Angle Seat Valve / Air Operated Type

Steam
* Can be used with air or water

RoHS

Low pressure loss due to angle seat structure! Reduced leakage with rubber seal!

Long service life

3 million cycles *1 (Steam)

5 million cycles *1 (Air)

*1 Based on SMC's test conditions

Low leakage

10

cm³/min *2 or less

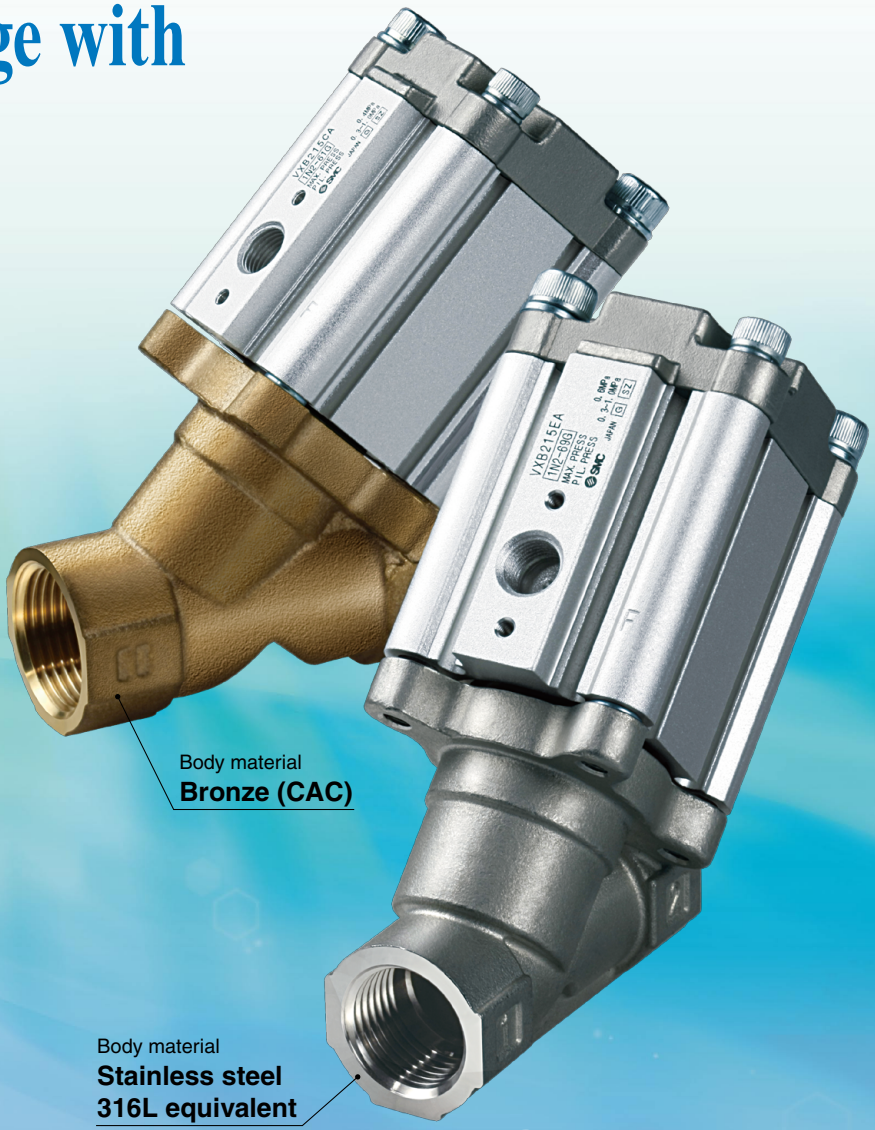
*2 With air

Space saving

Height

100 mm *3

*3 Port size: 3/8



New With indicator

VXB Series

SMC

CAT.ES70-54B

Angle Seat Valve / Air Operated Type *VXB Series*

Long service life

Steam **3 million cycles**[*1]

Air **5 million cycles**[*1]

*1 Based on SMC's test conditions

2 Squeeze seal with scraper function
A scraper function has been added to the seal to shut off fluid leakage.

3 Resin scraper
Scraper function used during the main valve stroke

4 Protective seal
Prevents foreign matter from entering the squeeze seal when the valve is open

5 Guide bushing
Prevents misalignment and lengthens the squeeze seal life

Low leakage

Internal leakage **10 cm³/min**[*2] **or less**

*2 With air

1 Rubber seal
Special FKM with high sealing performance

Indicator

Visual confirmation of valve open/close status

Valve opened	Valve closed
	

Pilot pressure

[MPa]

Standard	0.3 to 1
High pressure	0.5 to 1

Body material

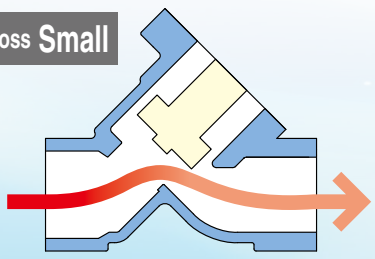
Stainless steel 316L equivalent / Bronze (CAC)

Fluid temperature

183°C (steam) or less

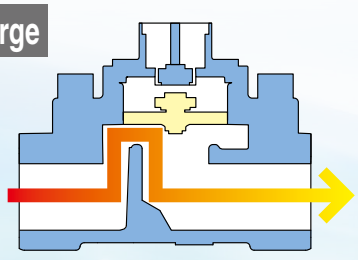
Low pressure loss

Pressure loss **Small**



Angle seat structure

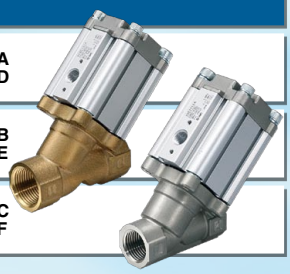
Pressure loss **Large**



Current structure

Variations

Model	Orifice diameter [mmø]	Cv	Port size	Max. operating pressure [MPa]		Body material	Fluid
				Standard	High pressure		
VXB215$^{A}_{D}$	11	3.5	3/8 (10A)	1	1.6	Stainless steel 316L equivalent, Bronze (CAC)	Steam * Can be used with air or water
VXB215$^{B}_{E}$	14	5.4	1/2 (15A)	0.6	1.2		
VXB215$^{C}_{F}$	18	7.6	3/4 (20A)	0.4	0.6		



2 Port Solenoid Valve Variations

Series

Direct Operated

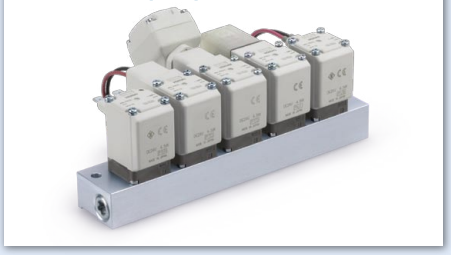
VX Series

Air, Medium vacuum, Water, Oil, Steam (* Can be used with heated water)

Single Unit

Valve type	Port size	Orifice diameter [mmø]
N.C./N.O.	1/8 to 1/2 ø6 to ø12	2, 3, 4, 5, 7, 8, 10

Manifold (Air)



Valve type	Port size				Orifice dia. [mmø]
	Common SUP type		Individual SUP type		
	IN	OUT	IN	OUT	
N.C./N.O.	3/8	1/8 1/4	1/8 1/4	3/8	2, 3, 4, 5, 7

Compact *VDW* Series

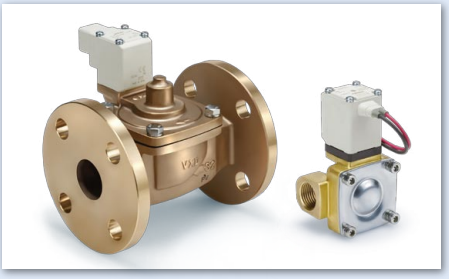
Air, Medium vacuum, Water

Valve type	Port size	Orifice diameter [mmø]
N.C.	M5, 1/8, ø3.2 to ø6	1, 1.6, 2.3, 3.2

Pilot Operated

VXD Series

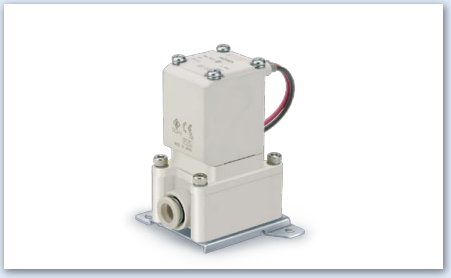
Air, Water, Oil, Heated water, High-temperature oil



Valve type	Port size	Orifice diameter [mmø]
N.C./N.O.	1/4 to 50A ø10 to ø12	10, 15, 20, 25, 35, 40, 50

Zero Differential Pressure *VXZ* Series

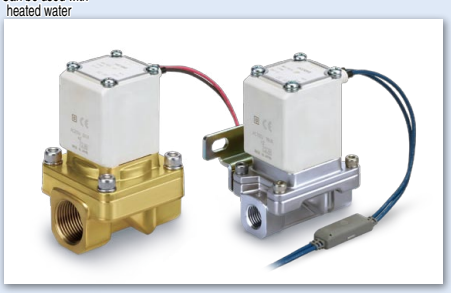
Air, Water, Oil, Heated water, High-temperature oil



Valve type	Port size	Orifice diameter [mmø]
N.C./N.O.	1/4 to 1 ø10 to ø12	10, 15, 20, 25

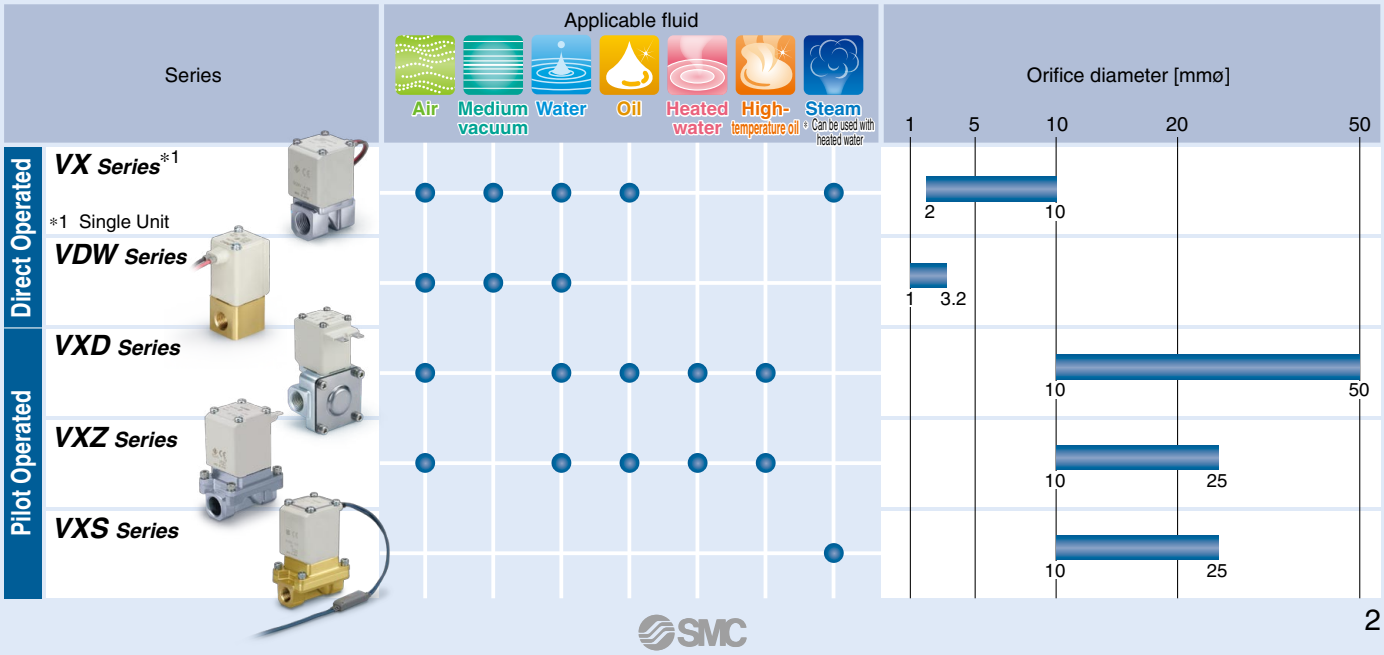
VXS Series

Steam (* Can be used with heated water)



Valve type	Port size	Orifice diameter [mmø]
N.C.	1/4 to 1	10, 15, 20, 25

Fluid / Orifice Diameter



VXB Series
Common Specifications/Selection Steps

Standard Specifications

Valve specifications	**Valve construction**	Air operated piston type
	Withstand pressure	2.4 MPa
	Body material	Stainless steel 316L equivalent, Bronze (CAC)
	Seal material	FKM
	Environment	Location without corrosive or explosive gases

Selection Steps

Step 1 **Select "Body material," "Port size," and "Orifice diameter."**

Item	Selected item		Symbol
● Body material ● Port size ● Orifice diameter	Body material	Bronze	A ❶
	Port size	3/8	
	Orifice diameter	12	

VXB2 1 5 **A** H B L (❶)

Step 2 **Select "Pressure type."**

Item	Selected item	Symbol
● Pressure type	High pressure	H ❷

VXB2 1 5 A **H** B L (❷)

Step 3 **Select "Thread type."**

Item	Selected item	Symbol
● Thread type	NPT	B ❸

VXB2 1 5 A H **B** L (❸)

Step 4 **Select "Indicator."**

Item	Selected item	Symbol
● Indicator	Yes	L ❹

VXB2 1 5 A H B **L** (❹)

Step 5 **For special options, refer to page 5.**

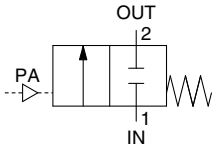
For Steam

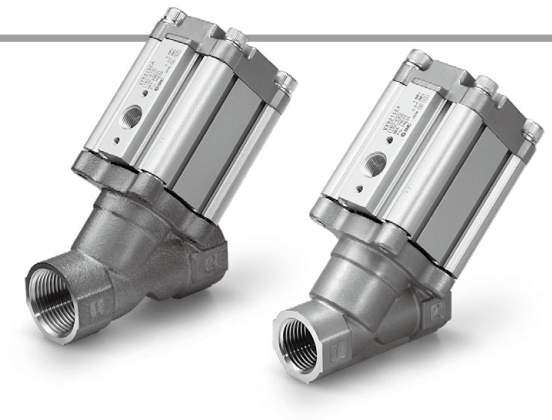
∗ Can be used with air or water

Flow Rate Characteristics

N.C. **(Normally closed)**

Symbol





Size	Port size	Orifice diameter [mm]	Pressure type	Model	Air			Water		Max. operating pressure [MPa]	Pilot pressure [MPa]	Weight [g]
					Cv	C [dm³/(s·bar)]	b	Cv	Kv			
1	3/8	11	Standard	**VXB215$^{A}_{D}$**	3.5	14.1	0.29	3.5	3.0	1.0	0.3 to 1	570
			High pressure	**VXB215$^{A}_{D}$H**						1.0 (1.6) ∗1	0.5 to 1	
	1/2	14	Standard	**VXB215$^{B}_{E}$**	5.4	20.0	0.35	5.4	4.6	0.6	0.3 to 1	620
			High pressure	**VXB215$^{B}_{E}$H**						1.0 (1.2) ∗1	0.5 to 1	
	3/4	18	Standard	**VXB215$^{C}_{F}$**	7.6	23.9	0.45	7.6	6.5	0.4	0.3 to 1	680
			High pressure	**VXB215$^{C}_{F}$H**						0.6	0.5 to 1	

∗ When using steam as the fluid, refer to page 16 for pilot piping selection.
∗1 The value in ( ) shows the pressure when air or water is used as the fluid.

Fluid and Ambient Temperatures

Fluid temperature [°C]	Ambient temperature [°C]
Steam: 183 or less Water, Air: 99 or less	–20 to 60

∗ No freezing

Valve Leakage Rate

Internal Leakage

Fluid	Seal material	Leakage rate ∗1
Steam, Air	FKM	10 cm³/min or less ∗2
Water		1 cm³/min or less

External Leakage

Fluid	Seal material	Leakage rate ∗1
Steam, Air	FKM	10 cm³/min or less ∗2
Water		1 cm³/min or less

∗1 Leakage is the value at an ambient temperature of 20°C.
∗2 With air

RoHS

How to Order

VXB2 1 5 A □ □ □

Valve type

1	N.C.

Fluid

5	Steam

Body material/Port size/Orifice diameter

Symbol	Body material	Port size	Orifice diameter
A	Bronze (CAC)	3/8	11
B		1/2	14
C		3/4	18
D	Stainless steel 316L equivalent	3/8	11
E		1/2	14
F		3/4	18

Thread type∗1

Nil	Rc
A	G∗2
B	NPT

∗1 The thread type for the main piping and pilot piping is the same.
∗2 For connection, prepare a fitting compliant with ISO 16030 and JIS B 8674.

Pressure type

Nil	Standard
H	High pressure

Indicator

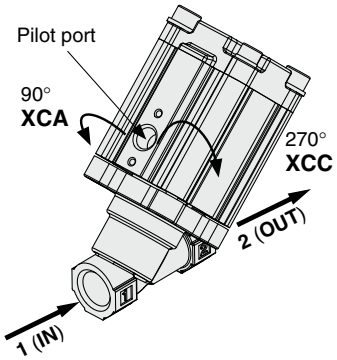
Nil	No
L	Yes

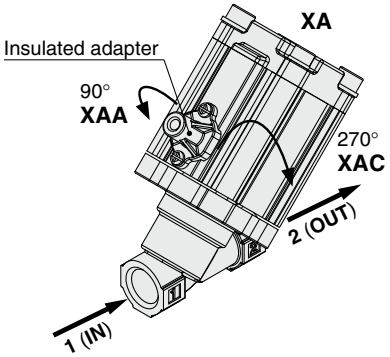
Other Special Options

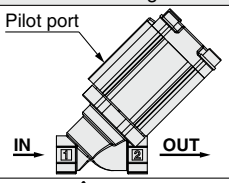
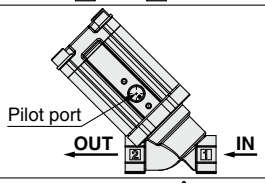
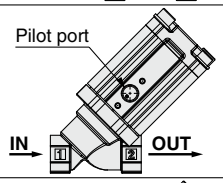
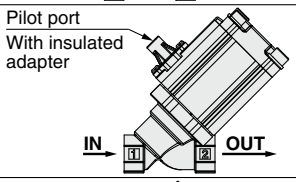
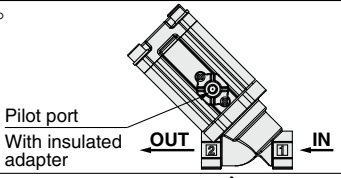
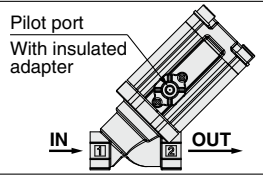
● Special Entry for Pilot Port/ Insulating Adapter Type

VXB215 □ □ □ □ XCA

Enter the standard product number.

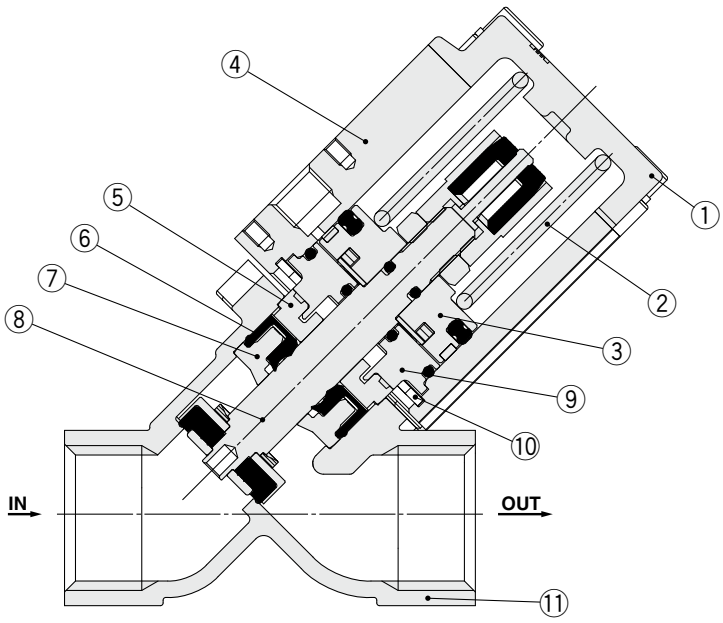




Symbol	Rotation angle	Insulated adapter
Nil		No
XCA	90° 	
XCC	270° 	
XA		Yes
XAA	90° 	
XAC	270° 	

∗ For details about the insulated adapter, refer to page 7.

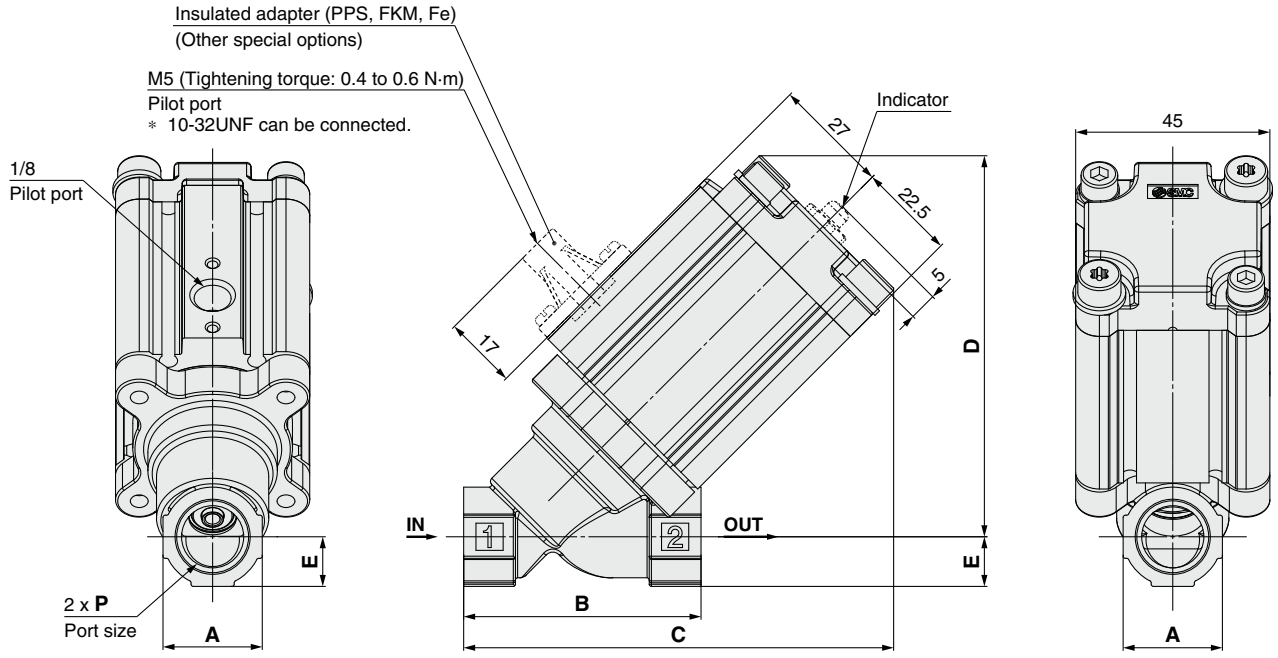
Construction



Component Parts

No.	Description	Material
1	**Cover**	Stainless steel 316L equivalent
2	**Spring**	Stainless steel 304
3	**Piston assembly**	Al, FKM, PTFE, Stainless steel 304
4	**Housing**	Al
5	**Guide bushing**	PPS
6	**Squeeze seal with scraper function**	FKM
7	**Resin scraper**	PEEK
8	**Main valve assembly**	FKM, Stainless steel 316L
9	**Bushing assembly**	Al, FKM
10	**Inverted internal retaining ring**	Fe
11	**Body**	CAC or Stainless steel 316L equivalent

Dimensions



Dimensions

[mm]

Model	Port size **P**	**A**	**B**	**C**	**D**	**E**
VXB215$^{A}_{D}$	3/8	23	55	99.8	88.3	11.5
VXB215$^{B}_{E}$	1/2	27	65	106.8	90.8	13.5
VXB215$^{C}_{F}$	3/4	32	75	111.5	93.2	16

Replacement Parts

● Maintenance Kit

How to order the maintenance kit

VXB215 − □ □ □ □ − KT

Indicator

Nil	No
L	Yes

Port size

Symbol	Port size
03	3/8
04	1/2
06	3/4

Pressure type

Symbol	Pressure type
Nil	Standard
H	High pressure

Thread type

Symbol	Thread type
Nil	Rc
A	G*1
B	NPT

*1 For connection, prepare a fitting compliant with ISO 16030 and JIS B 8674.

Component Parts

a	Housing assembly	1 pc.
b	Mounting screw: M5 hexagon socket head cap screw	2 pcs.

● Disassembly/Assembly Procedures

Disassembly

1) Loosen the 2 M5 hexagon socket head cap screws.
2) Remove the housing assembly from the body.

Assembly

1) Insert the housing assembly into the body.
2) Tighten the 2 M5 hexagon socket head cap screws.
   Tighten the screws diagonally in the order of ①→②→① (Fig.1).
   * Tightening torque for M5 hexagon socket head cap screw: 3 N·m

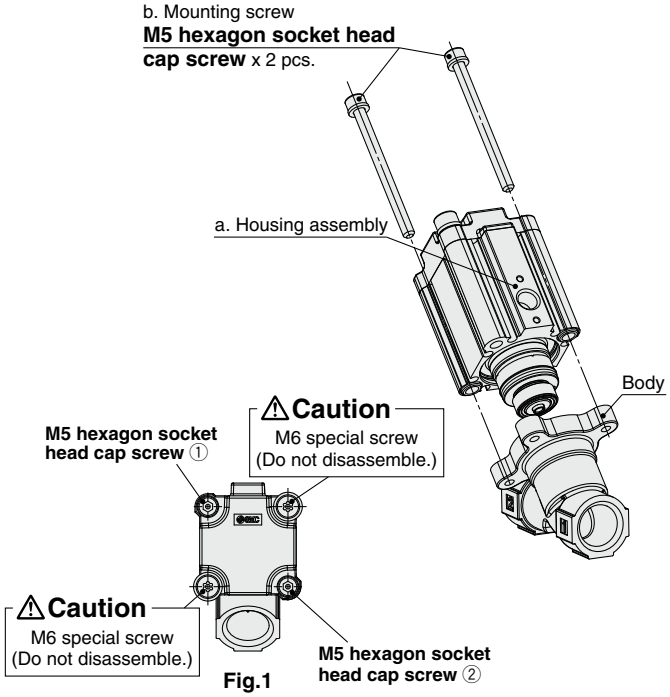


Fig.1

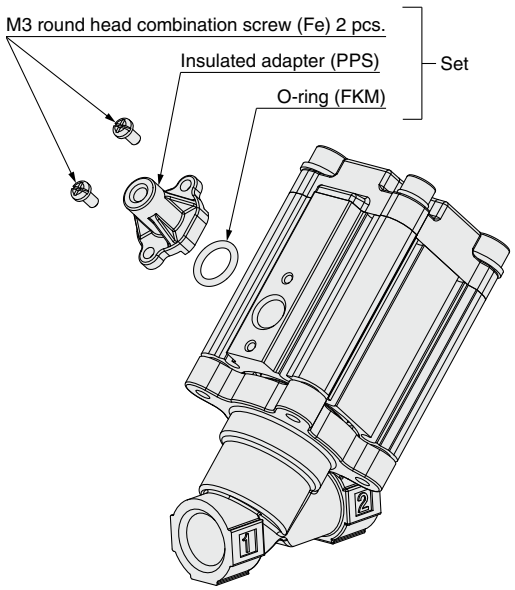
⚠Caution

1. Before disassembling, be sure to shut off the pressure supply, and then release the residual pressure.
2. After assembly, confirm that there is no fluid leakage.
   Additionally, when restarting the valve, make sure that the valve operates correctly after checking the safety.

● Insulated Adapter (for Individual Parts)

VXB021-20-1A (1 set)

* Valve body is not included.



* This is the same for all thread types (Rc, G, NPT).
* Guideline for the tightening torque of the M3 round head combination screw is 0.5 N·m.

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

1. Indication of flow rate characteristics

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

Table (1) Indication of Flow Rate Characteristics

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

2. Pneumatic equipment

2.1 Indication according to the international standards

(1) Compliant standards

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

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

(2) Definition of flow rate characteristics

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

Sonic conductance ***C*** : Value which divides the passing mass flow rate of a piece of 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 : Flow in which the upstream pressure is higher than the downstream pressure and where sonic speed in a certain part of a piece of 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)
Compliant standards: ISO 8778: 1990 Pneumatic fluid power—Standard reference atmosphere, JIS B 8393: 2000: Pneumatic fluid power—Standard reference atmosphere

(3) Formula for flow rate

It is described by the practical units as following.

When

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

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

When

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

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

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

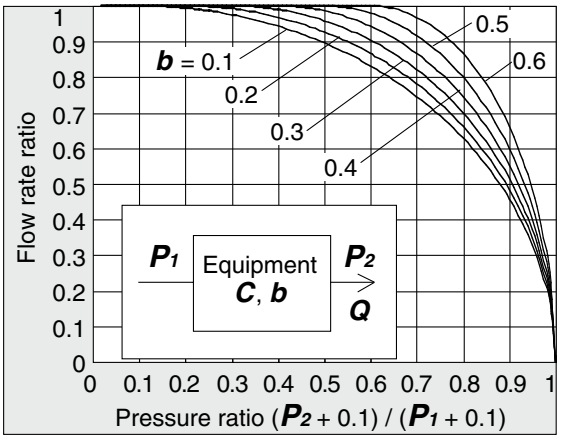
C : Sonic conductance [dm³/(s·bar)]
b : Critical pressure ratio [—]
P₁ : Upstream pressure [MPa]
P₂ : Downstream pressure [MPa]
t : Temperature [°C]
Note) Formula of subsonic flow is the elliptic analogous curve.
Flow rate characteristics are shown in Graph (1). For details, please make use of SMC's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

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

According to formula 1, the maximum flow rate = $600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}}$ = 600 [dm³/min (ANR)]

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

Based on Graph (1), it will be 0.7 if the pressure ratio is 0.8 and the flow rate ratio is b = 0.3.
Hence, the flow rate = Max. flow x flow ratio = 600 x 0.7 = 420 [dm³/min (ANR)]



Graph (1) Flow rate characteristics

(4) Test method

Connect the piece of test equipment to the test circuit as shown in Fig. (1). While maintaining the upstream pressure at a fixed value above 0.3 MPa, measure the maximum flow to be saturated initially. Next, measure this flow rate at 80%, 60%, 40%, and 20%, as well as the upstream and downstream pressure. The sonic conductance C can be calculated based on this maximum flow rate. Substitute the data of the others into the subsonic flow formula to find b, and calculate the critical pressure ratio b from that average.

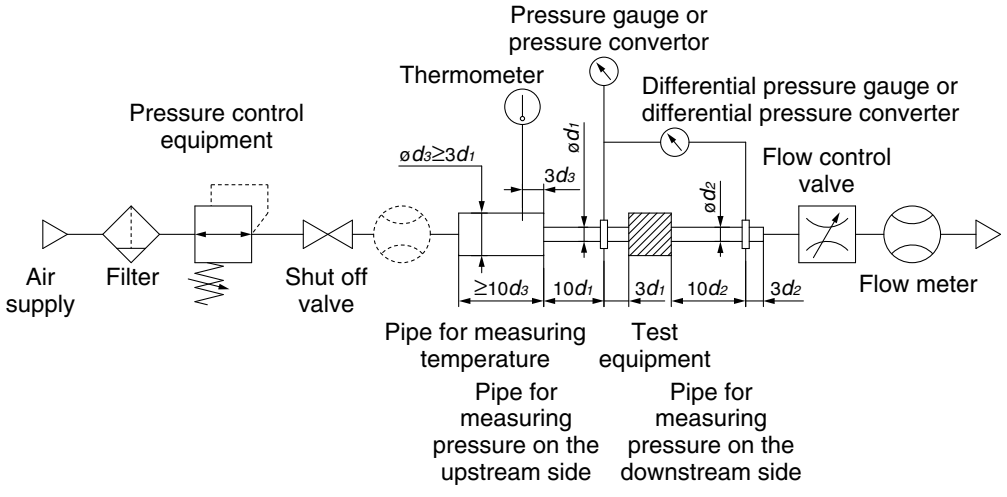


Fig. (1) Test circuit based on ISO 6358, JIS B 8390

2.2 Effective area *S*

(1) Compliant standards

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

Equipment standards: JIS B 8373: 2-port solenoid valve for pneumatics
JIS B 8374: 3-port solenoid valve for pneumatics
JIS B 8375: 4-port, 5-port solenoid valve for pneumatics
JIS B 8379: Silencer for pneumatics
JIS B 8381: Fittings of flexible joint for pneumatics

(2) Definition of flow rate characteristics

Effective area ***S***: Cross-sectional area that has an ideal throttle without friction or reduced flow. The value is derived by calculating pressure changes inside of an air tank when the compressed air is discharged from a piece of equipment mounted on the tank in a choked flow. The value of the effective area ***S***, like that of sonic conductance ***C***, expresses the "ease of flow."

(3) Formula for flow rate

When

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

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

When

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

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

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

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

Q : Air flow rate [dm³/min (ANR)], dm³ (Cubic decimeter) of SI units 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) The formula for subsonic flow (4) is only applicable when the critical pressure ratio ***b*** is the unknown piece of equipment. In the sonic conductance ***C*** formula (2), it is the same formula as when ***b*** = 0.5.

(4) Test method

Connect the piece of test equipment to the test circuit as shown in Fig. (2). Discharge the air from the air tank filled with compressed air at a fixed value above 0.6 MPa (0.5 MPa) into the atmosphere until the pressure inside the tank falls to 0.25 MPa (0.2 MPa). Measure the discharge time and the residual pressure inside the tank after discharging until it has returned to the normal value. Then, calculate the effective area ***S*** using the following formula. Select an air tank with a volume within the specified range of the test equipment's effective area. For JIS B 8373, 8374, 8375, 8379, and 8381, the pressure values are in parentheses and the coefficient of the formula is 12.9.

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

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

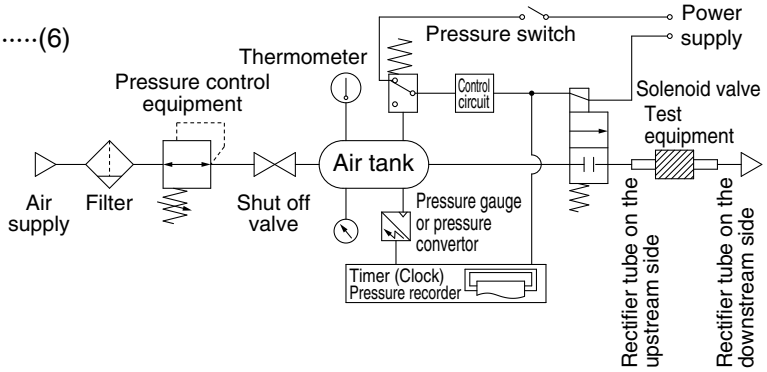


Fig. (2) Test circuit based on JIS B 8390

2.3 Flow coefficient *Cv* factor

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

This standard defines the ***Cv*** factor of the flow coefficient by the following formula that is based on the test conducted by the test circuit analogous to ISO 6358.

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

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 : Upstream absolute temperature [K]
The test conditions are < $P_1 + Pa = 6.5 \pm 0.2$ bar absolute, $T_1 = 297 \pm 5$K, 0.07 bar $\leq \Delta P \leq$ 0.14 bar.
This is the same concept as the 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) Compliant standards

IEC60534-2-3: 1997: Industrial-process control valves. Part 2: Flow capacity, Section Three-Test procedures
JIS B 2005: 1995: Test method for the flow coefficient of a valve
Equipment standards: JIS B 8471: Solenoid valve for water
JIS B 8472: Solenoid valve for steam
JIS B 8473: Solenoid valve for fuel oil

(2) Definition of flow rate characteristics

Av factor: Value of the clean water flow rate (represented by m³/s) which runs through a valve (test equipment) 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 practical units. Also, the flow rate characteristics are shown in Graph (2).
In the case of liquids:

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

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 [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]

Conversion of flow coefficient:

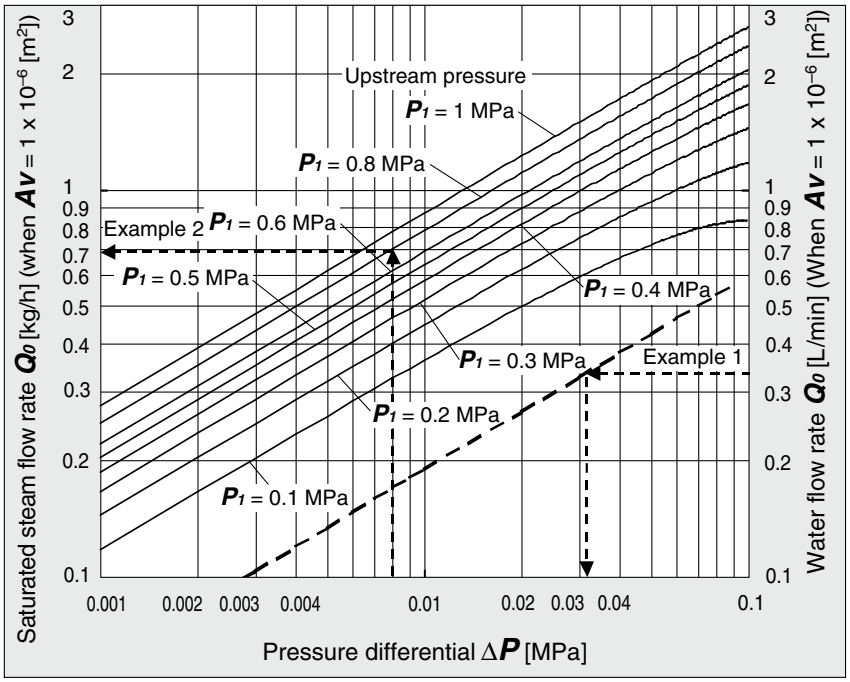
$Av = 28 \times 10^{-6}\ Kv = 24 \times 10^{-6}\ Cv$ ·····(11)

Here,

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

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

The values of ***Kv*** and ***Cv*** factors for pneumatic purposes are different due to different test methods.



Graph (2) Flow rate characteristics

Example 1)

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

Example 2)

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

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

(4) Test method

Connect the piece of test equipment to the test circuit as shown in Fig. (3). Pour in 5 to 40°C water and measure the flow rate with a pressure difference of 0.075 MPa. There are cases in which the pressure difference may need to be set higher in order to keep the Reynolds number in the range above 4×10^4 .

Substitute the measurement results into the formula (8) to calculate ***Av***.

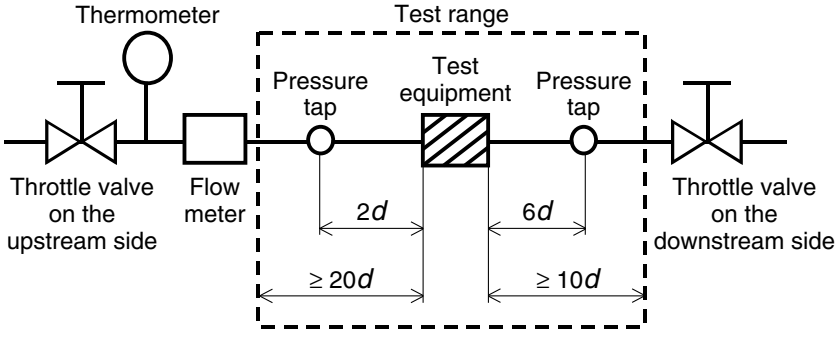
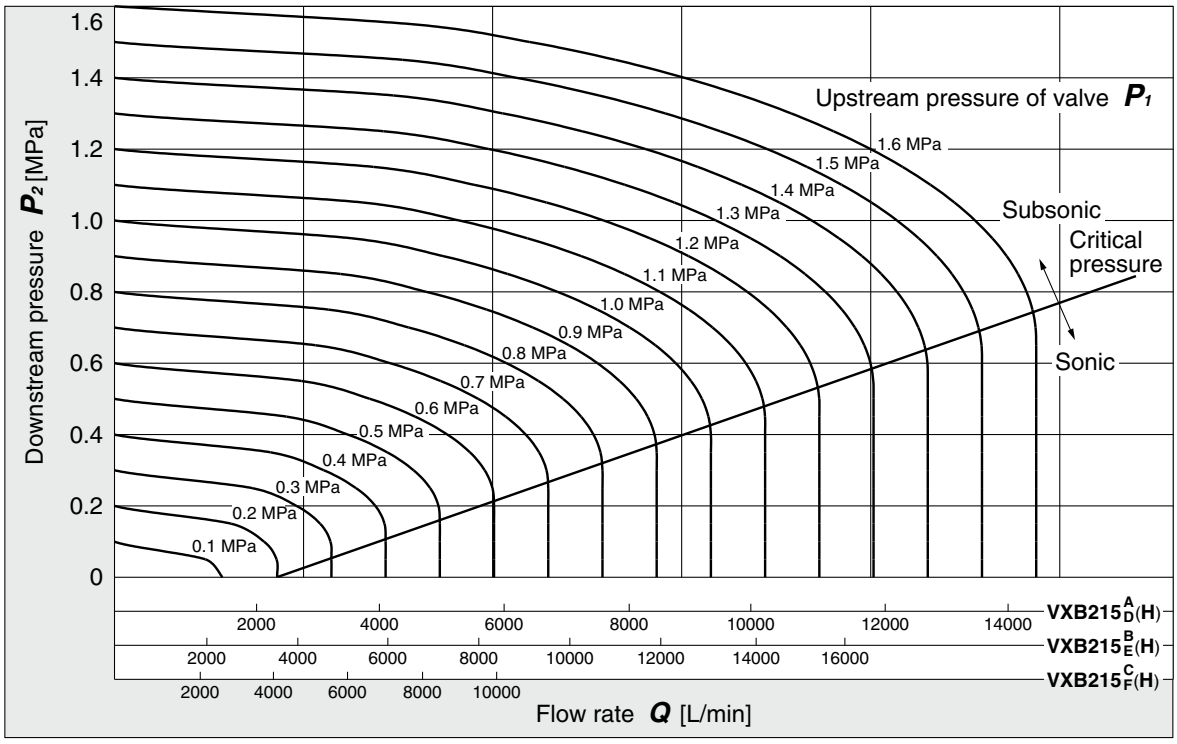


Fig. (3) Test circuit based on IEC60534-2-3, JIS B 2005

Flow Rate Characteristics

Note) Use this graph as a guide. If an accurate flow rate is required, refer to pages 8 to 12.

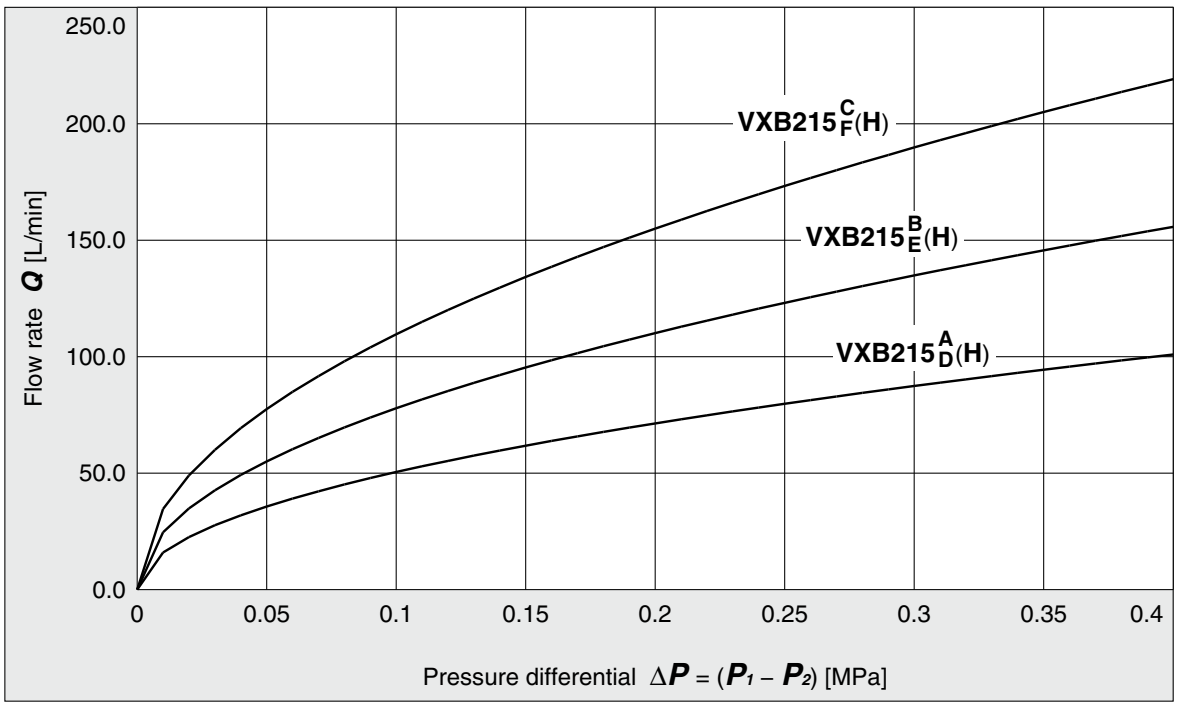
For Air



How to read the graph

The sonic range pressure to generate a flow rate of 4000 L/min (ANR) is $P_1 \approx 0.4$ MPa for the VXB215$^{A}_{D}$(H).

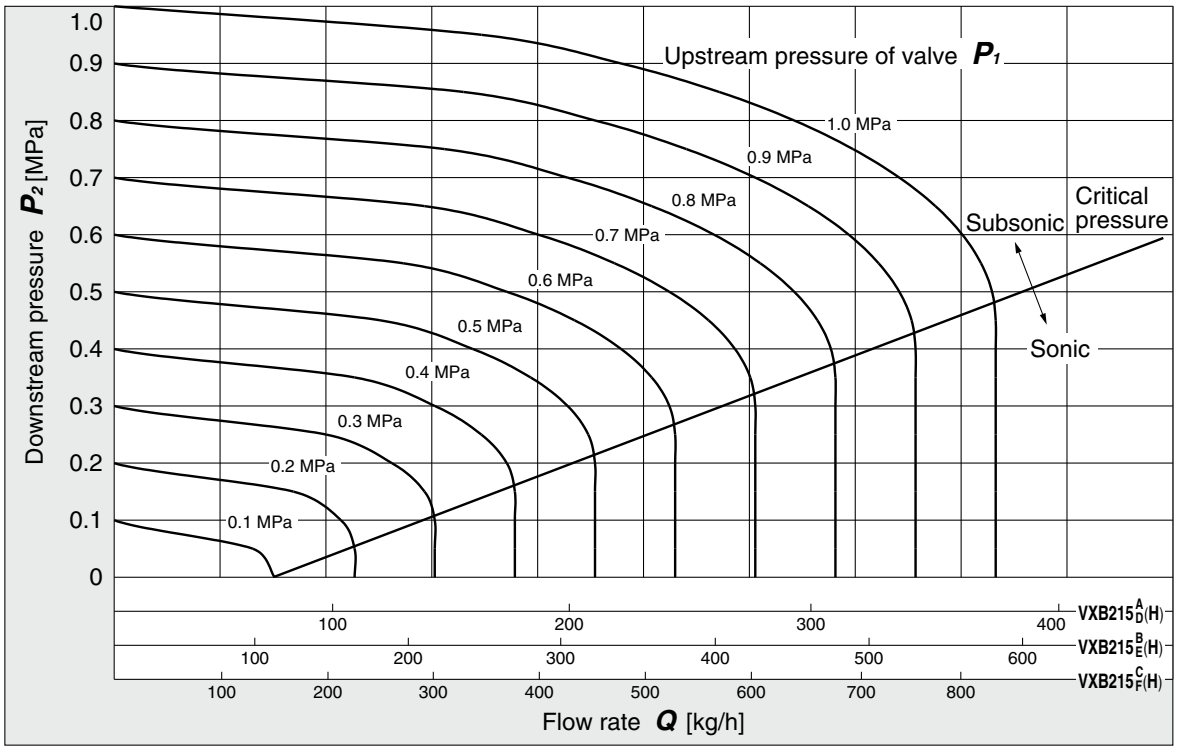
For Water



How to read the graph

When a water flow of 50 L/min is generated, $\Delta P \approx 0.1$ MPa for the VXB215$^{A}_{D}$(H).

For Saturated Steam



How to read the graph

The sonic range pressure to generate a flow rate of 300 kg/h is $P_1 \approx 0.3$ MPa for the VXB215$^{C}_{F}$(H).
The holding heat is approximately 196 Mcal/h at 300 kg/h.

VXB Series
Specific Product Precautions 1

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For 2 Port Solenoid Valves for Fluid Control Precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: http://www.smcworld.com

Design

⚠ Warning

1. For usage of reverse pressure, please consult SMC.

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

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

3. Closed liquid circuit

In a closed circuit, when liquid is static, pressure could rise due to changes in temperature. This pressure rise could cause malfunction and damage to components such as valves. To prevent this, install a relief valve in the system.

4. Pressure holding

It cannot be used for an application such as holding the pressure inside of a pressure vessel because air leakage is entailed in a valve.

5. When an impact, such as steam hammer, etc., caused by rapid pressure fluctuation is applied, the valve may be damaged. Please use with caution.

Selection

⚠ Warning

1. Fluid

Corrosive gases cannot be used since cracks caused by stress corrosion or other incidents may result.

2. Air quality

<Steam, Water>

The use of a fluid that contains foreign matter can cause problems, such as malfunction and seal failure, by promoting the wear of the valve seat and seal. Install a suitable filter (strainer) immediately upstream from the valve.

As per standard, the mesh count for the strainer should be 100 mesh. However, the size and shape of the foreign matter that occur depends on the operating environment. Check the fluid status and choose an appropriate mesh count.

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

Sediment and sludge from steam can cause the valve to not operate properly. Install a water softening device which removes these materials. Do not use operation steam which contains chemicals, synthetic oils that contain organic solvents, salts, corrosive gases, etc., as these can cause damage or deterioration.

The seal material (special FKM) used for wetted parts of the product can withstand steam in standard conditions. However, the resistance of the sealing material can deteriorate depending on the types of additives such as boiler compounds and water conditioners within the boiler steam. Please only utilize the product after determining the sealing material resistance within the actual usage conditions.

Selection

⚠ Warning

<Air>

- **Use clean air.**
  Do not use compressed air which contains chemicals, synthetic oils that contain organic solvents, salts, corrosive gases, etc., as these can cause damage or malfunction.
- **Install an air filter.**
  Install air filters close to the valves on the upstream side. A filtration size of 5 μm or less should be selected.
- **Install an aftercooler, air dryer, etc.**
  Compressed air that contains excessive drainage may cause the malfunction of valves and other pneumatic equipment. To prevent this, install an aftercooler, air dryer, etc.
- **If excessive carbon powder is generated, eliminate it by installing mist separators on the upstream side of valves.**
  If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

Refer to the Best Pneumatics No.6 catalog for further details on compressed air quality.

3. Ambient environment

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

4. Low-temperature operation

1) The valve can be used in an ambient temperature of –20°C. However, take measures to prevent the freezing or solidification of impurities, etc.
2) When using valves for water applications in cold climates, take appropriate countermeasures to prevent the water from freezing in the tubing after cutting the water supply from the pump, by draining the water, etc. The installation of a dryer and heat retaining of the body is recommended to prevent a freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.

VXB Series
Specific Product Precautions 2

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For 2 Port Solenoid Valves for Fluid Control Precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: http://www.smcworld.com

Mounting

⚠ Warning

1. If air leakage increases or equipment does not operate properly, stop operation.

After mounting is completed, confirm that it has been done correctly by performing a suitable function test.

2. Do not apply external force to the operating section.

When tightening is performed, apply a wrench or other tool to the outside of the piping connection parts.

3. Mount a valve with its operating section upward, not downward.

If the operating section is installed downward, foreign matter in the fluid may stick to the seal, causing a malfunction.

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

5. Painting and coating

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

Piping

⚠ Caution

1. Preparation before piping

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

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

3. Always tighten threads with the proper tightening torque.

Refer to the tightening torque in the table below for connecting steel piping. Insufficient tightening torque will lead to fluid leakage. For mounting the fittings, refer to the specified torque.

Tightening Torque for Piping

Connection thread	Proper tightening torque [N·m]
M5 (Insulated adapter)	0.4 to 0.6
Rc1/8	7 to 9
Rc3/8	22 to 24
Rc1/2	28 to 30
Rc3/4	

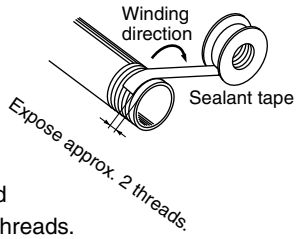
4. When connecting piping to a product, avoid mistakes regarding the connecting direction of the product.

Piping

⚠ Caution

5. Winding of sealant tape

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



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

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

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

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

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

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

11. Pilot piping

When using steam as the fluid, use heat resistant fittings and tubing. (Metal One-touch fittings, self-align fittings, fluoropolymer tubing, copper tubing, etc.)

When an insulated adapter (other special option) is used, nylon tubes can be used. However, nylon tubes may not be used according to the operating pressure. Measure the temperature of the operating environment with the actual machine to select usable tubes and fittings.

[Reference temperature]

∗ The temperature of the pilot port becomes approx. 70°C as the insulated adapter is mounted.

Measurement conditions: Fluid temperature 183°C,
Ambient temperature 60°C

Temperature of the fitting port of the insulated adapter:
Mounted 70°C
Not mounted 130°C

VXB Series
Specific Product Precautions 3

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For 2 Port Solenoid Valves for Fluid Control Precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: http://www.smcworld.com

Maintenance

⚠ Warning

1. Removing the product

The valve will reach a high temperature when used with high-temperature fluids. Confirm that the valve temperature has dropped sufficiently before performing work. If touched inadvertently, there is a danger of being burned.

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

2. Low-frequency operation

Switch valves at least once every 30 days to prevent a malfunction. Also, in order to use them under the optimum state, conduct a regular inspection biannually.

⚠ Caution

1. Strainers

1) Be careful regarding the clogging of strainers.
2) Clean strainers when the pressure drop reaches 0.1 MPa.

2. Lubrication

When using after lubricating, be sure to lubricate continuously.

3. Storage

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

4. Exhaust the drainage from the piping periodically.

Operating Precautions

⚠ Warning

1. The valve will reach a high temperature when used with high-temperature fluids. Use caution, as there is a danger of being burned if a valve is touched directly.

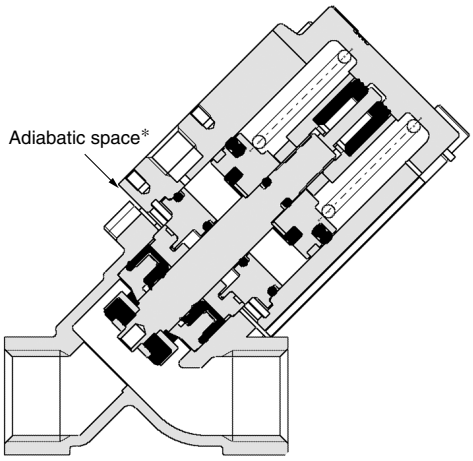
2. When problems are caused by steam hammer, install a steam hammer relief device, such as an accumulator.

3. When the valve is closed and pressure exceeding the maximum operating pressure is applied suddenly, due to the starting of a fluid supply source such as a boiler, the valve may open momentarily and fluid may leak.

Adiabatic Space

⚠ Caution

There is a space between the body and housing (∗: approximately 1 mm) for adiabatic effect.



⚠ Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **"Caution," "Warning"** or **"Danger."** They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

⚠ Caution: **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

⚠ Warning: **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ Danger : **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots – Safety.
etc.

⚠ Warning

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

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/ equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

⚠ Caution

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

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

Limited warranty and Disclaimer/ Compliance Requirements

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

Limited warranty and Disclaimer

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

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

Compliance Requirements

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

⚠ Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Revision History

Edition B
- Indicator have been added.
- Component parts of the maintenance kit have been changed.
- Notations about pilot piping have been revised.

VQ