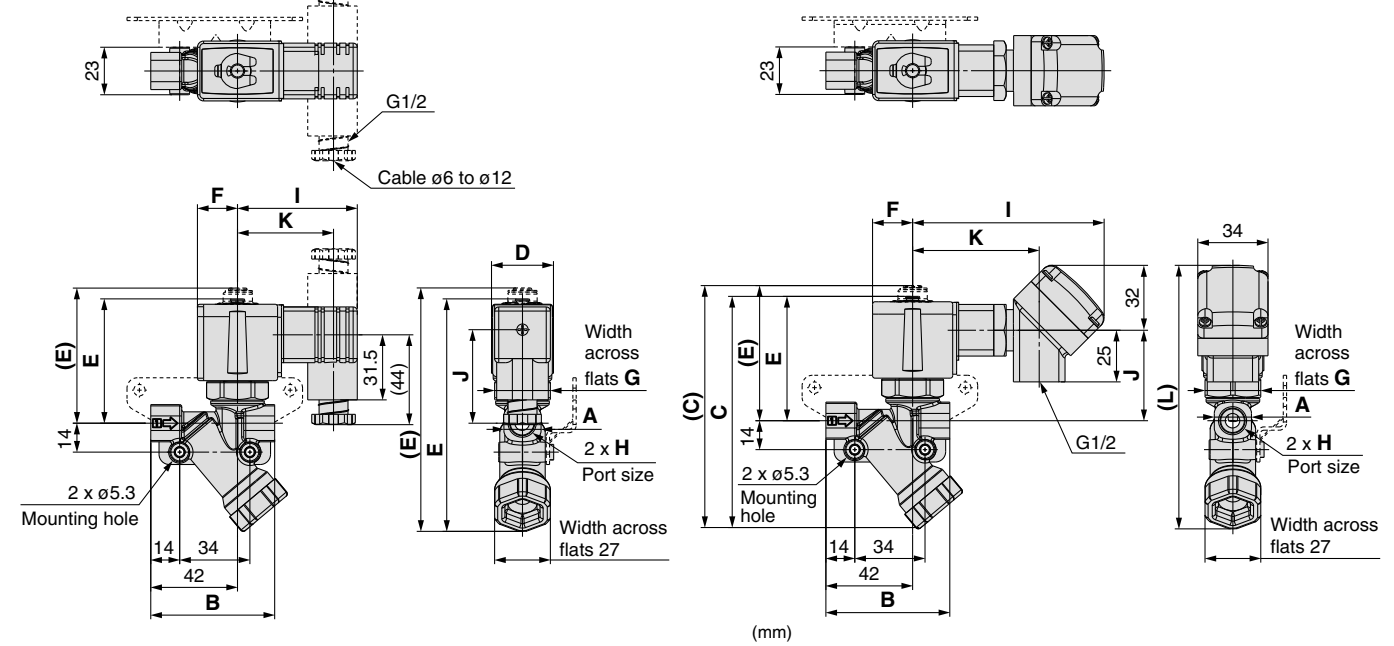
Grommet: G

Conduit: C



DIN terminal: D

Conduit terminal: T



(mm)

Model		Orifice size	Port size H	A	B	C	(C) <small>Note 2)</small>	D	E	(E) <small>Note 2)</small>	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 <small>Note 1)</small>	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 <small>Note 1)</small>	1/4, 3/8	22	63.5	(127.5)	(135)	40	75.5	83.5	25	36

Model		Orifice size	Port size H	Electrical entry <small>Note 3)</small>								Built-in full-wave rectifier type Electrical entry <small>Note 3)</small>													
Normally closed (N.C.)	Normally open (N.O.)			Grommet		Conduit		DIN terminal		Conduit terminal		Grommet		Conduit		DIN terminal		Conduit terminal							
I	J	I	J	I	J	I	J	K	I	J	K	L	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 <small>Note 1)</small>	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 <small>Note 1)</small>	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.

Specifications

For Air

For Water

For Oil

For Steam

Construction

Dimensions

Series VXK21/22/23

For Air, Water, Oil, Steam

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


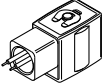
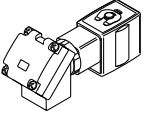
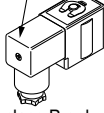
Coil insulation type (Note)

Nil	Class B
H*	Class H

* DIN terminal and DC spec. are not available.

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

Electrical entry

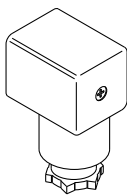
<p>G - Grommet</p> <p>GS - With grommet surge voltage suppressor</p> 	<p>C - Conduit</p> 
<p>T - With conduit terminal</p> <p>TS - With conduit terminal and surge voltage suppressor</p> <p>TL - With conduit terminal and light</p> <p>TZ - With conduit terminal, surge voltage suppressor and light</p> 	<p>D - DIN terminal</p> <p>DS - DIN terminal with surge voltage suppressor</p> <p>DL - DIN terminal with light</p> <p>DZ - DIN terminal with surge voltage suppressor and light</p> <p>DO - For DIN terminal (without connector)</p> <p>* DIN type is available with class B only.</p> 

* 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**GR-□

Model

1	VXK21□□
2	VXK22□□
3	VXK23□□

Valve


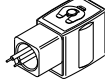
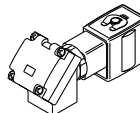
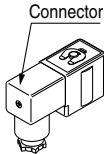
Nil	N.C.
2	N.O.

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
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

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

* 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	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	●	—	—	—	—
DC	J	230 V	●	—	—	—	
	5	24 V	●	●	●	DC spec. is not available.	
	6	12 V	●	—	—	DC spec. is not available.	

* 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.)

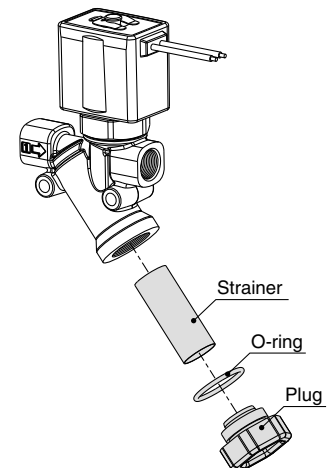
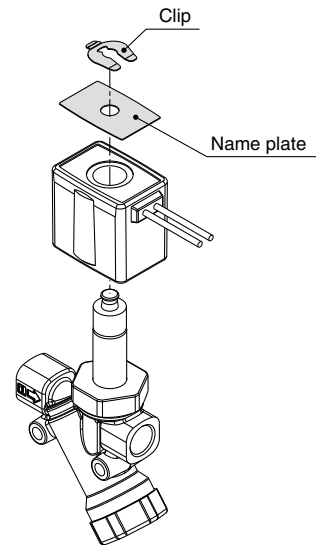
For VX21: **ETW-7**

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 <small>* Part numbers are for a set of ten O-rings.</small>	VXK-OR (NBR) VXK-OR-F (FKM) VXK-OR-E (EPDM) VXK-OR-P (PTFE)



Specifications

For Air

For Water

For Oil

For Steam

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 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
	—	Cv	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

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

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

When

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

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

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

Solenoid Valve Flow Characteristics

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".

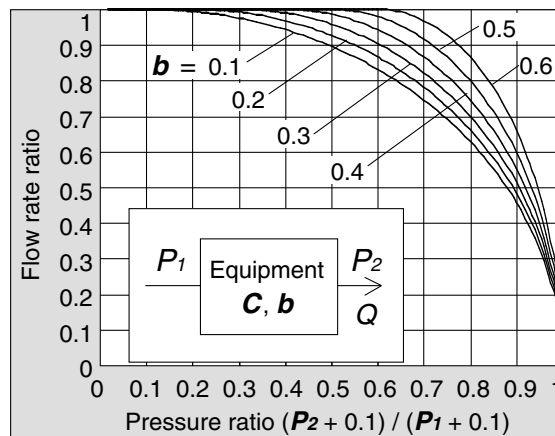
Example)

Obtain the air flow rate for **P₁** = 0.4 [MPa], **P₂** = 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.

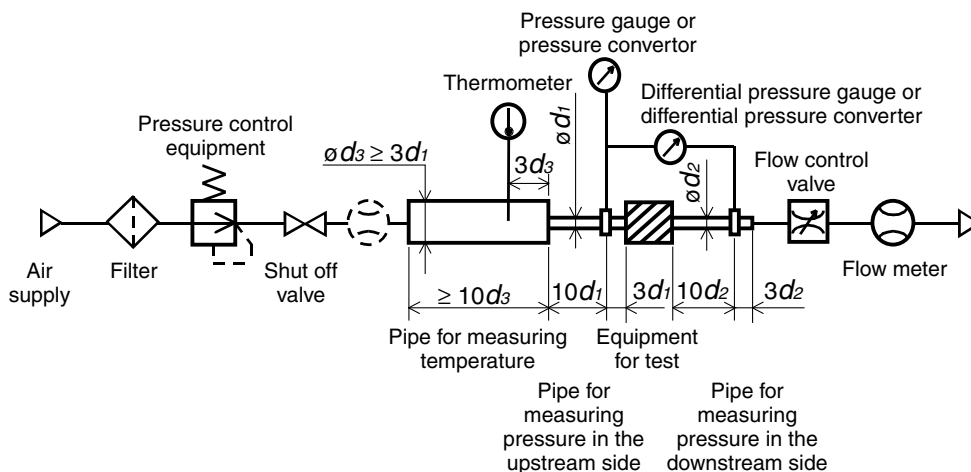


Fig. (1) Test circuit based on ISO 6358, JIS B 8390

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**

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

When

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

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

Conversion with sonic conductance C :

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

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.

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

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]

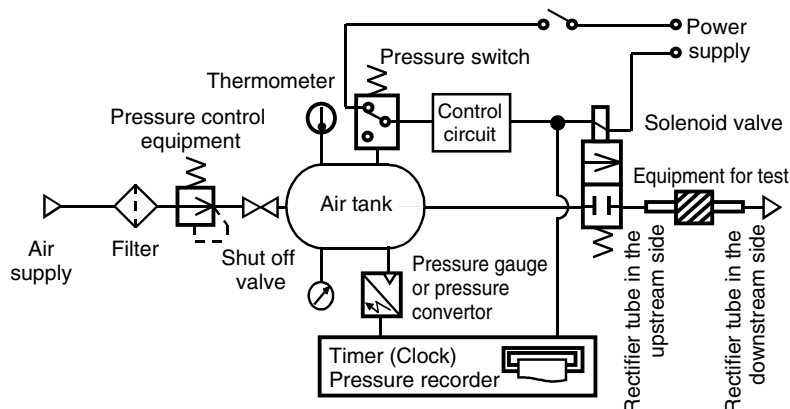


Fig. (2) Test circuit based on JIS B 8390

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.

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

- 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, $0.07 \text{ bar} \leq \Delta P \leq 0.14$ 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.

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

- 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:

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

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

In the case of saturated steam:

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

- 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:

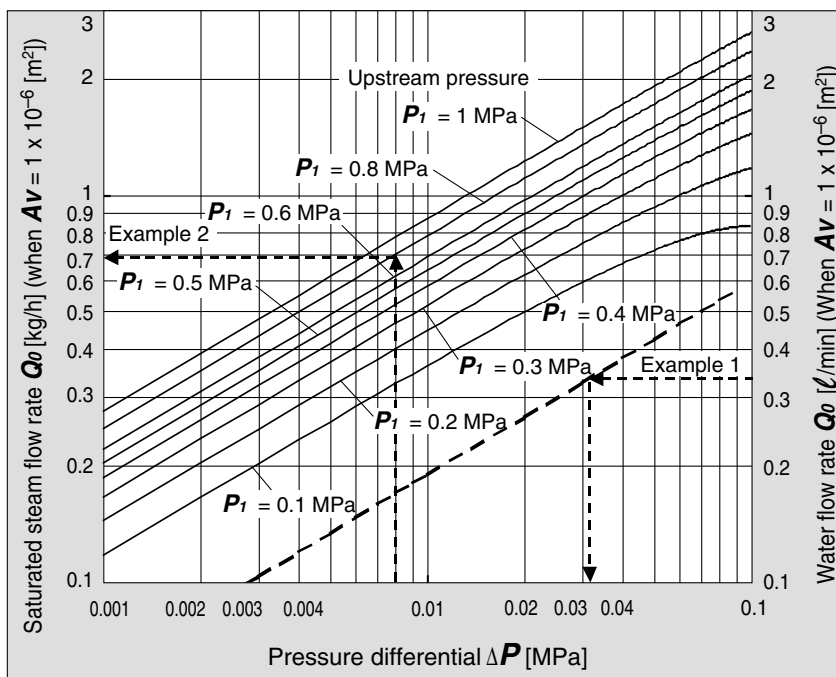
$$Av = 28 \times 10^{-6} Kv = 24 \times 10^{-6} Cv \dots\dots\dots(11)$$

Here,

Kv factor: Value of the clean water flow rate represented by m³/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/in² (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 × 10⁻⁶ [m²]. Since **Qo** = 15/45 = 0.33 [l/min], according to Graph (2), if reading **ΔP** when **Qo** is 0.33, it will be 0.031 [MPa].

Example 2)

Obtain the saturated steam flow rate when **P1** = 0.8 [MPa], **ΔP** = 0.008 [MPa] with a solenoid valve with an **Av** = 1.5 × 10⁻⁶ [m²]. According to Graph (2), if reading **Qo** when **P1** 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 × 10⁴.

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

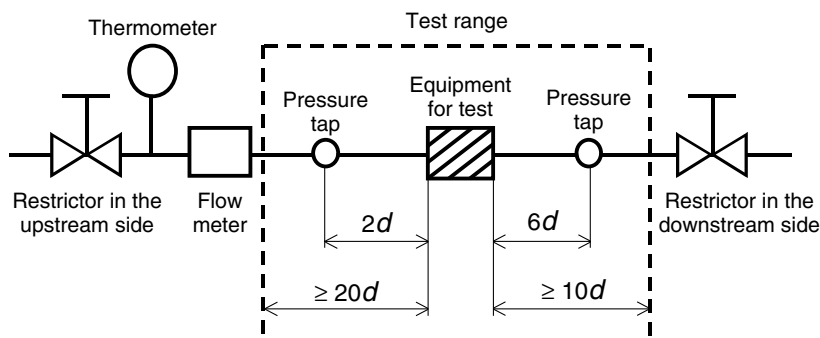
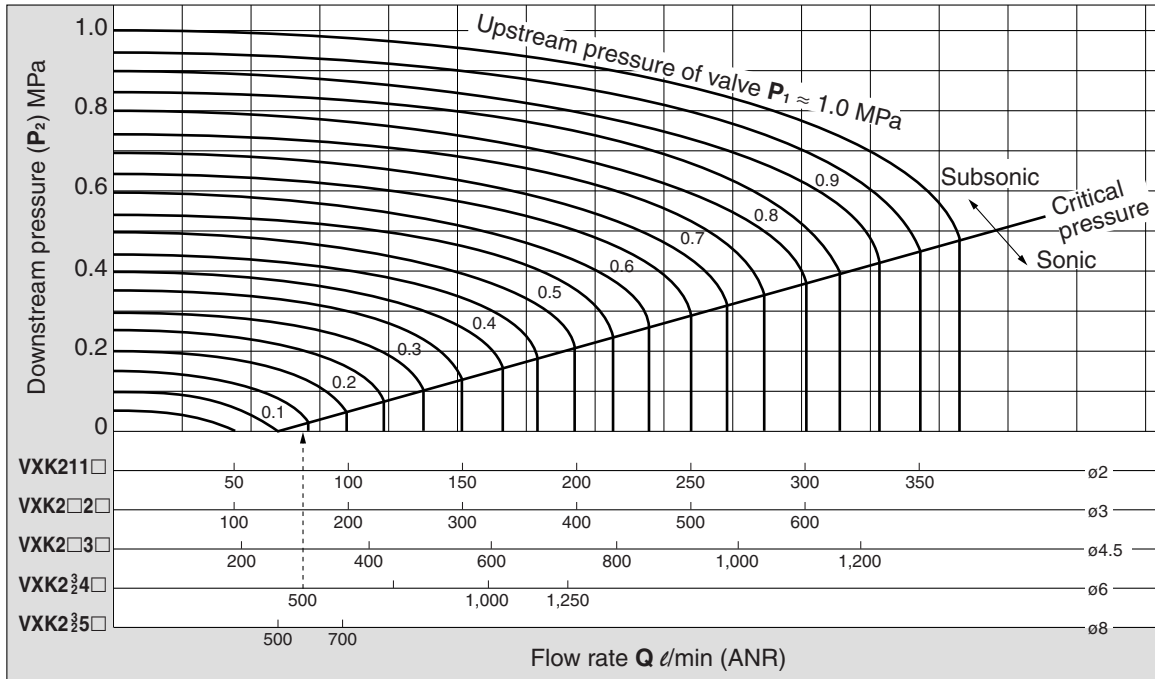


Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005

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



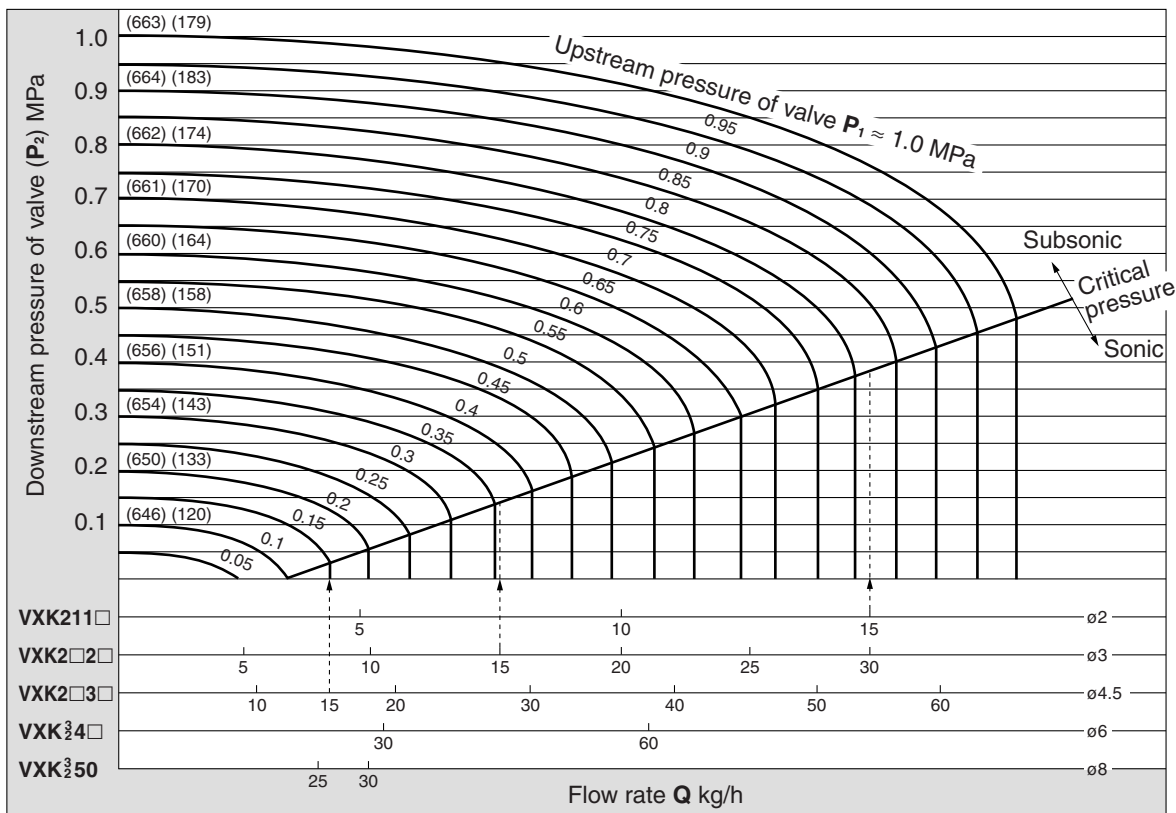
How to read the graph

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 (VXK2₄) and

$P_1 \approx 0.3$ MPa for a ø4.5 orifice (VX2₃).

Saturated Steam



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

How to read the graph

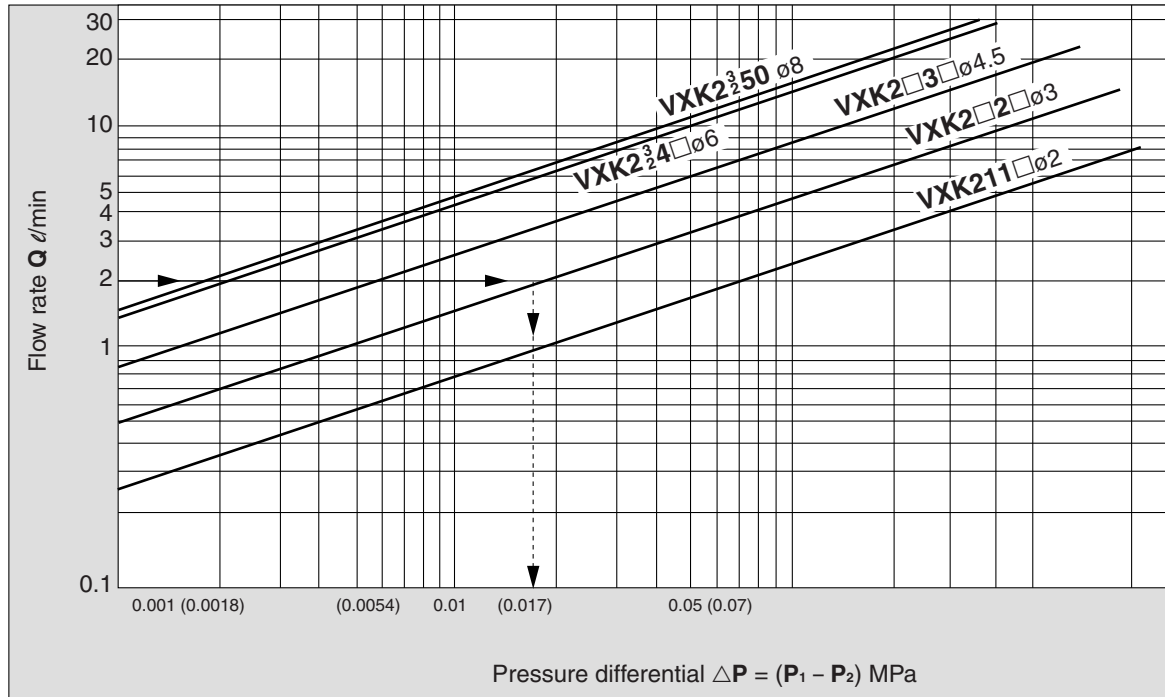
The sonic range pressure to generate a flow rate of 15 kg/h is

$P_1 \approx 0.15$ MPa for ø4.5 orifice (VXK2₃S), $P_1 \approx 0.37$ MPa for ø3 orifice (VXK2₂S), and

$P_1 \approx 0.82$ MPa for ø2 orifice (VXK211S). 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, $\Delta P \approx 0.017$ MPa for a valve with $\phi 3$ orifice (VXK212 \square , 222 \square , 232 \square).

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 ϕ and greater
2	Protected against solid foreign objects of 12 mm ϕ and greater
3	Protected against solid foreign objects of 2.5 mm ϕ and greater
4	Protected against solid foreign objects of 1.0 mm ϕ 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 (止動符) IN and OUT are in a blocked condition (止), but actually in the case of reverse pressure (OUT>IN), there is a limit to the blocking.
(ϕ) 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

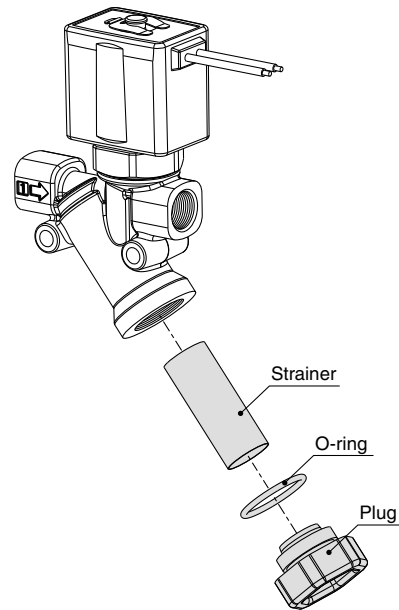
Warning

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)





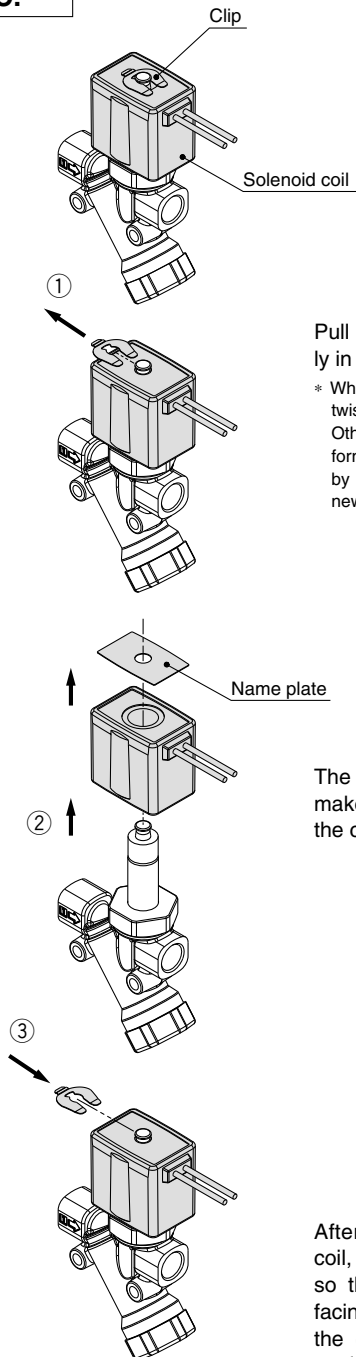
Series VXK Specific Product Precautions 2

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.



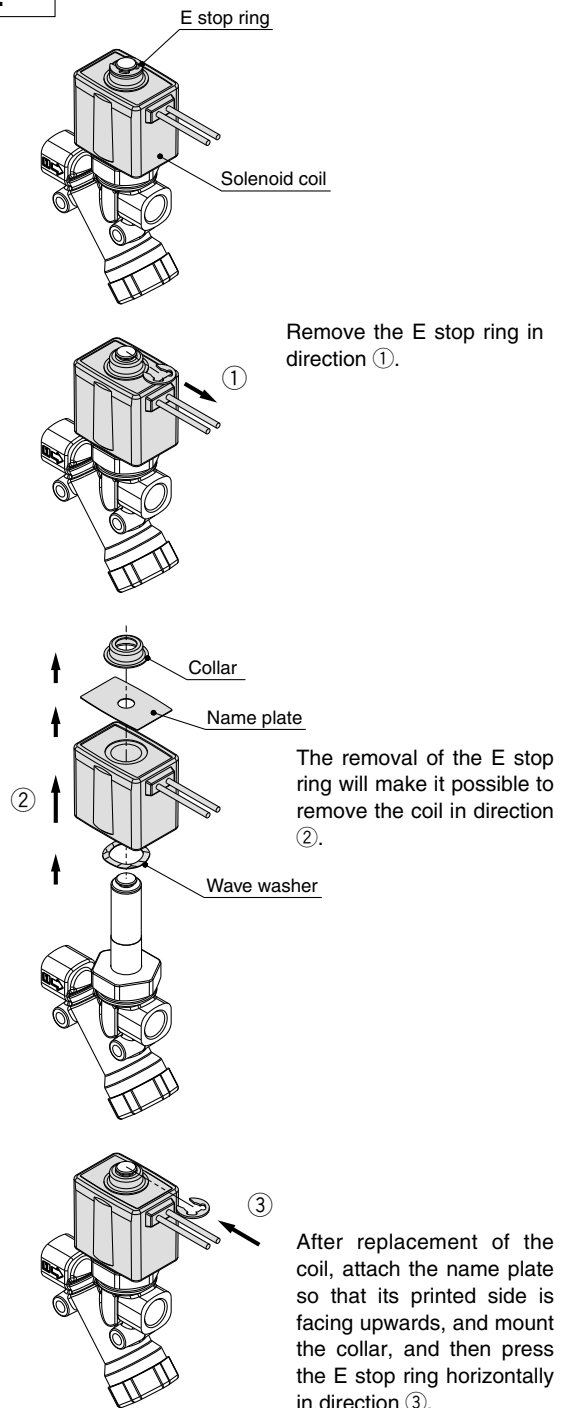
Pull out the clip horizontally in direction ①.

* 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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D-DN

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