

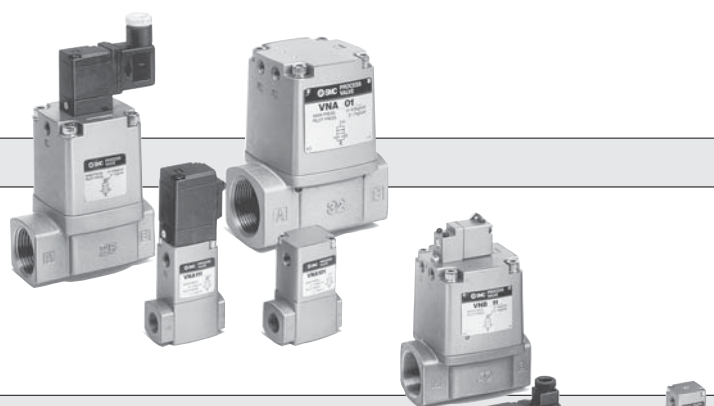
For General Purpose 2/3 Port Valve

Process Valve/Series VN

- The cylinder operation by external pilot air
- Can be operated with pressure differential zero.
- Wide variations

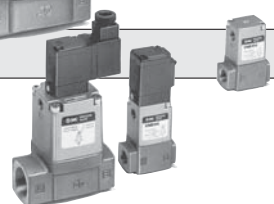
Series VNA

For controlling pneumatic systems or air-hydro circuits.
A balance poppet that enables air to flow forward or backward.



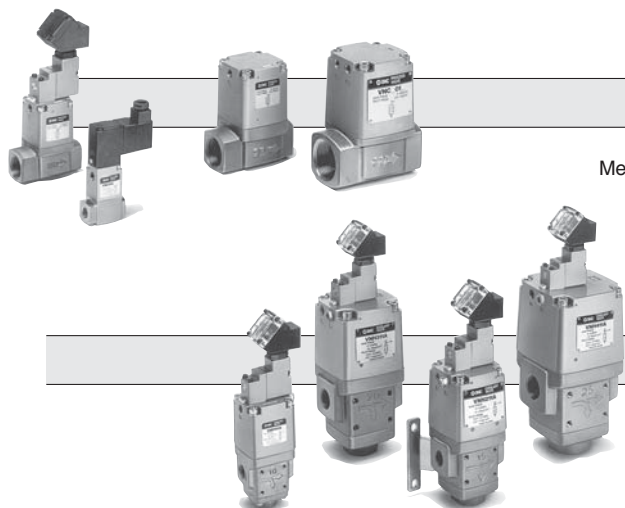
Series VNB

For controlling various fluids
Can operate with a wide range of fluids, such as air, water, oil, gas, vacuum, etc., by selecting the body material and the seal material.



Series VNC

For controlling the cutting oils and coolants used in machine tools.
Metal seals are used for preventing foreign matter such as cutting chips from entering.
Maximum operating pressure: 0.5MPa, 1MPa

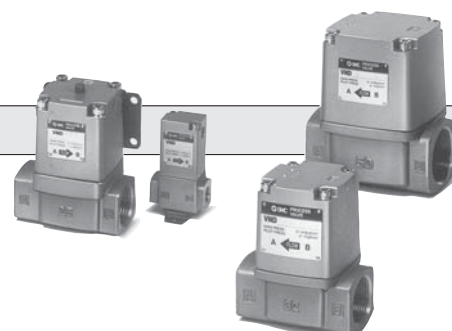


Series VNH

For controlling the high pressure cutting oils and coolants used in machine tools.
Maximum operating pressure: 3.5MPa, 7MPa

Series VND

For steam control
PTFE seal adopted
With indicator (Option)



Series VN

Process Valve

Process valve Series			Process valve Series VNA			Process valve Series VNB			Coolant valve Series VNC		Coolant valve for high pressure Series VNH	Steam valve Series VND	
Valve Style			N.C.	N.O.	C.O.	N.C.	N.O.	C.O.	N.C.	N.O.	N.C.	N.C.	N.O.
Applicable fluid	Water		—	—	—	●	●	●	—	—	—	—	—
	Air		●	●	●	●	●	●	—	—	—	—	—
	Oil		●	●	●	●	●	●	●	●	●	—	—
	Low vacuum (1 Torr)		—	—	—	●	●	●	—	—	—	—	—
	Coolant		—	—	—	—	—	—	●	●	●	—	—
	Steam		—	—	—	—	—	—	—	—	—	●	●
Port size	Rc G NPT NPTF	1/8	●	●	●	●	●	●	●	●	—	●	●
		1/4	●	●	●	●	●	●	●	●	—	●	●
		3/8	●	●	●	●	●	●	●	●	●	●	●
		1/2	●	●	●	●	●	●	●	●	●	●	●
		3/4	●	●	●	●	●	●	●	●	●	●	●
		1	●	●	●	●	●	●	●	●	●	●	●
		1 1/4	●	●	●	●	●	●	●	●	—	●	●
		1 1/2	●	●	●	●	●	●	●	●	—	●	●
		2	●	●	●	●	●	●	●	●	—	●	●
Page			P.4.2-3 to P.4.2-10			P.4.2-11 to P.4.2-18			P.4.2-19 to P.4.2-26		P.4.2-27 to P.4.2-32	P.4.2-33 to P.4.2-40	

2 Port Valve for Flow Control Process Valve Series VNB

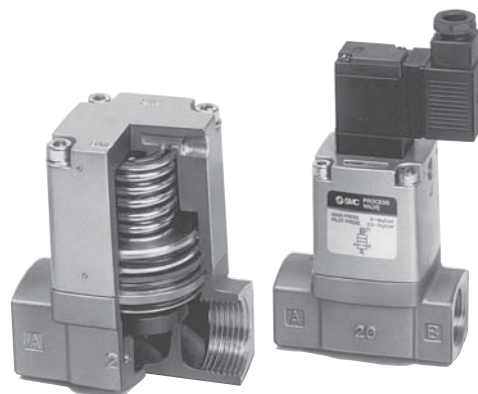
Extensive applicable fluids

Proper selection with body and sealing materials permits application with a wide variety of fluids such as air, water, oil, gas and vacuum.

The cylinder operated by external pilot air

Many variations

The N.C., N.O. and C.O. types are available.



Air operated

External pilot solenoid

Selection procedures

1 Fluid

- Refer to Table ① to check that the desired fluid is applicable.
- Select the body and sealing materials that best suit the fluid to be used.

2 Flow characteristics (Air and water)

- To find the flow rate of air or water, refer to the table of flow rate characteristics on page 4.2-14. Use the flow rate calculation equation to find the exact answer. Although the flow rate is the same, the operating pressure differs according to the valve size. Therefore, select the proper valve size from applicable valves.
- Refer to Table ② to select the port size.

3 Construction

- Select the air operated or external pilot solenoid styles. Valves come in N.C. (normally closed), N.O. (normally open), C.O. (double acting), and N.C.1MPa (normally closed) types. Select the proper one according to the operating conditions.

4 Supply voltage and electrical entry (External pilot solenoid)

- Select AC or DC power supply, and select the proper method of electrical entry according to Table ③.

Table ① Applicable fluid check list

Fluid	Copper alloy: Standard			Aluminium: L			Stainless steel: S		
	NBR : A	FKM : B	EPR : C	NBR : A	FKM : B	EPR : C	NBR : A	FKM : B	EPR : C
Air (Standard, Dry)	●	●		●	●		●	●	
Low vacuum (1 Torr)	●	●		●	●		●	●	
Carbon dioxide (CO ₂ , 0.7MPa or less)	●			●			●		
Carbon dioxide (CO ₂ , 0.7 to 1MPa)			●			●			●
Nitrogen gas (N ₂)	●	●	●	●	●	●	●	●	●
Argon	●	●		●	●		●	●	
Helium		●			●			●	
Water (Standard, up to 60°C)	●						●		
Water (up to 99°C only air operated)		●	●					●	●
Turbine oil	●	●		●	●		●	●	
Spindle oil		●			●			●	
Fuel oil class 3		●			●			●	
Silicone oil		●			●			●	
Naphtha		●						●	
Ethylene glycol (bis 80°C)			●						●
Boiler water							●		●

⚠ Caution

When fluid permits application of multiple body and sealing material, select the best ones according to the ambient environment (FKM or EPR seal material for high temperature) and other conditions (corrosion resistance and viscosity). Contact SMC on other fluids, operating conditions, etc..

Table ② Valve size, port size combinations

Valve size	Port size								
	6A	8A	10A	15A	20A	25A	32A	40A	50A
1	●	●	●						
2			●	●					
3					●				
4						●			
5							●		
6								●	
7									●

Table ③ Combination of electrical entry and light/surge voltage suppressor

Valve size	Electrical entry	Indicator light and surge suppressor	Manual override
	D	Z	
1, 2, 3, 4	●	●	●
5, 6, 7	●	●	

How to Order

Seal material	
A	NBR seals
B	FKM seals
C	EPR seals

Refer to Table (1) for availability.

Body material option	
—	Standard
S	Stainless steel body
L	Aluminum body

Pilot system option	
—	Standard
V	Vacuum pilot type

Note) Symbol V is for vacuum pilot valve specification, for both main pressure and pilot pressure, valve size 2 to 7.

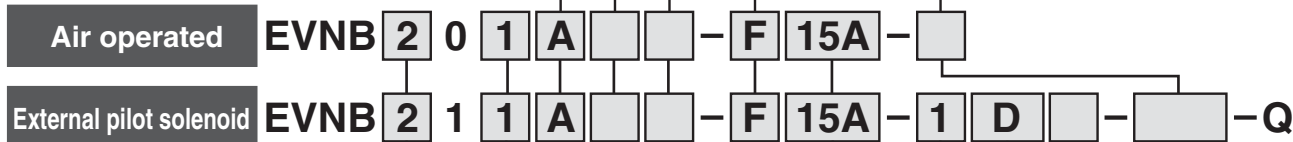
Thread type

—	Rc
F	G
N	NPT
T	NPTF

Bracket (valve size: 1/2/3/4.)

—	None
B Note)	With bracket

Note) Only valve sizes 1, 2, 3 and 4.
Shipped after assembled at our factory.
Bracket part no.
Valve size 1: VN1-A16 (with thread)
Valve sizes 2 to 4: VN□-16
2 to 4



Valve size Valve type Port size

Symbol	Orifice dia. (mm)	Symbol				Symbol	Port size Rc
		1 N.C. 0.5 MPa	2 N.O. 1 MPa	3 Note 1) C.O. 1 MPa	4 N.C. 1 MPa		
1	ø7	—	●	●	●	6A	1/8
		—	●	●	●	8A	1/4
		—	●	●	●	10A	3/8
2	ø11	—	—	—	●	10A	3/8
	ø15	●	●	—	—	15A	1/2
	ø15	●	●	●	—	—	—
3	ø14	—	—	—	●	20A	3/4
	ø20	●	●	●	—	—	—
4	ø16	—	—	—	●	25A	1
	ø25	●	●	●	—	—	—
5	ø22	—	—	—	●	32A	1 1/4
	ø32	●	●	●	—	—	—
6	ø28	—	—	—	●	40A	1 1/2
	ø40	●	●	●	—	—	—
7	ø33	—	—	—	●	50A	2
	ø50	●	●	●	—	—	—

Note 1) Air operated only

Note 2) The valve type symbols for vacuum pilot type are 1 (N.C.) and 2 (N.O.) only.

Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
Note 1) 3	110 VAC 50/60 Hz
4	220 VAC 50/60 Hz
Note 1) 5	24 VDC
Note 1) 6	12 VDC
Note 1) 7	240 VAC 50/60 Hz

Note 1) Semi-standard

Note 2) Contact SMC for other voltages

Manual override

—: Non-locking push type

A: Non-locking push type A (projecting) Note)

B: Slotted locking type B (tool required) Note)

—: Non-locking push type

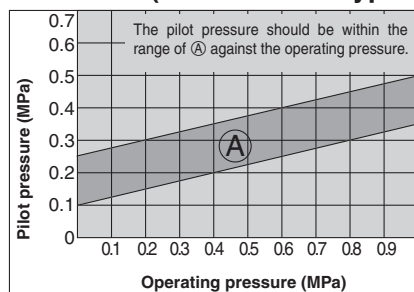
Valve size 1 to 4

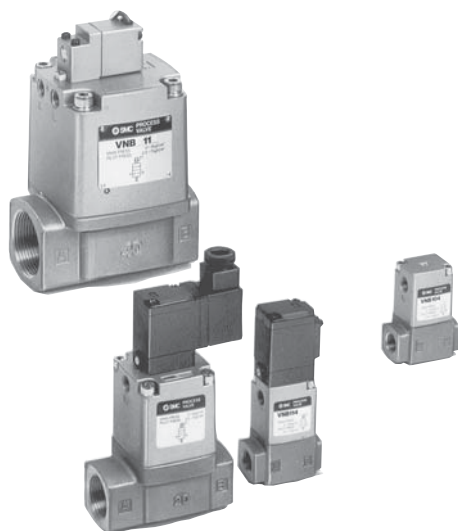
Note) Semi-standard

Electrical entry/With light/surge voltage suppressor

D	DIN terminal	Valve size
DZ	DIN terminal with light/surge voltage suppressor	1 to 7

Graph (4) VNB□□²/₃□ Pilot Pressure (N.O. and C.O. types)





Model

Model	Port size		Orifice size ø (mm)	Flow rate		Weight (kg)	
	Rc(PT)	Flange ⁽¹⁾		N _l /min	Effective area (mm ²)	Air operated	External pilot solenoid
VNB1□□□-6A	1/8	—	7	687.05	13	0.3	0.4
VNB1□□□-8A	1/4	—		981.50	18		
VNB1□□□-10A	—	—		1275.95	23		
VNB2□4□-10A	3/8	—	11	2453.75	45	0.6	0.7
VNB2□□□-10A	—	—	15	3729.70	70		
VNB2□4□-15A	1/2	—	11	2944.50	55		
VNB2□□□-15A	—	—	15	4907.50	90	0.9	1.0
VNB3□4□-20A	3/4	—	14	4907.50	90		
VNB3□□□-20A	—	—	20	7852.00	140		
VNB4□4□-25A	1	—	16	6870.50	130	1.4	1.5
VNB4□□□-25A	—	—	25	11778.0	220		
VNB5□4□-32A	1 1/4	—	22	10796.50	210	2.5	2.6
VNB5□□□-32A	—	—	32	17667.0	320		
VNB6□4□-40A	1 1/2	—	28	18648.50	330	4.1	4.2
VNB6□□□-40A	—	—	40	27482.0	500		
VNB7□4□-50A	2	—	33	28463.50	520	6.3	6.4
VNB7□□□-50A	—	—	50	42204.50	770		

Symbol

Valve Style	N.C. Normally closed	N.O. Normally open	C.O. Double acting
	VNB□0□ ¹	VNB□02	VNB□03
Air operated			
External pilot solenoid			

Option Specifications

Vacuum pilot valve VNB□□□□V

(Valve size 2 to 7)

It is used when the valve is to be operated by the main vacuum in the absence of pressurized air.

Valve Specifications

Fluid	Vacuum
Pressure range	1 to 760 Torr
Pilot pressure range	1 to 400 Torr

Valve Style	N.C. Normally closed	N.O. Normally open
	VNB□01□V	VNB□02□V
Air operated		
External pilot solenoid		

Valve Specifications

Fluids	VNB□□□A	Water, Oil, Air, Vacuum, etc.
Fluid temperature	VNB□□□B	-5 to 60°C ⁽¹⁾ -5 to 99°C ⁽¹⁾ (Water, oil etc. Only air operated)
Ambient temperature		-5 to 50°C (Air operated type: 60°C) ⁽¹⁾
Proof pressure		1.5MPa
Applicable press. range	VNB□□1□ VNB□□3□	Low vacuum to 0.5MPa Low vacuum to 1MPa
External pilot air	Press. VNB□□1□ VNB□□3□	0.25 to 0.7MPa 0.1 to 0.5MPa See Table 4 on page P.
	Lubrication	Not required (Use turbine oil No.1 (ISO VG32), if lubricated.) ⁽²⁾
	Temperature	-5 to 50°C (Air operated: 60°C) ⁽¹⁾



Note 1) No freezing Note 2) Lubrication is not allowed in case of seal material EPR.

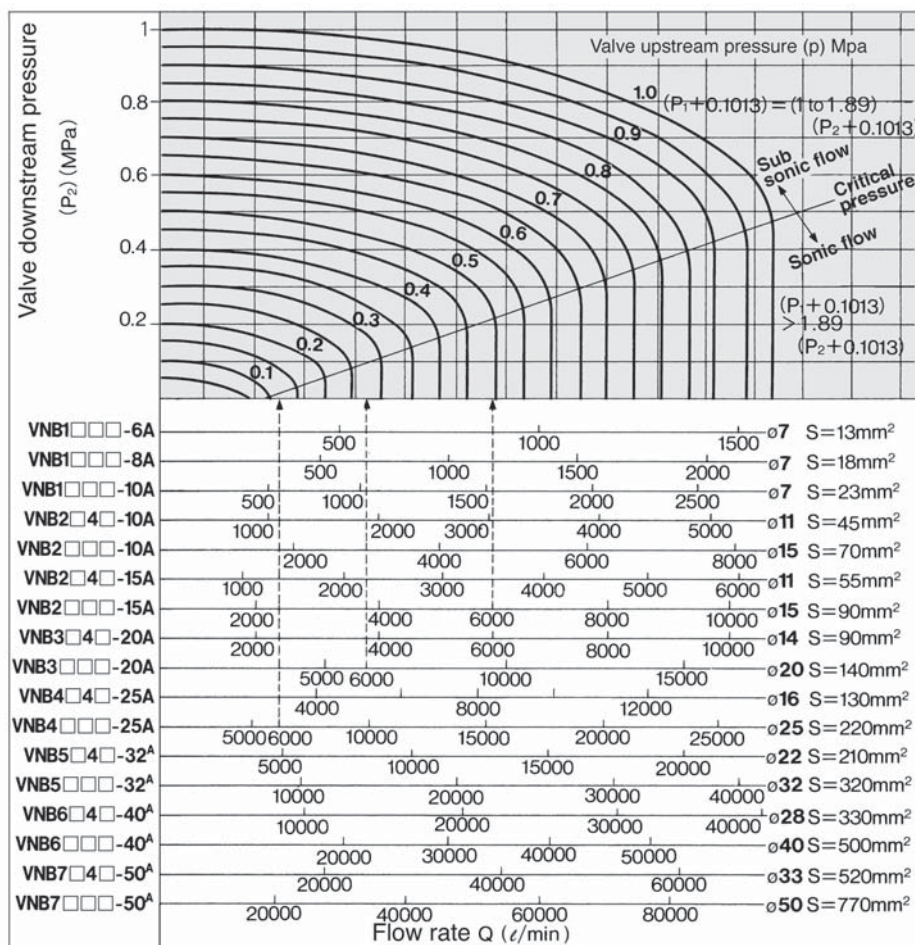
Pilot Solenoid Specifications

Port size	6A to 25A	32A to 50A
Pilot solenoid valve	SF4-□□□-23-Q	VO307-□□□1-Q
Electrical entry	DIN connector	DIN connector
Coil rated voltage	AC (50/60Hz)	100V, 200V, Others (Option)
	DC	24V, Others (Option)
Allowable voltage		-15% to +10% of rated voltage
Coil insulation		Class B or equivalent (130°C)
Temperature rise		≤35°C (Application of rated voltage)
		≤50°C (Application of rated voltage)
Apparent power	AC	Inrush 5.6VA(50Hz), 5.0VA(60Hz) Holding 3.4VA(50Hz), 2.3VA(60Hz)
	DC	1.8W
Power consumption		4W
Manual override		Non-locking push style Others (Option)

Note) Vacuum pilot type pilot solenoid valves will become VO307V-□□□1-Q.

Flow Characteristics

Air



How to Read The Graph

In the sonic flow region: For a flow of 6000 (l/min)
 VNB4□□□ (Orifice ø25).....P1 ≅ 0.14MPa
 VNB4□□□ (Orifice ø20).....P1 ≅ 0.28MPa
 VNB4□□□ (Orifice ø15).....P1 ≅ 0.5MPa

How to Calculate Flow

<Air and other gases>

① Equation in the domain of subsonic flow

• Calculation by Cv factor

$$Q = 4080 \cdot C_v \cdot \sqrt{\frac{\Delta P (P_2 + 0.1013)}{G}} \cdot \sqrt{\frac{273}{273 + \theta}} \quad \text{..... l/min (ANR)}$$

• Calculation by effective area

$$Q = 226 \cdot S \cdot \sqrt{\frac{\Delta P (P_2 + 0.1013)}{G}} \cdot \sqrt{\frac{273}{273 + \theta}} \quad \text{..... l/min (ANR)}$$

② Equation in the domain of sonic flow

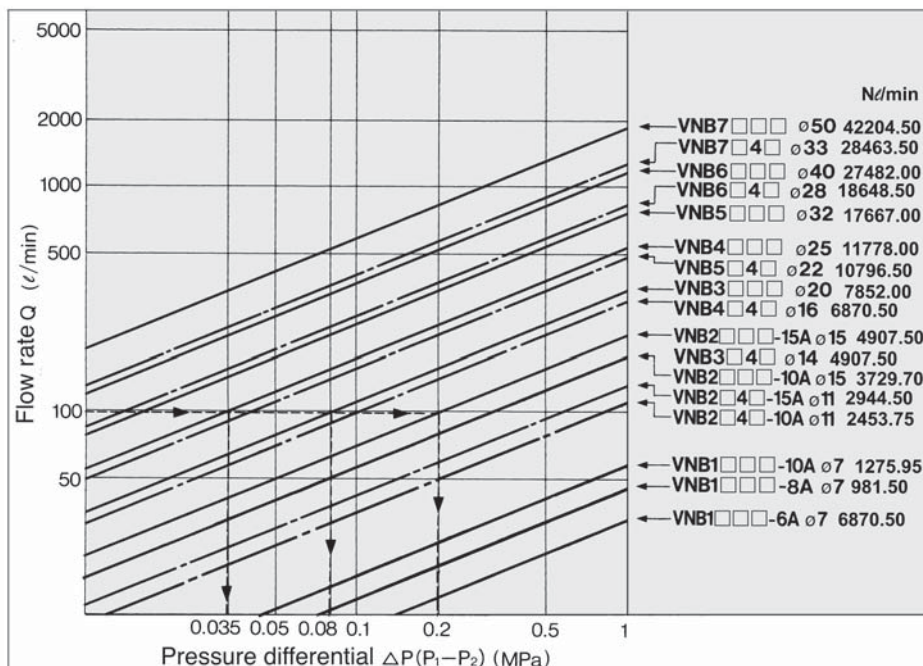
• Calculation by Cv factor

$$Q = 2040 \cdot C_v \cdot (P_1 + 0.1013) \cdot \frac{1}{\sqrt{G}} \cdot \sqrt{\frac{273}{273 + \theta}} \quad \text{..... l/min (ANR)}$$

• Calculation by effective area

$$Q = 113 \cdot S \cdot (P_1 + 0.1013) \cdot \frac{1}{\sqrt{G}} \cdot \sqrt{\frac{273}{273 + \theta}} \quad \text{..... l/min (ANR)}$$

Water



How to Read The Graph

In case of a flow of 100 l/min:
 VNB4□□□ (Orifice ø25).....ΔP to 0.035MPa
 VNB4□□□ (Orifice ø20).....ΔP to 0.08MPa
 VNB4□□□ (Orifice ø15).....ΔP to 0.2MPa

How to Calculate Flow

• Calculation by Cv factor

$$Q = 14.2 \cdot C_v \cdot \sqrt{\frac{10.2 \Delta P}{G}} \quad \text{..... l/min}$$

• Calculation by effective area

$$Q = 0.8 \cdot S \cdot \sqrt{\frac{10.2 \Delta P}{G}} \quad \text{..... l/min}$$

Note) Calculation error of fluid with viscosity of 50cSt or less will be very small.

Symbol

Q : Flow rate (Air and other gases l/min(ANR))
 (Water and other fluids l/min)

ΔP: Pressure differential(P1—P2)

P1 : Upstream pressure (MPa)

P2 : Downstream pressure (MPa)

θ : Temperature of air and other gases (°C)

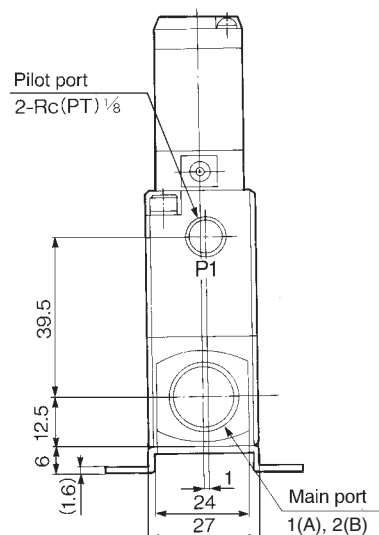
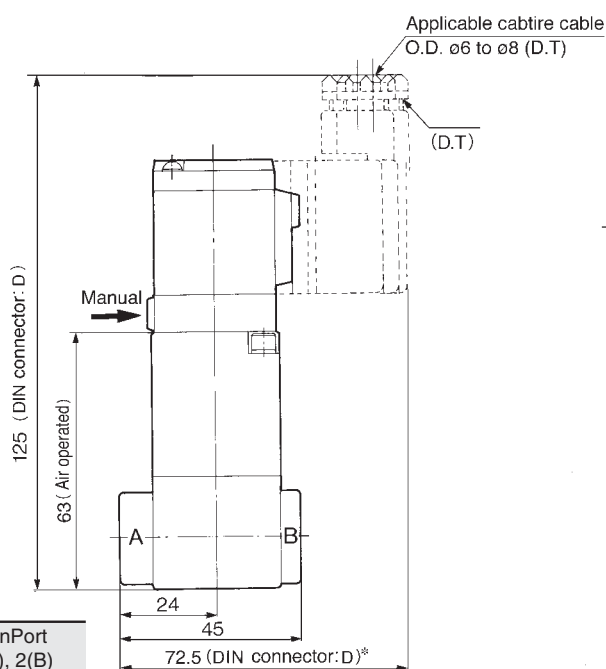
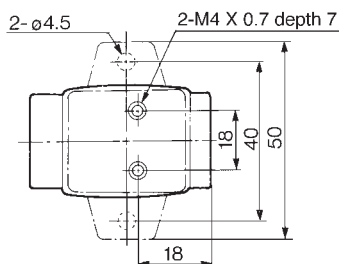
S : Effective area(mm²) S ≅ 17667. Nl/min

Cv : Cv factor (/)

G : Specific gravity (/) Air/Water=1

Port size 6A, 8A, 10A

Standard



* DZ is 9mm longer

Model	MainPort 1(A), 2(B)
VNB1□□□-6A	1/8
VNB1□□□-8A	1/4
VNB1□□□-10A	3/8

⚠ Precautions

External Pilot

⚠ Caution

Pilot port piping

Please arrange P1 and P2 piping as follows according to the model.

Standard

Port	VNB□0□□	VNB□02□	VNB□03□	VNB□1□□
P1	External pilot	Bleed port	External pilot	External pilot
P2	Bleed port	External pilot	External pilot	Pilot exhaust

Vacuum pilot

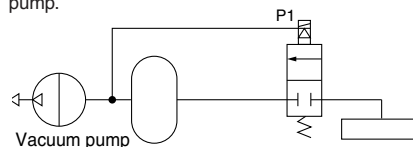
Port	VNB□01□V	VNB□02□V	VNB□1□□V
P1	Bleed port	External pilot	External pilot
P2	External pilot	Bleed port	Pilot exhaust

It is recommended to mount a silencer in the EXH port and the bleed port for noise reduction and dust entry prevention.

Vacuum Pilot

⚠ Caution

When using the VNB□1□V N.C. vacuum pilot, maintain the specified pilot pressure by providing a tank with an appropriate capacity or by acquiring the pilot pressure from an area near the vacuum pump.



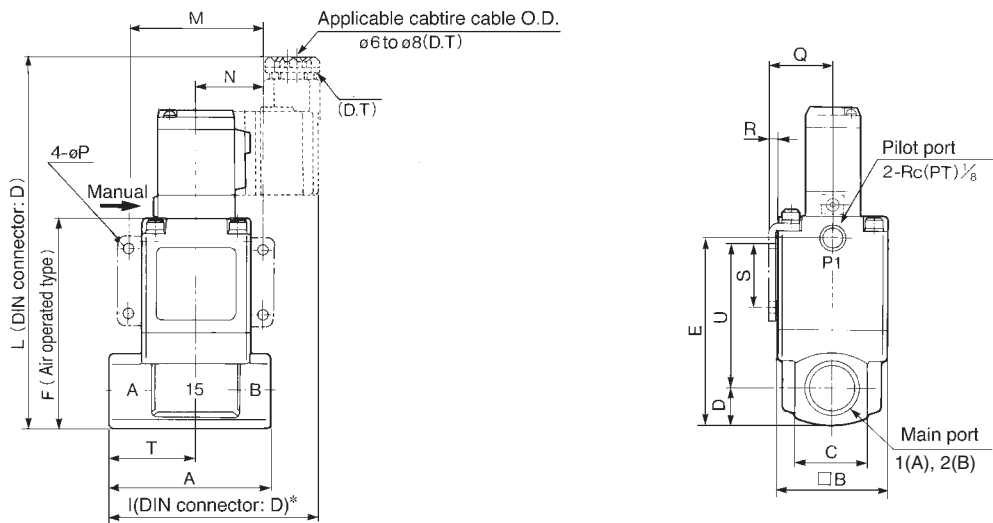
Piping


⚠ Caution

To use the piping with a high temperature fluid, use heat resistant fittings and tubes. (Self-align fittings, tube copper pipe, etc.)

Port size 10A, 15A, 20A, 25A

Standard

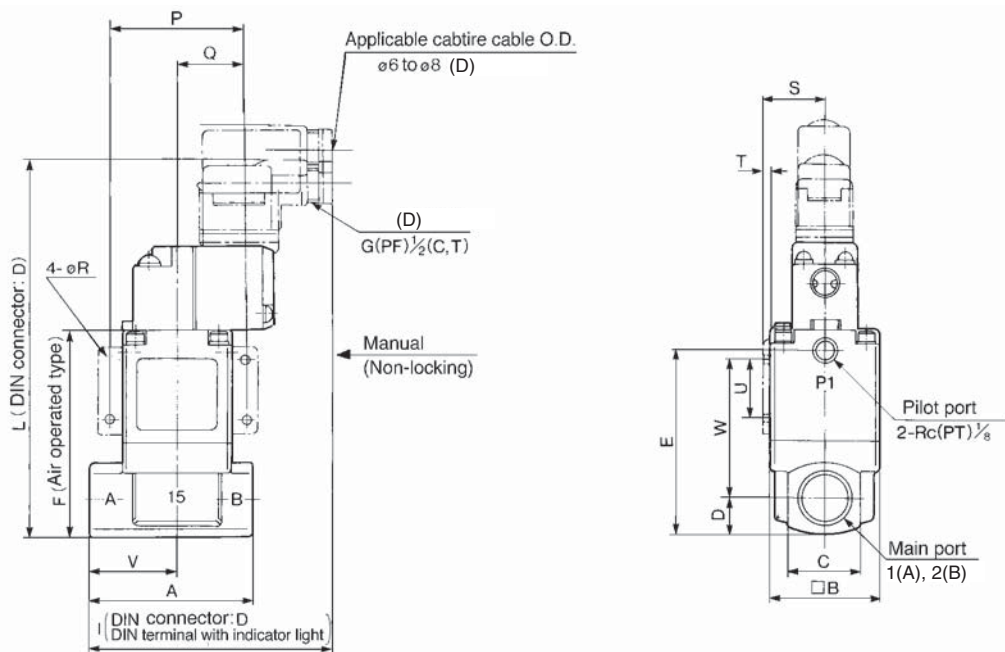


 * DZ is 9 mm longer.

Model	Main port 1(A), 2(B)	A	B	C	D	E	F	I	L	M	N	P	Q	R	S	T	U
VNB2□□□V-10A	3/8	63	42	28	14	72.5	80.5	82.5	142.5	52	26	4.5	24.3	2.3	25	34	55
VNB2□□□V-15A	1/2																
VNB3□□□V-20A	3/4	80	50	35	17.5	84	92	91.5	154	62	31	5.5	28.3	2.3	30	43	60.5
VNB4□□□V-25A	1	90	60	40	20	100	108	97.5	170	72	36	6.5	33.3	2.3	35	49	73

Port size 10A, 15A, 20A, 25A

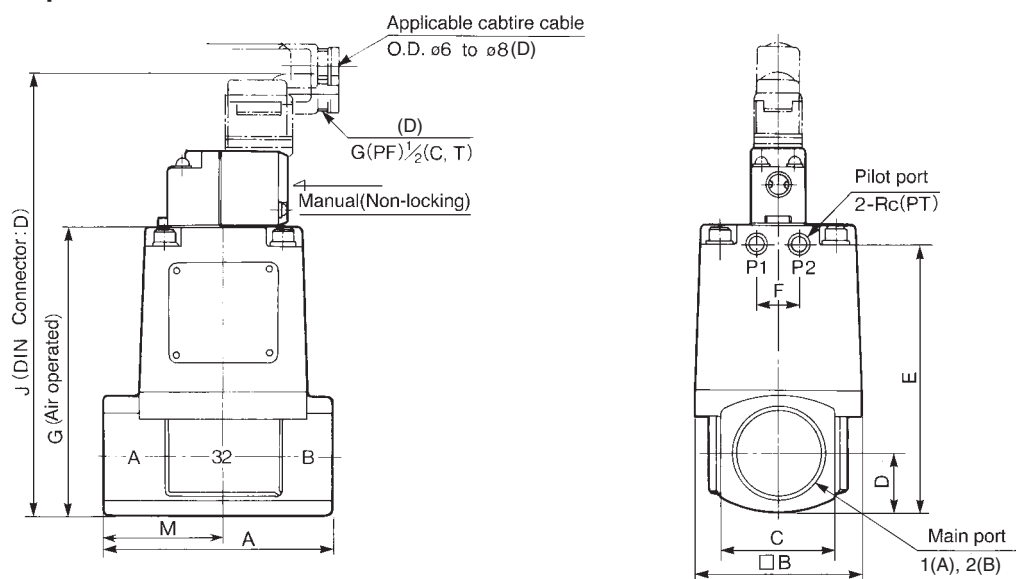
Vacuum pilot



Model	Main port 1(A), 2(B)	A	B	C	D	E	F	I	L	P	Q	R	S	T	U	V	W
VNB2□□□V-10A	3/8	63	42	28	14	72.5	80.5	97	170.5	52	26	4.5	24.3	2.3	25	34	55
VNB2□□□V-15A	1/2																
VNB3□□□V-20A	3/4	80	50	35	17.5	84	92	102	182	62	31	5.5	28.3	2.3	30	43	60.5
VNB4□□□V-25A	1	90	60	40	20	100	108	103	198	72	36	6.5	33.3	2.3	35	49	73

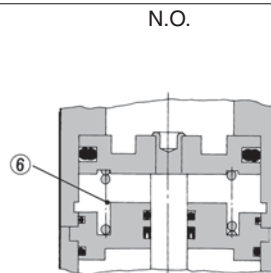
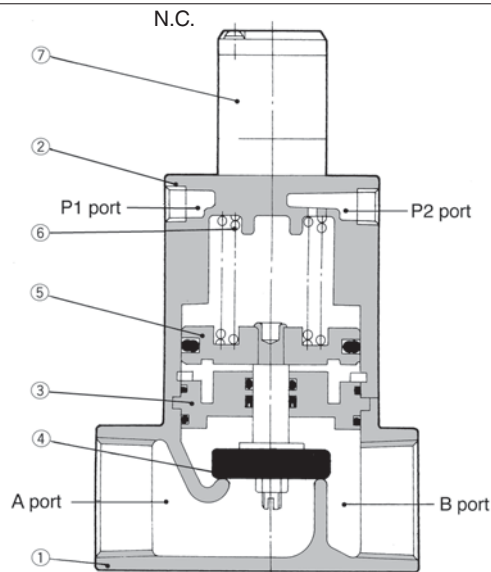
Port size 32A, 40A, 50A

Standard/Vacuum pilot



Model	Main port 1(A), 2(B)	Pilot port Rc(PT)	A	B	C	D	E	F	G	J	M
VNB5□□□□-32A	1 1/4	1/8	105	77	53	26.5	120.5	20	129.5	219.5	55
VNB6□□□□-40A	1 1/2	1/4	120	96	60	30	137	24	147	237	63
VNB7□□□□-50A	2	1/4	140	113	74	37	160	24	170	260	74

Construction



Principles of Operation (The vacuum pilot style is excluded)

VNB□□□□□□□□□□□□□□ (N.C.)

When the pilot solenoid valve ⑦ is not energized (or when air is exhausted from the P1 port of the air operated type), the valve element ④ linked to the piston ⑤ is closed by the return spring ⑥.

• When valve element opens

When the pilot solenoid valve is energized (or when pressurized air enters through the P1 port of the air operated style), the pilot air that has entered under the piston moves upward to open the valve element.

• When valve element closes

When the power to the pilot solenoid valve is turned off (or when fluid is exhausted from the P1 port of the air operated style), the pilot air under the piston is exhausted, and the return spring closes the valve element.

VNB□□□□□□□□□□□□□□ (N.O.)

In contrast with the N.C., when the power to the pilot solenoid valve is turned off (or when air is exhausted from the P2 port of the air operated style), the valve is held open by the return spring. When the pilot solenoid valve is energized (or when pressurized air enters through the P2 port of the air operated style), the valve element closes.

VNB□□□□□□□□□□□□□□ (C.O.)

The valve element for the C.O. type, which has no return spring, is in an arbitrary position when air is exhausted through the P1 and P2 ports. When pressurized air enters the P1 port (exhaust from the P2 port), the valve element opens, and it closes when pressurized air enters the P2 port (exhaust from the P1 port).

Component Parts

No.	Description	Material	Note
①	Body	Bronze*	Clear coated
②	Cover assembly	Aluminium alloy	Platinum silver painted
③	Plate assembly	Brass*	Valve material (NBR, FKM, EPR)
④	Valve element	(NBR, FKM, EPR)	Stainless steel or brass
⑤	Piston assembly	Aluminium alloy	—
⑥	Return spring	Piano wire	—
⑦	Pilot solenoid valve	—	—

Note) Parts ③ and ④ are for selection of valve composition.

* The body option "S" is stainless steel, and "L" is aluminium.

Replacement Parts

No.	Description		Part No.									
			VNB1□□□□ -6A, 8A, 10A	VNB2□□□□ -10A, 15A	VNB3□□□□ -20A	VNB4□□□□ -25A	VNB5□□□□ -32A	VNB5□□□□ -32A	VNB6□□□□ -40A	VNB6□□□□ -40A	VNB7□□□□ -50A	VNB7□□□□ -50A
③(1)	Plate assembly	Valve material	NBR	VN1-A3BA	VN2-A3BA	VN3-A3BA	VN4-A3BA	VN5-A3BA	VN6-A3BA	VN7-A3BA	VN8-A3BA	VN9-A3BA
		FKM	VN1-A3BB	VN2-A3BB	VN3-A3BB	VN4-A3BB	VN5-A3BB	VN6-A3BB	VN7-A3BB	VN8-A3BB	VN9-A3BB	VN10-A3BB
		EPR	VN1-A3BC	VN2-A3BC	VN3-A3BC	VN4-A3BC	VN5-A3BC	VN6-A3BC	VN7-A3BC	VN8-A3BC	VN9-A3BC	VN10-A3BC
④(1)	Valve element	Valve material	NBR	VN1-4BA	VN2-4BA	VN3-4BA	VN4-4BA	VN5-4BA	VN6-4BA	VN7-4BA	VN8-4BA	VN9-4BA
		FKM	VN1-4BB	VN2-4BB	VN3-4BB	VN4-4BB	VN5-4BB	VN6-4BB	VN7-4BB	VN8-4BB	VN9-4BB	VN10-4BB
		EPR	VN1-4BC	VN2-4BC	VN3-4BC	VN4-4BC	VN5-4BC	VN6-4BC	VN7-4BC	VN8-4BC	VN9-4BC	VN10-4BC
⑦	Pilot solenoid valve		SF4-□□□-23-Q					VO307-□□□□-1-Q				

Note 1) In the cases of body options "S" and "L", the materials of the parts Nos. ③ and ④ are as follows: (Example): VN1-A3B□□□□

Note 2) 32A to 50A come in valve element assembly

□ L: Aluminium, S: Stainless steel

However all brackets of valve element of VNB 1 to 4 are made of stainless steel. (No need to add options "S" and "L".)

How to Order Pilot Solenoid Valve

Valve size 1, 2, 3, 4

SF4-1-DZ-23-Q

Coil rated voltage

- 1 — 100V AC 50/60Hz
- 2 — 200V AC 50/60Hz
- 3* — 110V AC 50/60Hz
- 4* — 220V AC 50/60Hz
- 5 — 24V DC
- 6 — 12V DC
- 7* — 240V AC 50/60Hz
- 9* — Other

* Option

Manual override

—	Non-locking push type
A*	Non-locking push type A (projecting)
B*	Slotted locking type B (tool required)

* Semi-standard

Electrical entry and indicator light and surge voltage suppressor

D	DIN connector
DZ	DIN connector with indicator light and surge suppressor



Contact SMC for other voltages (9)



Protective class class I (Mark:)..... DIN terminal type

Valve size 5, 6, 7 and vacuum pilot type

VO301-5-D 1-Q

Body option

—	Standard
V	Vacuum pilot

Coil rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3 ^{Note 1)}	110 VAC 50/60 Hz
4 ^{Note 1)}	220 VAC 50/60 Hz
5	24 VDC
6 ^{Note 1)}	12 VDC
7 ^{Note 1)}	240 VAC 50/60 Hz

Note 1) Semi-standard

Note 2) For other voltages, please consult with SMC

Electrical entry

D	DIN terminal
DZ	DIN terminal with light/surge voltage suppressor

Accessory

Function plate for VO307: DXT152-14-1A