Solenoid Valves Flow Characteristics
(How to indicate flow characteristics)

1. Indication of flow characteristics
Indication of the flow characteristics in specifications for equipment such as solenoid valve, etc. is depending on “Table (1)”.

Table (1) Indication of Flow Characteristics

Corresponding equipment	Indication by international standard	Other indications	Standards conforming to
Equipment for pneumatics	*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
Equipment for controlling process fluids	*Av*	—	IEC60534-2-3: 1997 JIS B 2005: 1995 Equipment: JIS B 8471, 8472, 8473
	—	*Cv*	

2. Equipment for pneumatics
2.1 Indication according to the international standards
(1) Standards conforming to

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

Flow rate characteristics are indicated as a result of a comparison between sonic conductance C and critical pressure ratio b.

Sonic conductance C : Values which divide 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 the standard condition.

Critical pressure ratio b : It is the pressure ratio which will turn to the choke flow (downstream pressure/upstream pressure) when it is smaller than this values. (critical pressure ratio)

Choked flow : It is 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. (choked flow)

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 abbreviation (ANR) after the unit depicting air volume. (standard reference atmosphere) Standard conforming to: ISO 8778: 1990 Pneumatic fluid power—Standard reference atmosphere, JIS B 8393: 2000: Pneumatic fluid power—Standard reference atmosphere

(3) Formula of flow rate

It can be indicated by the practical unit as following.

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

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

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

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

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

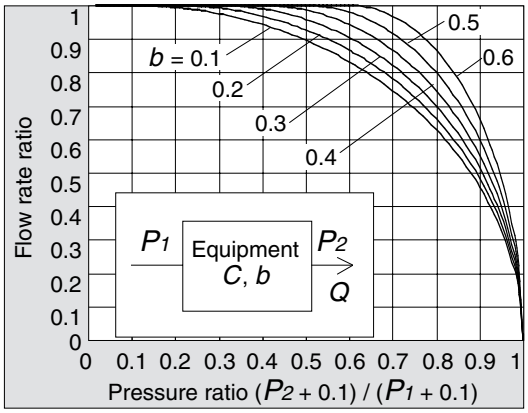
C : Sonic conductance [dm³/(s·bar)]
b : Critical pressure ratio [—]
P_1 : Upstream pressure [MPa]
P_2 : Downstream pressure [MPa]
t : Temperature [°C]
Note) Formula of subsonic flow is the elliptic analogous curve.
Flow characteristics curve is indicated in the Graph (1) For details, please use SMC's "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 the Graph (1), it is going to be 0.7 if it is read by the pressure ratio as 0.8 and the flow ratio to be b = 0.3.
Hence, flow rate = Max. flow x flow ratio = 600 x 0.7 = 420 [dm³/min (ANR)]



Graph (1) Flow characteristics line

(4) Test method

By attaching a test equipment with the test circuit indicated in Fig. (1) while maintaining to a certain amount which does not let the upstream pressure go down below 0.3 MPa, measure the maximum flow to be saturated in the first place. Next, 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 formula of subsonic flow in order to find b, then obtain the critical pressure ratio b from that average.

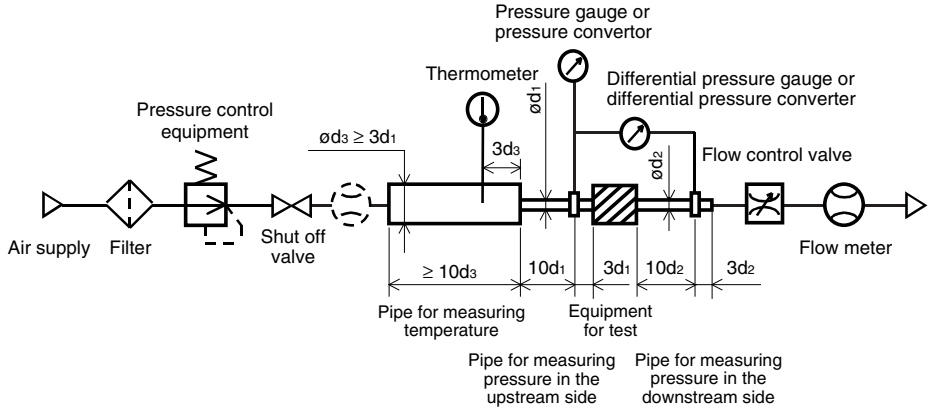


Fig. (1) Test circuit based on ISO 6358, JIS B 8390

Solenoid Valves Flow Characteristics
(How to indicate flow characteristics)

2.2 Effective area *S*

(1) Standards conforming to

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*: is 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* (effective area).

(3) Formula of 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 is good to be described by ℓ (liter), too. 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 by sonic conductance *C* (2), it is the same formula when $b = 0.5$.

(4) Test method

By attaching the equipment for testing with the test circuit shown in Fig. (2), 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 compressed air of a certain pressure (0.5 MPa) which does not go down 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, and then determine the effective area *S* by using the following formula. The volume of air tank should be selected within the specified range by corresponding to the effective area of the equipment being tested. In the case of JIS B 8373, 8374, 8375, 8379, 8381, the pressure values are in parentheses and the coefficient of formula is 12.9.

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

S : Effective area [mm²]
V : Air tank capacity [dm³]
t : Discharging time [s]
Ps : Pressure inside air tank before discharging [MPa]
P : Residual pressure inside air tank after discharging [MPa]
T : Temperature inside air tank before discharging [K]

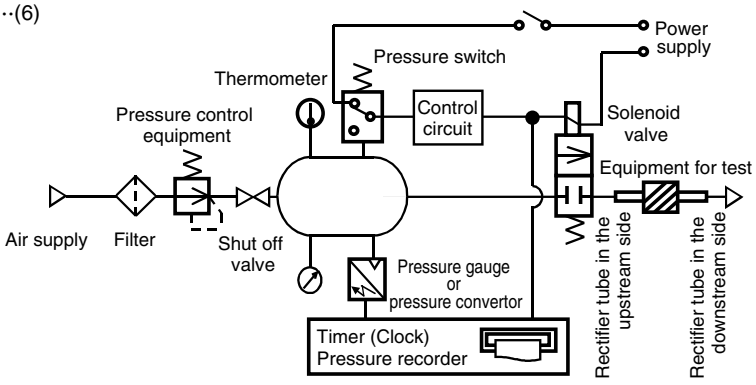


Fig. (2) Test circuit based on JIS B 8390

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]
Pa : Atmospheric pressure [bar absolute]
T_1 : Test conditions of the upstream absolute temperature [K]
is < $P_1 + P_a$ = 6.5 ± 0.2 bar absolute, T_1 = 297 ± 5K, 0.07 bar ≤ ΔP ≤ 0.14 bar.

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

3. Equipment for process fluids

(1) Standards conforming to

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: Regulator 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 known unit. Also, the flow characteristics line shown in the 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 : Relative density [water = 1]

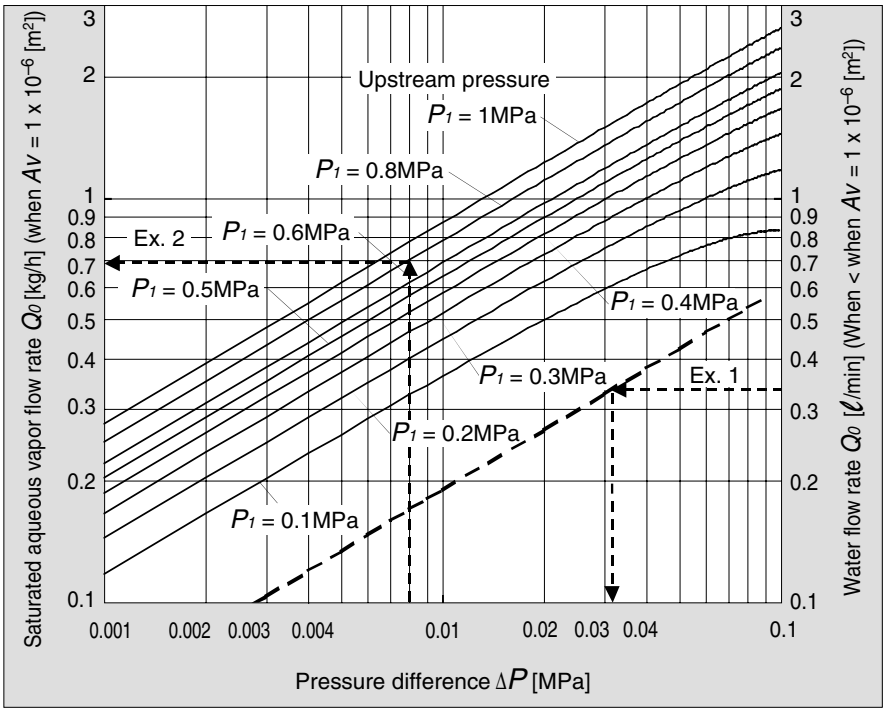
In the case of saturated aqueous vapor:

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

Q : Flow rate [m³/s]
Av : Flow coefficient [m²]
ΔP : Pressure difference [Pa]
P_1 : Relative density [MPa]: $\Delta P = P_1 - P_2$
P_2 : Relative density [MPa]

Solenoid Valves Flow Characteristics
(How to indicate 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 the m^3/h which runs through the valve at 5 to 40°C, when the pressure difference is 1 bar.
Cv factor (Reference values): It is the figures representing the flow rate of clean water by US gal/min which runs through the valve at 60°F, when the pressure difference is 1 lbf/in^2 (psi).
Values of pneumatic Kv are different from Cv because the testing method is different from each other.



Graph (2) Flow characteristics line

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

Example 2)
Obtain the flow rate of saturated aqueous vapor 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 the 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

By attaching the equipment for testing with the test circuit shown in Fig. (3) and running water at 5 to 40°C, 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.

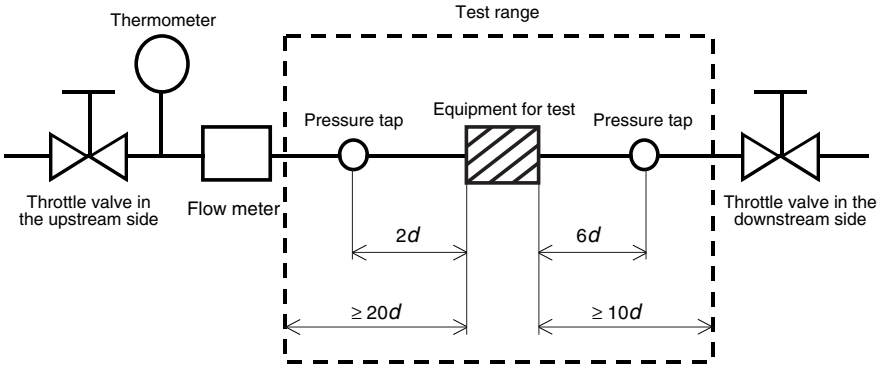
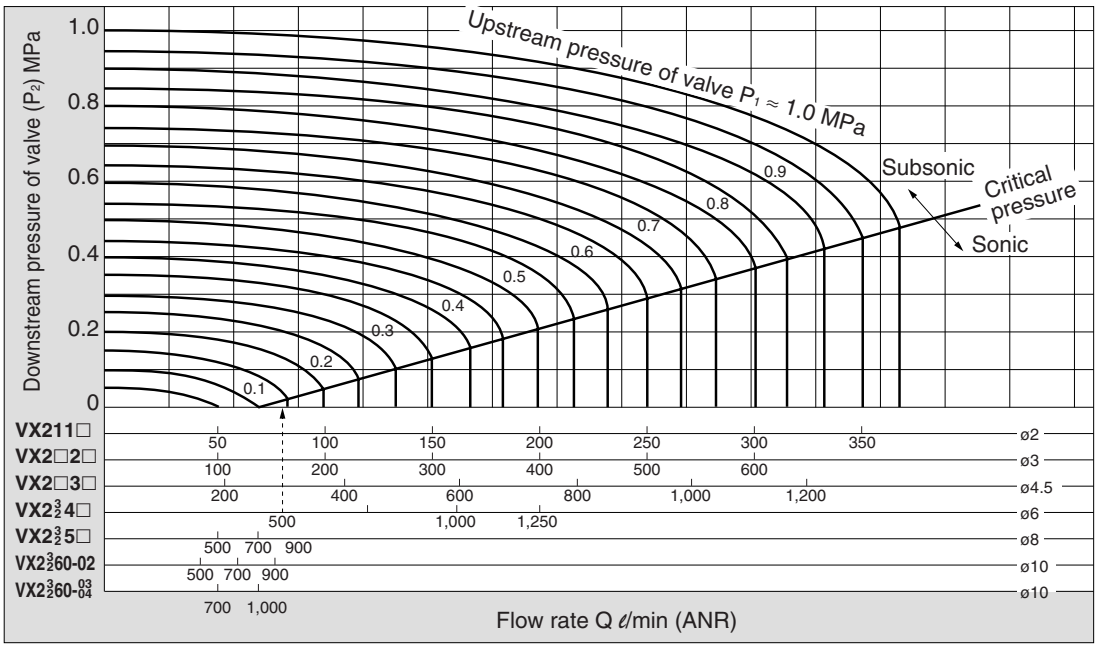


Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005

Flow Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to front matter pages 1 to 6.

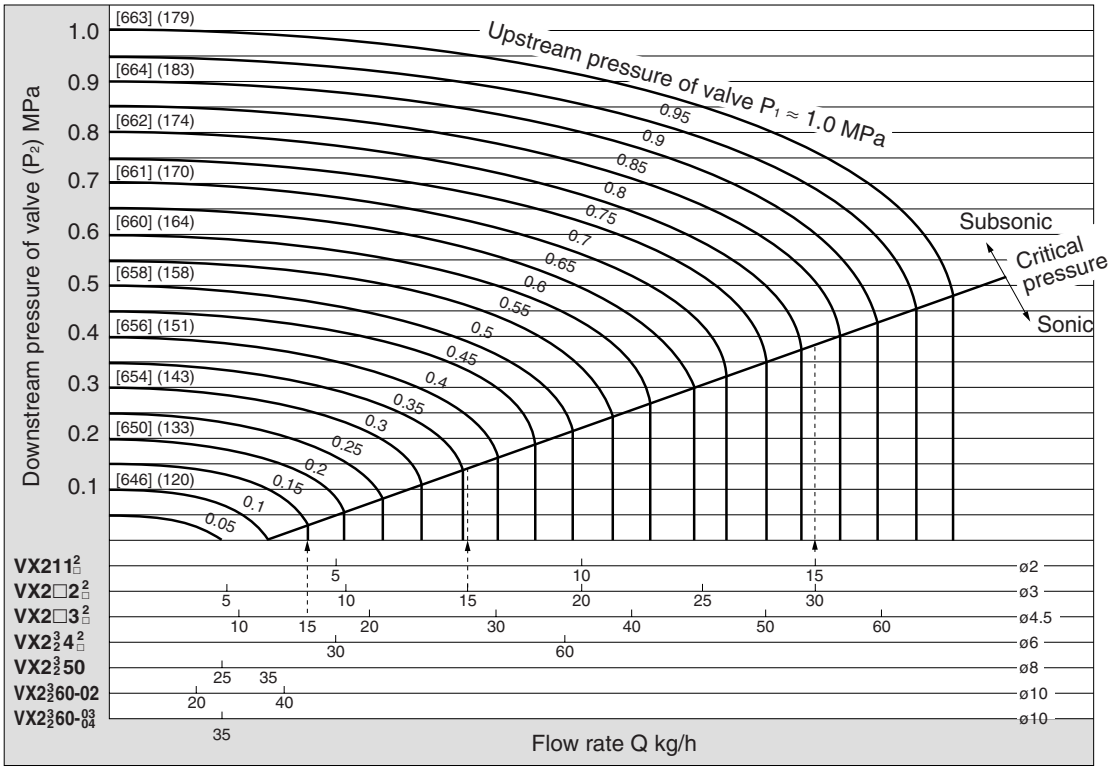
For Air



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 (VX2 3/2 4□), and
$P_1 \approx 0.3$ MPa for a ø4.5 orifice (VX2□3□).

For Saturated Steam



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

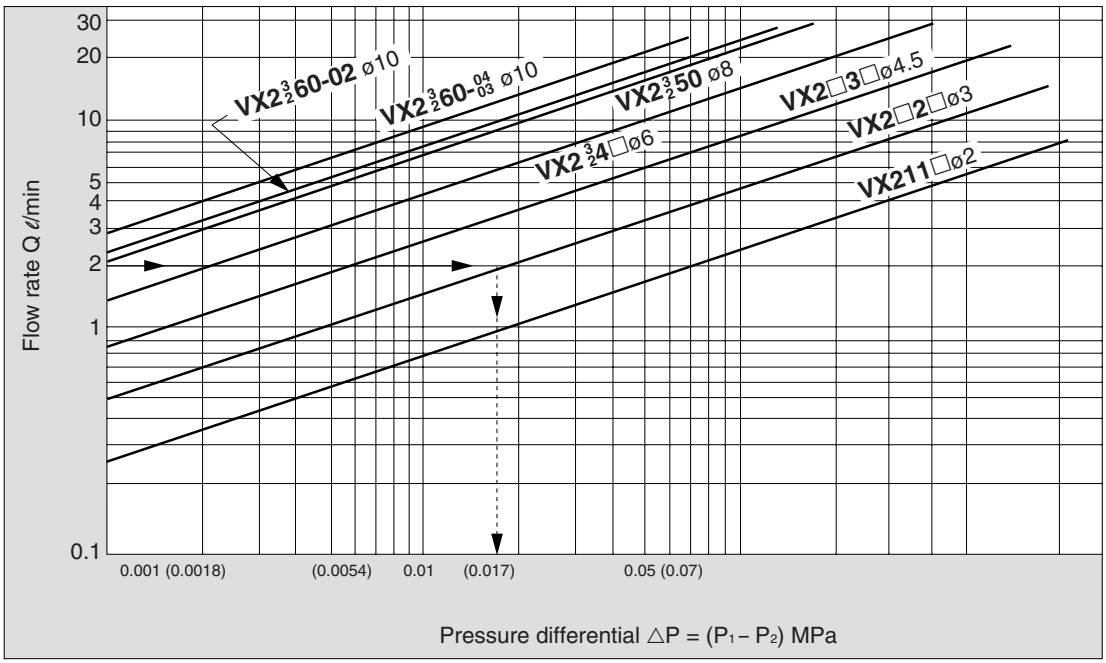
How to read the graph

The sonic range pressure to generate a flow rate of 15 kg/h is
$P_1 \approx 0.15$ MPa for ø4.5 orifice (VX2□3□S), P1 ≈ 0.37 MPa for ø3 orifice (VX2□2□S), and
$P_1 \approx 0.82$ MPa for ø2 orifice (VX211□S). The holding heat differs somewhat depending on the pressure P_1, but at 15 kg/h it is approximately 9700 kcal/h.

Flow Characteristics

Note) Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to front matter pages 1 to 6.

For Water



How to read the graph

When a water flow of 2 ℓ/min is generated, △IP ≈ 0.017 MPa for a valve with ø3 orifice (VX212□, 222□, 232□).

Applicable Fluid Check List

Direct Operated 2 Port Solenoid Valve *Series VX21/22/23*

All Options (Single Unit)

Option symbol	Seal material	Body, Shading coil material	Coil insulation type	Note
Nil	NBR	Brass/Copper	B	—
A	FKM			
B	EPDM			
C	PTFE			
D	FKM		H	
E	EPDM			
G	NBR	Stainless steel/Silver	B	
H	FKM			
J	EPDM			
K	PTFE			
L Note 1)	FKM			High corrosive spec., Oil-free
M Note 1)	FKM			Non-leak, Oil-free
N	FKM		H	—
P	EPDM			
Q	PTFE			Steam (Max. 183°C)
S	PTFE	Brass/Copper		
V Note 1)	FKM		B	Non-leak, Oil-free

Note 1) "L", "M", "V" options are for non-lube treatment.
Note 2) Contact SMC regarding manifold type.

Fluid Name and Option

Fluid (Application)	Option symbol and body material	
	Brass	Stainless steel
Ethyl alcohol	B	J
Caustic soda (25% ≥)	—	J
Gas oil	A	H
Silicon oil	A	H
Steam system (Steam) (Max. 183°C)	S	Q
Steam system (Condensation) (Max. 99°C)	E	P
Medium vacuum (up to 0.1 Pa.abs)	V	M
Parachloroethylene	A	H
Helium	V	M
Non-leak (10^{-6}Pa·m^3/s)	V	M
Heated water (Max. 99°C)	E	P

Note 1) The leakage amount (10^{-6} Pa·m^3/s) of "V", "M" options are values when differential pressure is 0.1 MPa.
Note 2) If using for other fluids, contact SMC.

Glossary of Terms

Pressure Terminology

1. Maximum operating pressure differential

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

2. Minimum operating pressure differential

The minimum pressure differential (differential between the inlet pressure and the outlet pressure) required to keep the main valve fully opened.

3. Maximum system pressure

The maximum pressure that can be applied inside the pipelines (line pressure).
(The pressure differential of the solenoid valve unit must be less than the maximum operating pressure differential.)

4. Proof pressure

The pressure which must be withstood without a drop in performance after returning to the operating pressure range. (value under the prescribed conditions)

Electrical Terminology

1. Apparent power (VA)

Volt-ampere is the product of voltage (V) and current (A). Power dissipation (W): For AC , W = V/A cosθ. For DC, W = V/A.
(Note) cosθ shows power factor. cosθ = 0.6

2. Surge voltage

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

3. Degree of protection

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

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 discharging water for 3 minutes in the prescribed manner. Take appropriate protection measures, since a device is not usable in an environment where a water drop is splashed.

Others

1. Material

NBR: Nitrile rubber

FKM: Fluoro rubber – Trade names: Viton®, Dai-el®, etc.

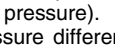
EPDM: Ethylene propylene rubber

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.

Direct Operated 2 Port Solenoid Valve

Series VX21/22/23

For Water, Oil, Steam, Air

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 —— Brass, Stainless steel
Seal —— NBR, FKM, EPDM, PTFE

■ Electrical Entry

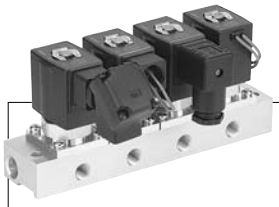
- Grommet
- Conduit
- DIN terminal
- Conduit terminal

Normally Closed (N.C.)

Model		VX21	VX22		VX23	
Orifice size	2 mmø	●	—	—	—	—
	3 mmø	●	●	—	●	—
	4.5 mmø	●	●	—	●	—
	6 mmø	—	●	—	●	—
	8 mmø	—	●	—	●	—
	10 mmø	—	●	●	●	●
Port size		1/8, 1/4	1/4, 3/8	1/2	1/4, 3/8	1/2

Normally Open (N.O.)

Model		VX21	VX22	VX23
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



Manifold

■ Valve

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

■ Base

Common SUP type, Individual SUP type (Base material Aluminum only)

■ Solenoid Coil

Coil: Class B, Class H

■ Rated Voltage

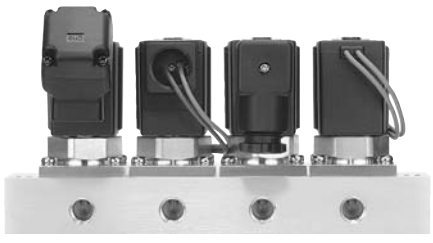
100 VAC, 200 VAC, 110 VAC,
220 VAC, 240 VAC, 230 VAC,
48 VAC, 24 VDC, 12 VDC

■ Material

Body —Aluminum, Brass, Stainless steel
Base —Aluminum, Brass, Stainless steel
Seal —NBR, FKM, EPDM, PTFE

■ Electrical Entry

- Grommet
- Conduit
- DIN terminal
- Conduit terminal



Manifold

Model		VX21	VX22	VX23
Orifice size	2 mmø	●	—	—
	3 mmø	●	●	●
	4.5 mmø	●	●	●
	6 mmø	—	●	●
(Common SUP type) Port size	IN port	3/8		
	OUT port	1/8, 1/4		

Standard Specifications

Valve specifications	**Valve construction**		Direct operated poppet
	Withstand pressure	**MPa**	5.0
	Body material		Brass, Stainless steel
	Seal material		NBR, FKM, EPDM, PTFE
	Enclosure		Dusttight, Low jetproof (equivalent to IP65)∗
	Environment		Location without corrosive or explosive gases
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**	±20% or less of rated voltage
		DC	±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)
VX21	4.5	45
VX22	7	45
VX23	10.5	60

AC Specification

Model		Apparent power (VA)		Temperature rise (C°) Note)
	Frequency (Hz)	Inrush	Holding	
VX21	50	19	9	45
	60	16	7	40
VX22	50	43	19	55
	60	35	16	50
VX23	50	62	30	65
	60	52	25	60

Note) The values are for an ambient temperature of 20°C and at the rated voltage.

Normally Open (N.O.)

DC Specification

Model	Power consumption (W)	Temperature rise (C°) Note)
VX21	4.5	45
VX22	7	45
VX23	10.5	60

AC Specification

Model		Apparent power (VA)		Temperature rise (C°) Note)
	Frequency (Hz)	Inrush	Holding	
VX21	50	22	11	50
	60	18	8	45
VX22	50	46	20	55
	60	38	18	50
VX23	50	64	32	65
	60	54	27	60

Note) The values are for an ambient temperature of 20°C and at the of rated voltage.

● How to order solenoid coil assembly

VX02 [1] N — [1] [G] — [ ] — [ ]

Series

1	VX21□□
2	VX22□□
3	VX23□□

Rated voltage Note 1)

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

Coil insulation type Note 1)

Nil	Class B
H ∗	Class H

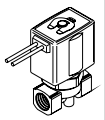
∗ DIN terminal or DC not available.

Valve/Material

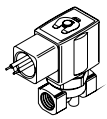
Symbol	Valve
Nil	N.C.
2	N.O.

Electrical entry

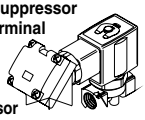
G - **Grommet**
GS - **With grommet surge voltage suppressor**



C - **Conduit**

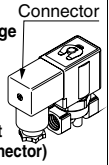


T - **With conduit terminal**
TS - **With conduit terminal and surge voltage suppressor**
TL - **With conduit terminal and light**
TZ - **With conduit terminal, surge voltage suppressor and light**



D - **DIN**
DS - **DIN with surge voltage suppressor**
DL - **DIN with light**
DZ - **DIN with surge voltage suppressor suppressor and light**
DO - **For DIN (without connector)**

Connector



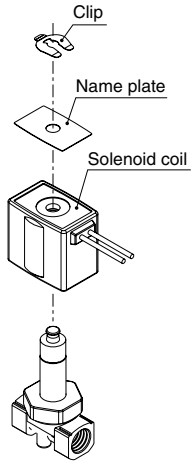
∗ DIN type is available with class B insulation only.

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

● Name plate part no.

AZ-T-VX **Valve model**

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



● Clip part no. (For N.C.)

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

Table (1) Rated Voltage – Electrical Option

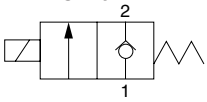
Rated voltage			Class B			Class H		
			S	**L**	**Z**	**S**	**L**	**Z**
AC/DC	Voltage symbol	Voltage	With surge voltage suppressor	With light	With light and surge voltage suppressor	With surge voltage suppressor	With light	With light and surge voltage suppressor
AC	**1**	100 V	●	●	●	●	●	●
	2	200 V	●	●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

For Water/Single Unit

Model/Valve Specifications

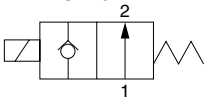
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa) AC	DC	Flow characteristics Av x 10^{-6} m^2	Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VX2110-01**	2.0	1.5	4.1	0.17	3.0	300
	3	**VX2120-01**	0.9	0.5	7.9	0.33		
	4.5	**VX2130-01**	0.4	0.2	15.0	0.61		
1/4 (8A)	2	**VX2110-02**	2.0	1.5	4.1	0.17		
	3	**VX2120-02**	0.9	0.5	7.9	0.33		
		VX2220-02	1.7	1.5				470
		VX2320-02	2.5	3.0				620
	4.5	**VX2130-02**	0.4	0.2	15.0	0.61		300
		VX2230-02	0.6	0.35				470
		VX2330-02	0.85	0.9				620
	6	**VX2240-02**	0.35	0.15	26.0	1.10		470
		VX2340-02	0.55	0.3				620
	8	**VX2250-02**	0.13	0.08	38.0	1.60	1.0	560
		VX2350-02	0.17	0.2				700
	10	**VX2260-02**	0.08	0.03	46.0	1.90		560
		VX2360-02	0.1	0.07				700
3/8 (10A)	3	**VX2220-03**	1.7	1.5	7.9	0.33	3.0	470
		VX2320-03	2.5	3.0				620
	4.5	**VX2230-03**	0.6	0.35	15.0	0.61		470
		VX2330-03	0.85	0.9				620
	6	**VX2240-03**	0.35	0.15	26.0	1.10		470
		VX2340-03	0.55	0.3				620
	8	**VX2250-03**	0.13	0.08	38.0	1.60	1.0	560
		VX2350-03	0.17	0.2				700
	10	**VX2260-03**	0.08	0.03	53.0	2.20		560
		VX2360-03	0.1	0.07				700
1/2 (15A)	10	**VX2260-04**	0.08	0.03	53.0	2.20		560
		VX2360-04	0.1	0.07				700

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 front matter 10 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) AC·DC	Flow characteristics Av x 10^{-6} m^2	Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VX2112-01**	0.9	4.1	0.17	3.0	320
	3	**VX2122-01**	0.45	7.9	0.33		
	4.5	**VX2132-01**	0.2	15.0	0.61		
1/4 (8A)	2	**VX2112-02**	0.9	4.1	0.17		
	3	**VX2122-02**	0.45	7.9	0.33		
		VX2222-02	0.8				500
		VX2322-02	1.2				660
	4.5	**VX2132-02**	0.2	15.0	0.61		320
		VX2232-02	0.3				500
		VX2332-02	0.6				660
	6	**VX2242-02**	0.15	26.0	1.10		500
		VX2342-02	0.35				660
3/8 (10)	3	**VX2222-03**	0.8	7.9	0.33		500
		VX2322-03	1.2				660
	4.5	**VX2232-03**	0.3	15.0	0.61		500
		VX2332-03	0.6				660
	6	**VX2242-03**	0.15	26.0	1.10		500
		VX2342-03	0.35				660

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 front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C) Solenoid valve option (symbol) Nil, G, L	E, P	Ambient temperature (°C)
AC	1 to 60	1 to 99	–20 to 60
DC	1 to 40	—	–20 to 40

Note) With no freezing

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate (With water pressure)
NBR, FKM, EPDM	0.1 cm^3/min or less

How to Order (Single Unit)

Normally Closed (N.C.) VX 21 2 0 □ □ – 01 □ – 1 G 1 – □

Normally Open (N.O.) VX 21 2 2 □ □ – 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.

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

Suffix

Nil	—
Z	Oil-free specification

Select "Nil" because the solenoid valve option "L" 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 2 for ordering coil only.

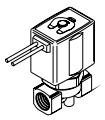
Bracket

Nil	None
B	With bracket

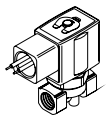
∗ Refer to the table (4) if a bracket is ordered separately.

Electrical entry

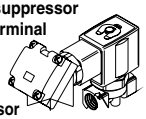
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

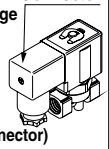


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

Connector



∗ DIN type is available with class B insulation only.

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

Table (1) Port/Orifice Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (diameter)					
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)	**5** (8 mmø)	**6** (10 mmø)
Port no. (Port size)	**01** (1/8)	—	—	●	●	●	—	—	—
	02 (1/4)	—	—	●	●	●	—	—	—
	—	**02** (1/4)	**02** (1/4)	—	●	●	●	●	●
	—	**03** (3/8)	**03** (3/8)	—	●	●	●	●	●
	—	**04** (1/2)	**04** (1/2)	—	—	—	—	—	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (diameter)			
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6mmø)
Port no. (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	Note
Nil	NBR	Brass, Copper	B	—
G		Stainless steel, Silver		
E	EPDM	Brass, Copper	H	Heated water (AC only)
P		Stainless steel, Silver		
L	FKM	Stainless steel, Silver	B	High corrosive, Oil-free

Dimensions → page 22 (Single unit)

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	●	—	—

Rated voltage			Class H		
			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	DC spec. is not available.		
	6	12 V			

Table (4) Bracket Part No.

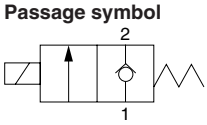
Model	Part no.
VX21$^{1}_{2}$**0**	VX021N-12A
VX22$^{2}_{3}$**0** **VX23**$^{2}_{4}$**0**	VX022N-12A
VX22$^{5}_{6}$**0** **VX23**$^{5}_{6}$**0**	VX023N-12A-L

For Oil/Single Unit

Model/Valve Specifications

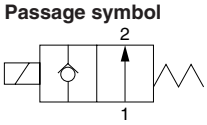
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa) AC	DC	Flow characteristics Av x 10^{-6} m^2	Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)		**VX2110-01**	1.5	1.5	4.1	0.17	3.0	300
	3	**VX2120-01**	0.5	0.5	7.9	0.33		
	4.5	**VX2130-01**	0.2	0.15	15	0.61		
1/4 (8A)	2	**VX2110-02**	1.5	1.5	4.1	0.17		
	3	**VX2120-02**	0.5	0.5	7.9	0.33		
		VX2220-02	1.2	1.2				470
		VX2320-02	1.7	2.0				620
	4.5	**VX2130-02**	0.2	0.15	15	0.61		300
		VX2230-02	0.35	0.3				470
		VX2330-02	0.55	0.85				620
	6	**VX2240-02**	0.2	0.1	26	1.1		470
		VX2340-02	0.35	0.3				620
	8	**VX2250-02**	0.1	0.08	38	1.6	1.0	560
		VX2350-02	0.14	0.2				700
	10	**VX2260-02**	0.05	0.03	46	1.9		560
		VX2360-02	0.08	0.07				700
3/8 (10A)	3	**VX2220-03**	1.2	1.2	7.9	0.33	3.0	470
		VX2320-03	1.7	2.0				620
	4.5	**VX2230-03**	0.35	0.3	15	0.61		470
		VX2330-03	0.55	0.85				620
	6	**VX2240-03**	0.2	0.1	26	1.1		470
		VX2340-03	0.35	0.3				620
	8	**VX2250-03**	0.1	0.08	38	1.6	1.0	560
		VX2350-03	0.14	0.2				700
	10	**VX2260-03**	0.05	0.03	53	2.2		560
		VX2360-03	0.08	0.07				700
1/2 (15A)	10	**VX2260-04**	0.05	0.03	53	2.2		560
		VX2360-04	0.08	0.07				700

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 front matter 10 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) AC·DC	Flow characteristics Av x 10^{-6} m^2	Cv converted	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VX2112-01**	0.8	4.1	0.17	3.0	320
	3	**VX2122-01**	0.45	7.9	0.33		
	4.5	**VX2132-01**	0.2	15	0.61		
1/4 (8A)	2	**VX2112-02**	0.8	4.1	0.17		
	3	**VX2122-02**	0.45	7.9	0.33		
		VX2222-02	0.7				500
		VX2322-02	1.0				660
	4.5	**VX2132-02**	0.2	15	0.61		320
		VX2232-02	0.3				500
		VX2332-02	0.6				660
	6	**VX2242-02**	0.15	26	1.1		500
		VX2342-02	0.35				660
3/8 (10)	3	**VX2222-03**	0.7	7.9	0.33		500
		VX2322-03	1.0				660
	4.5	**VX2232-03**	0.3	15	0.61		500
		VX2332-03	0.6				660
	6	**VX2242-03**	0.15	26	1.1		500
		VX2342-03	0.35				660

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 front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C) Solenoid valve option (symbol) A, H	D, N	Ambient temperature (°C)
AC	–5 Note) to 60	–5 Note) to 120	–20 to 60
DC	–5 Note) to 40	—	–20 to 40

Note) Dynamic viscosity: 50 mm^2/s or less

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate (With oil pressure)
FKM	0.1 cm^3/min or less

Normally Closed (N.C.) VX 21 2 0 □ □ — 01 □ — 1 G 1 — □

Normally Open (N.O.) VX 21 2 2 □ □ — 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.

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

Suffix

Nil	—
Z	Oil-free specification

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 2 for ordering coil only.

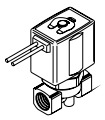
Bracket

Nil	None
B	With bracket

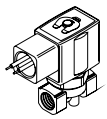
∗ Refer to the table (4) if a bracket is ordered separately.

Electrical entry

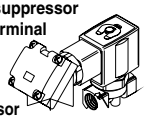
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

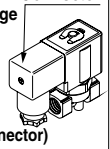


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

Connector



∗ DIN type is available with class B insulation only.

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

Table (1) Port/Orifice Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (diameter)					
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)	**5** (8 mmø)	**6** (10 mmø)
Port no. (Port size)	**01** (1/8)	—	—	●	●	●	—	—	—
	02 (1/4)	—	—	●	●	●	—	—	—
	—	**02** (1/4)	**02** (1/4)	—	●	●	●	●	●
	—	**03** (3/8)	**03** (3/8)	—	●	●	●	●	●
	—	**04** (1/2)	**04** (1/2)	—	—	—	—	—	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (diameter)			
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)
Port no. (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	Brass, Copper	B
H		Stainless steel, Silver	
D		Brass, Copper	H
N		Stainless steel, Silver	

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.

Dimensions → page 22 (Single unit)

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	●	—	—

Rated voltage			Class H		
			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	DC spec. is not available.		
	6	12 V			

Table (4) Bracket Part No.

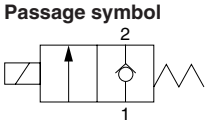
Model	Part no.
VX21 1/2/3 0	VX021N-12A
VX22 2/3/4 0 **VX23 2/3/4 0**	VX022N-12A
VX22 5/6 0 **VX23 5/6 0**	VX023N-12A-L

For Steam /Single Unit

Model/Valve Specifications

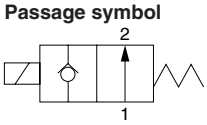
N.C.

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	**VX2110-01**	1.0	4.1	0.17	1.0	300
	3	**VX2120-01**	1.0	7.9	0.33		
	4.5	**VX2130-01**	0.45	15	0.61		
1/4 (8A)	2	**VX2110-02**	1.0	4.1	0.17		
	3	**VX2120-02**	1.0	7.9	0.33		
	4.5	**VX2130-02**	0.45	15	0.61		
		VX2230-02	0.75				470
		VX2330-02	1.0				620
	6	**VX2240-02**	0.4	26	1.1		470
		VX2340-02	0.5				620
	8	**VX2250-02**	0.15	38	1.6	0.5	560
		VX2350-02	0.2				700
	10	**VX2260-02**	0.08	46	1.9		560
		VX2360-02	0.1				700
3/8 (10A)	3	**VX2220-03**	1.0	7.9	0.33	1.0	470
	4.5	**VX2230-03**	0.75	15	0.61		470
		VX2330-03	1.0				620
	6	**VX2240-03**	0.4	26	1.1		470
		VX2340-03	0.5				620
	8	**VX2250-03**	0.15	38	1.6	0.5	560
		VX2350-03	0.2				700
	10	**VX2260-03**	0.08	53	2.2		560
		VX2360-03	0.1				700
1/2 (15A)	10	**VX2260-04**	0.08	53	2.2		560
		VX2360-04	0.1				700

Note) Weight of grommet type. Add 60 g for conduit terminal type.
• Refer to “Glossary of Terms” on front matter 10 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	**VX2112-01**	1.0	4.1	0.17	1.0	320
	3	**VX2122-01**	0.7	7.9	0.33		
	4.5	**VX2132-01**	0.3	15	0.61		
1/4 (8A)	2	**VX2112-02**	1.0	4.1	0.17		
	3	**VX2122-02**	0.7	7.9	0.33		
		VX2222-02	1.0				500
	4.5	**VX2132-02**	0.3	15	0.61		320
		VX2232-02	0.45				500
		VX2332-02	0.8				660
	6	**VX2242-02**	0.25	26	1.1		500
		VX2342-02	0.45				660
3/8 (10)	3	**VX2222-03**	1.0	7.9	0.33		500
	4.5	**VX2232-03**	0.45	15	0.61		
		VX2332-03	0.8				660
	6	**VX2242-03**	0.25	26	1.1		500
		VX2342-03	0.45				660

Note) Weight of grommet type. Add 60 g for conduit terminal type.
• Refer to “Glossary of Terms” on front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
	Solenoid valve option (symbol)	
	S, Q	
AC	183	–20 to 60

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate (With air pressure)
PTFE	300 cm^3/min or less

How to Order (Single Unit)

Normally Closed (N.C.) VX 21 2 0 □ □ – 01 □ – 1 G 1 – □

Normally Open (N.O.) VX 21 2 2 □ □ – 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.

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

Suffix

Nil	—
Z	Oil-free specification

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 2 for ordering coil only.

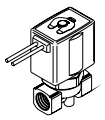
Bracket

Nil	None
B	With bracket

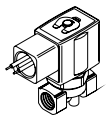
∗ Refer to the table (4) if a bracket is ordered separately.

Electrical entry

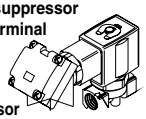
G - Grommet
GS - With grommet surge voltage suppressor



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



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

Table (1) Port/Orifice Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (diameter)					
Model	VX21	VX22	VX23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)	5 (8 mmø)	6 (10 mmø)
Port no. (Port size)	**01** (1/8)	–	–	●	●	●	–	–	–
	02 (1/4)	–	–	●	●	●	–	–	–
	–	**02** (1/4)	**02** (1/4)	–	●	●	●	●	●
	–	**03** (3/8)	**03** (3/8)	–	●	●	●	●	●
	–	**04** (1/2)	**04** (1/2)	–	–	–	–	–	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (diameter)			
Model	VX21	VX22	VX23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)
Port no. (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
S	PTFE	Brass	H
Q		Stainless steel	

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 and surge voltage suppressor
AC	1	100 V	●	●	●
	2	200 V	●	●	●
	3	110 V	●	●	●
	4	220 V	●	●	●
	7	240 V	●	—	—
	8	48 V	●	—	—
	J	230 V	●	—	—
DC	5	24 V	DC spec. is not available.		
	6	12 V			

Table (4) Bracket Part No.

Model	Part no.
VX21[1/2/3]**0**	VX021N-12A
VX22[2/3/4]**0** **VX23**[2/3/4]**0**	VX022N-12A
VX22[5/6]**0** **VX23**[5/6]**0**	VX023N-12A-L

Dimensions → page 22 (Single unit)

For Air/Single Unit

(Inert gas, Non-leak, Medium vacuum)

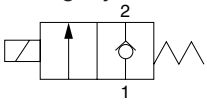
When the fluid is air.

Please select the VCA series when using air because it is specifically designed for it. (The VCA series is limited to air to improve its function and service life.)

Model/Valve Specifications

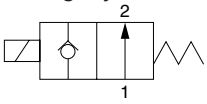
N.C.

Passage symbol



N.O.

Passage symbol



Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa) AC	DC	Flow characteristics C[dm³/(s·bar)]	b	Cv	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VX2110-01**	2.0	1.5	0.59	0.48	0.18	3.0	300
	3	**VX2120-01**	1.1	0.6	1.2	0.45	0.33		
	4.5	**VX2130-01**	0.45	0.2	2.4	0.44	0.61		
1/4 (8A)	2	**VX2110-02**	2.0	1.5	0.59	0.48	0.18		
	3	**VX2120-02**	1.1	0.6	1.2	0.45	0.33		
		VX2220-02	2.0	1.5					470
		VX2320-02	3.0	3.0					620
	4.5	**VX2130-02**	0.45	0.2	2.3	0.46	0.61		300
		VX2230-02	0.75	0.35					470
		VX2330-02	1.0	0.9					620
	6	**VX2240-02**	0.4	0.15	4.1	0.3	1.1		470
		VX2340-02	0.5	0.35					620
	8	**VX2250-02**	0.15	0.08	6.4	0.3	1.6	1.0	560
		VX2350-02	0.2	0.2					700
	10	**VX2260-02**	0.08	0.03	8.8	0.3	2.0		560
		VX2360-02	0.1	0.07					700
3/8 (10A)	3	**VX2220-03**	2.0	1.5	1.2	0.45	0.33	3.0	470
		VX2320-03	3.0	3.0					620
	4.5	**VX2230-03**	0.75	0.35	2.3	0.46	0.61		470
		VX2330-03	1.0	0.9					620
	6	**VX2240-03**	0.4	0.15	4.1	0.3	1.1		470
		VX2340-03	0.5	0.35					620
	8	**VX2250-03**	0.15	0.08	6.4	0.3	1.6	1.0	560
		VX2350-03	0.2	0.2					700
	10	**VX2260-03**	0.08	0.03	11	0.3	2.2		560
		VX2360-03	0.1	0.07					700
1/2 (15A)	10	**VX2260-04**	0.08	0.03	11	0.3	2.2		560
		VX2360-04	0.1	0.07					700

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 front matter 10 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 C[dm³/(s·bar)]	b	Cv	Max. system pressure (MPa)	Note) Weight (g)
1/8 (6A)	2	**VX2112-01**	1.5	0.59	0.48	0.18	3.0	320
	3	**VX2122-01**	0.7	1.2	0.45	0.33		
	4.5	**VX2132-01**	0.3	2.3	0.46	0.61		
1/4 (8A)	2	**VX2112-02**	1.5	0.59	0.48	0.18		
	3	**VX2122-02**	0.7	1.2	0.45	0.33		
		VX2222-02	1.0					500
		VX2322-02	1.6					660
	4.5	**VX2132-02**	0.3	2.3	0.46	0.61		320
		VX2232-02	0.45					500
		VX2332-02	0.8					660
	6	**VX2242-02**	0.25	4.1	0.3	1.1		500
		VX2342-02	0.45					660
3/8 (10)	3	**VX2222-03**	1.0	1.2	0.45	0.33		500
		VX2322-03	1.6					660
	4.5	**VX2232-03**	0.45	2.3	0.46	0.61		500
		VX2332-03	0.8					660
	6	**VX2242-03**	0.25	4.1	0.3	1.1		500
		VX2342-03	0.45					660

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 front matter 10 for details on the max. operating pressure differential and the max. system pressure.

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C) Solenoid valve option (symbol) Nil, G	V, M	Ambient temperature (°C)
AC	–10 Note) to 80	–10 Note) to 60	–20 to 60
DC	–10 Note) to 60	–10 Note) to 40	–20 to 40

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

Tightness of Valve (Leakage Rate)

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

Note) Value on option "V", "M" (non-leak, medium vacuum)

How to Order (Single Unit)

Normally Closed (N.C.) VX 21 2 0 □ □ — 01 □ — 1 G 1 — □

Normally Open (N.O.) VX 21 2 2 □ □ — 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.

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

Suffix

Nil	—
Z	Oil-free specification

Select "Nil" because the solenoid valve options "V", "M" are 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 2 for ordering coil only.

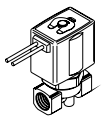
Bracket

Nil	None
B	With bracket

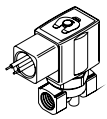
∗ Refer to the table (4) if a bracket is ordered separately.

Electrical entry

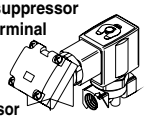
G - Grommet
GS - With grommet surge voltage suppressor



C - Conduit

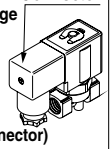


T - With conduit terminal
TS - With conduit terminal and surge voltage suppressor
TL - With conduit terminal and light
TZ - With conduit terminal, surge voltage suppressor and light



D - DIN
DS - DIN with surge voltage suppressor
DL - DIN with light
DZ - DIN with surge voltage suppressor and light
DO - For DIN (without connector)

Connector



∗ DIN type is available with class B insulation only.

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

Table (1) Port/Orifice Size

Normally Closed (N.C.)

Solenoid valve (Port size)				Orifice symbol (diameter)					
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)	**5** (8 mmø)	**6** (10 mmø)
Port no. (Port size)	**01** (1/8)	—	—	●	●	●	—	—	—
	02 (1/4)	—	—	●	●	●	—	—	—
	—	**02** (1/4)	**02** (1/4)	—	●	●	●	●	●
	—	**03** (3/8)	**03** (3/8)	—	●	●	●	●	●
	—	**04** (1/2)	**04** (1/2)	—	—	—	—	—	●

Normally Open (N.O.)

Solenoid valve (Port size)				Orifice symbol (diameter)			
Model	**VX21**	**VX22**	**VX23**	**1** (2 mmø)	**2** (3 mmø)	**3** (4.5 mmø)	**4** (6 mmø)
Port no. (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	Note
Nil	NBR	Brass	B	—
G		Stainless steel		
V	FKM	Brass		Non-leak (10^{-6} Pam³/sec), Oil-free, Medium vacuum (0.1 Pa.abs)
M		Stainless steel		

Please select the VCA series when using air because it is specifically designed for it.
(The VCA series is limited to air to improve its function and service life.)

Table (3) Rated Voltage – Electrical Entry – 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	●	—	—

Table (4) Bracket Part No.

Model	Part no.
VX21$^{1}_{2}$**0**	VX021N-12A
VX22$^{2}_{3}$**0** **VX23**$^{2}_{3}$**0**	VX022N-12A
VX22$^{5}_{6}$**0** **VX23**$^{5}_{6}$**0**	VX023N-12A-L

Dimensions → page 22 (Single unit)

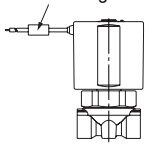
Low Power Consumption Type
Series VX21/22/23
For Water, Air

Solenoid Coil Electricity Specifications

Model		VX21	VX22	VX23
Rated voltage (V)		24 DC		
Power consumption (W)	Inrush	3	4	5
	Holding	0.8	0.8	0.8

(Equivalent to IP40 enclosure)

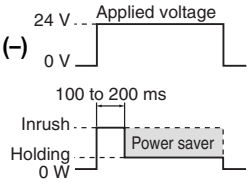
Power saving circuit



Electric Circuit Diagram

With power saving circuit
(There is the polarity. Red (+), Black (–)

Energy saving type/
Electrical power waveform
(Rated voltage 24 VDC)



Model/Valve Specifications N.C.

Normally Closed (N.C.)

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics					Max. system pressure (MPa)
			DC	Av x 10^{-6} m^2	Cv converted	C[dm^3/(s·bar)]	b	Cv	
1/8 (6A)	2	VX2110-01	1.0	4.1	0.17	0.59	0.48	0.18	3.0
	3	VX2120-01	0.3	7.9	0.33	1.2	0.45	0.33	
	4.5	VX2130-01	0.1	15.0	0.61	2.4	0.44	0.61	
1/4 (8A)	2	VX2110-02	1.0	4.1	0.17	0.59	0.48	0.18	
	3	VX2120-02	0.3	7.9	0.33	1.2	0.45	0.33	
		VX2220-02	0.8						
		VX2320-02	1.0						
	4.5	VX2130-02	0.1	15.0	0.61	2.3	0.46	0.61	
		VX2230-02	0.15						
		VX2330-02	0.2						
	6	VX2240-02	0.05	26.0	1.10	4.1	0.3	1.1	
		VX2340-02	0.1						
	8	VX2250-02	0.03	38.0	1.60	6.4	0.3	1.6	1.0
		VX2350-02	0.05						
	10	VX2360-02	0.02	46.0	1.90	8.8	0.3	2.0	

Port size	Orifice size (mmø)	Model	Max. operating pressure differential (MPa)	Flow characteristics					Max. system pressure (MPa)
			DC	Av x 10^{-6} m^2	Cv converted	C[dm^3/(s·bar)]	b	Cv	
3/8 (10A)	3	VX2220-03	0.8	7.9	0.33	1.2	0.45	0.33	3.0
		VX2320-03	1.0						
	4.5	VX2230-03	0.15	15.0	0.61	2.3	0.46	0.61	
		VX2330-03	0.2						
	6	VX2240-03	0.05	26.0	1.10	4.1	0.3	1.1	
		VX2340-03	0.1						
	8	VX2250-03	0.03	38.0	1.60	6.4	0.3	1.6	1.0
		VX2350-03	0.05						
	10	VX2360-03	0.02	53.0	2.20	11	0.3	2.2	
1/2 (15A)	10	VX2360-04	0.02	53.0	2.20	11	0.3	2.2	

Operating Fluid and Ambient Temperature

Power source	Operating fluid temperature (°C)	Ambient temperature (°C)
	Solenoid valve option (symbol)	
	Nil, G	
DC	1 to 40	–20 to 40

Note) With no condensation

Tightness of Valve (Leakage Rate)

Seal material	Leakage rate
NBR	0.1 cm^3/min or less (With water pressure)
	1 cm^3/min or less (Air)

How to Order (Single Unit)

Normally Closed (N.C.) **VX 21 2 0 □ □ – 01 □ – 5 GY1 – □**

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

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

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

Suffix

Nil	—
Z	Oil-free specification

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

Thread type

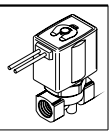
Nil	Rc
T	NPTF
F	G
N	NPT

Rated voltage

5	24 VDC

Electrical entry

GY-	Conduit (With power saving circuit)



Bracket

Nil	None
B	With bracket

* Refer to the table (3) if bracket is separately ordered.

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

Solenoid valve (Port size)				Orifice symbol (diameter)					
Model	VX21	VX22	VX23	1 (2 mmø)	2 (3 mmø)	3 (4.5 mmø)	4 (6 mmø)	5 (8 mmø)	6 (10 mmø)
Port no. (Port size)	01 (1/8)	–	–	●	●	●	–	–	–
	02 (1/4)	–	–	●	●	●	–	–	–
	–	02 (1/4)	02 (1/4)	–	●	●	●	●	● (VX23)
	–	03 (3/8)	03 (3/8)	–	●	●	●	●	● (VX23)
	–	04 (1/2)	04 (1/2)	–	–	–	–	–	● (VX23)

Table (2) Solenoid Valve Option

Option symbol	Seal material	Body material	Coil insulation type	Operating fluid
Nil	NBR	Brass	B	Water, Air
G		Stainless steel		

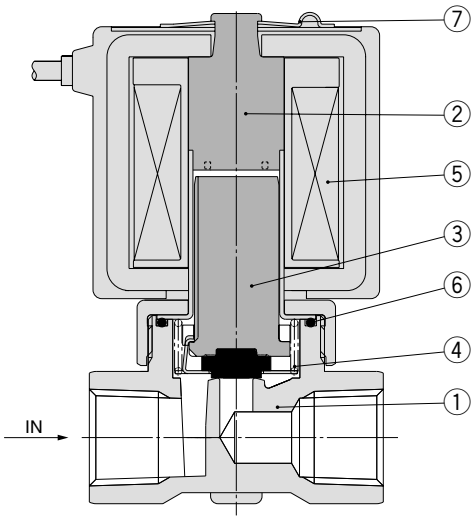
Table (3) Bracket Part No.

Model	Part no.
VX21 1/2/3 0	VX021N-12A
VX22 2/3/4 0 VX23 2/3/4 0	VX022N-12A
VX22 5/6 0 VX23 5/6 0	VX023N-12A-L

SMC

Construction: Single Unit

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

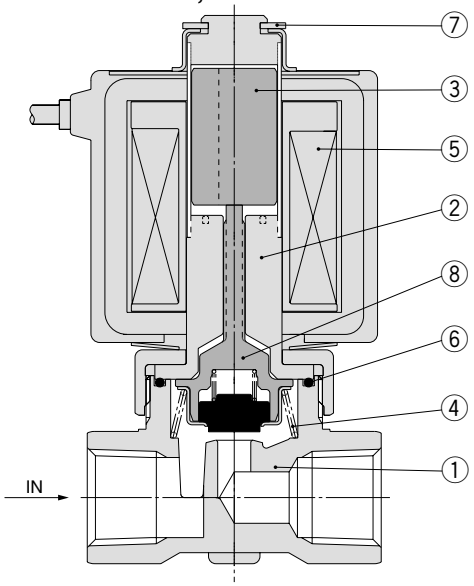


Component Parts

No.	Description	Material	
		Body material Brass specification	Body material stainless steel specification
1	**Body**	Brass	Stainless steel
2	**Tube assembly**	Stainless steel, Copper	Stainless steel, Silver
3	**Armature assembly**	(NBR, FKM, EPDM, PTFE) Stainless steel, PPS	
4	**Return spring**	Stainless steel	
5	**Solenoid coil**	Class B/H molded	
6	**O-ring**	(NBR, FKM, EPDM, PTFE)	
7	**Clip**	SK	

The materials in parentheses are the seal materials.

Normally open (N.O.)
Body material: Brass, Stainless Steel



Component Parts

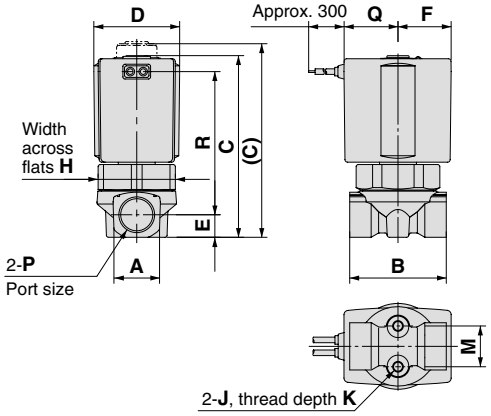
No.	Description	Material	
		Body material Brass specification	Body material stainless steel specification
1	**Body**	Brass	Stainless steel
2	**Tube assembly**	Stainless steel, Copper	Stainless steel, Silver
3	**Armature assembly**	Stainless steel	
4	**Return spring**	Stainless steel	
5	**Solenoid coil**	Class B/H molded	
6	**O-ring**	(NBR, FKM, EPDM, PTFE)	
7	**Clip**	SK	
8	**Push rod assembly**	(NBR, FKM, EPDM, PTFE) Stainless steel, PPS	

The materials in parentheses are the seal materials.

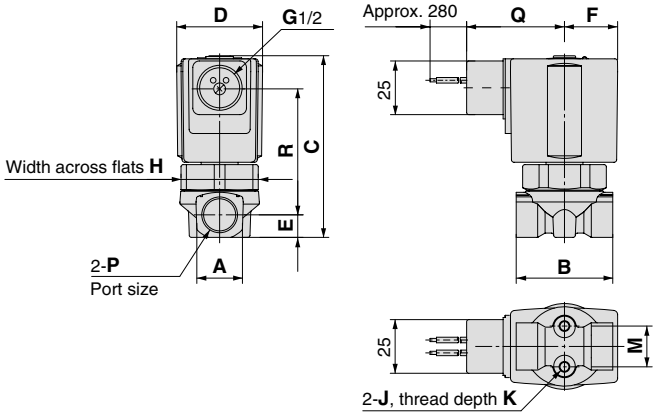
Dimensions: Single Unit/Body Material: Brass, Stainless Steel

Normally closed (N.C.): VX21□0/VX22□0/VX23□0
Normally open (N.O.): VX21□2/VX22□2/VX23□2

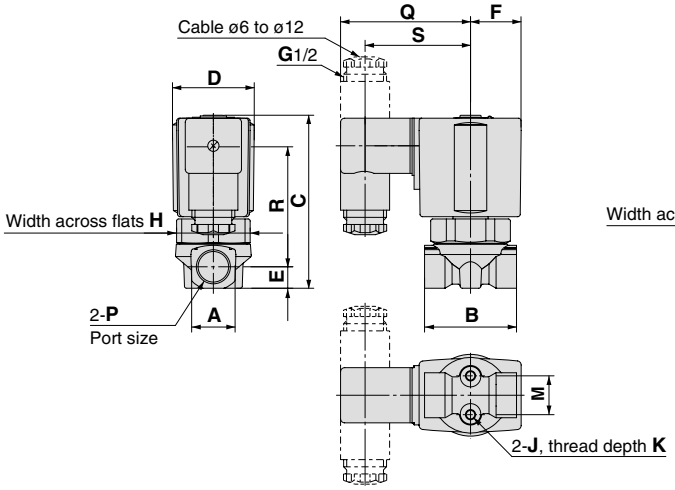
Grommet: G



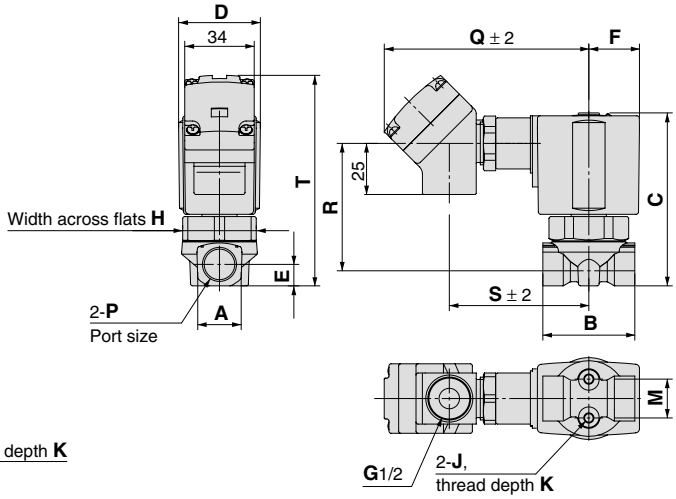
Conduit: C



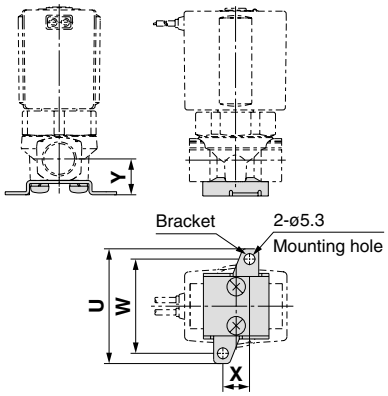
DIN terminal: D



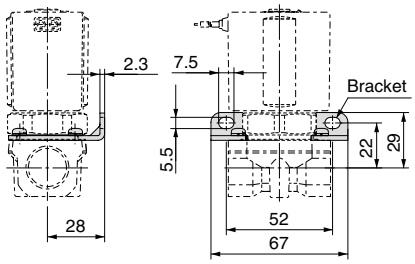
Conduit terminal: T



Specifications with bracket
Orifice ø2, ø3, ø4.5, ø6



Orifice ø8, ø10



(mm)

Model		Orifice size	Port size P	A	B	C		D	E	F	H	Mounting dimensions			Electrical entry										Bracket mounting			
															Grommet		Conduit		DIN terminal			Conduit terminal							
Normally closed	Normally open											J	K	M	Q	R	Q	R	Q	R	S	Q	R	S	T	U	W	X	Y
VX21□0	**VX21□2**	ø2, ø3, ø4.5	1/8, 1/4	18	40	68	(76)	30	9	19.5	27	M4	6	12.8	19.5	50	40	42.5	58	42.5	46	95	42.5	62	85	46	36	11	15
VX22□0	**VX22□2**	ø3, ø4.5, ø6	1/4, 3/8	22	45	78	(86)	35	10.5	22.5	32	M5	8	19	22.5	60	43	52	61	52	49	98	52	65	96.5	56	46	13	17.5
VX22□0	—	ø8, ø10	1/4, 3/8, 1/2	30	50	85	–		14			M5	8	23		63		55		55			55		103.5	–	–	–	–
VX23□0	**VX23□2**	ø3, ø4.5, ø6	1/4, 3/8	22	45	85	(93)	40	10.5	25	36	M5	8	19	25	66	46	58	63	58	50	101	58	68	103	56	46	13	17.5
VX23□0	—	ø8, ø10	1/4, 3/8, 1/2	30	50	92	–		14			M5	8	23		70		61		61			61		111	–	–	–	–

The figures in parentheses are the normally open type.