

# 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

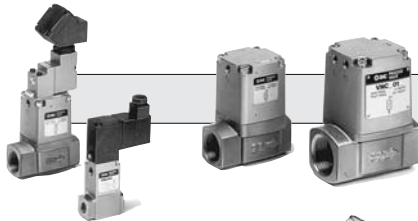
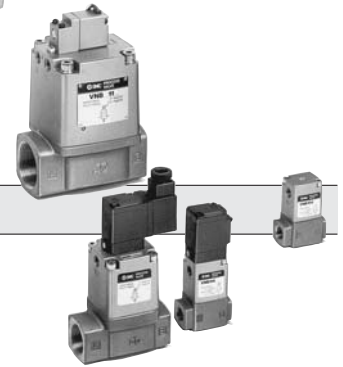
### Series VNA

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

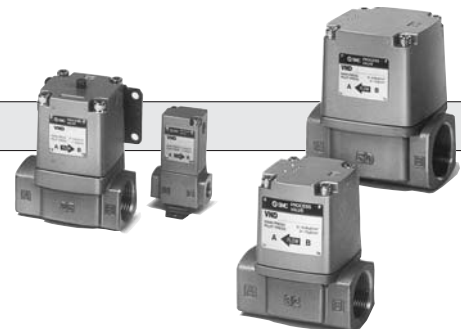


### Series VNH

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)



VX

VN□

VQ

VDW

VC

LV

PA

# Series VN

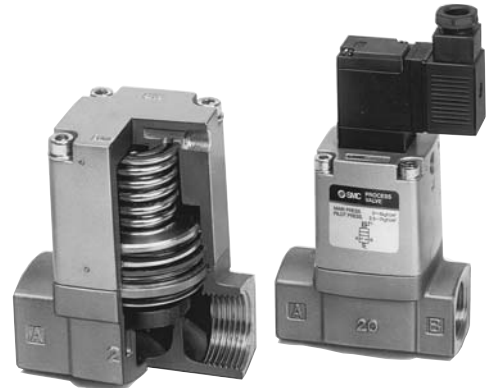
## Process Valve

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(PT)	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** The cylinder operated by external pilot air

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



Air operated

External pilot solenoid

## Many variations

The N.C, N.O, and C.O. types have made the screw-in styles (6A to 50A) and flanges (32F to 50F) into a series.

## 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 of the screw-in styles (6A to 50A) and flanges (32F to 50F).

### 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

Body material Seal material	BC6: Standard			Aluminum: L			Stainless steel: S		
	NBR : A	FPM : B	EPR : C	NBR : A	FPM : B	EPR : C	NBR : A	FPM : B	EPR : C
Fluid									
Air (Standard, Dry)	●	●		●	●		●	●	
Low vacuum (1 torr)	●	●		●	●		●	●	
Carbon dioxide (CO <sub>2</sub> , 0.7MPa or less)	●			●			●		
Carbon dioxide (CO <sub>2</sub> , 0.7 to 1MPa)			●			●			●
Nitrogen gas (N <sub>2</sub> )	●	●	●	●	●	●	●	●	●
Argon	●	●		●	●		●	●	
Helium		●			●			●	
Water (Standard, up to 60°C)	●						●		
Water (up to 99°C only air operated)		●	●					●	●
Turbine oil	●	●		●	●		●	●	
Spindle oil		●			●			●	
Kerosene		●			●			●	
Gas oil		●			●			●	
Fuel oil		●			●			●	
Brake oil (1)			●			●			●
Silicone oil		●						●	
Naphtha		●						●	
Ethyl alcohol		●						●	
Ethylene glycol (up to 80°C)			●						●
Boiler water							●		●
Copper free					●	●	●	●	●

- VX
- VN□
- VQ
- VDW
- VC
- LV
- PA

### ⚠ Caution

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

Note 1) Some brake oils are not allowed.

## 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	DL	S	Z	L	
1, 2, 3, 4	●			●		●
5, 6, 7	●	●	●			

(Except for DL) (Only T)





## Model

Model	Port size		Orifice size ø (mm)	Flow rate		Weight (kg)	
	Rc(PT)	Flange <sup>(1)</sup>		Nl/min	Effective area (mm <sup>2</sup> )	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			11	2944.50	55		
VNB2□□□-15A	1/2	—	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		
VNB7□□□-50A	50	42204.50			770		

## Symbol

Valve Style	N.C. Normally closed	N.O. Normally open	C.O. Double acting
	Air operated	VNB□0□ 	VNB□02 
External pilot solenoid	VNB□1□ 	VNB□12 	

## 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
	Air operated	VNB□01□V 
External pilot solenoid	VNB□11□V 	VNB□12□V 

## Valve Specifications

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



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	VO301□-00 □□□
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)	≤70°C (Application of rated voltage)
Apparent power	AC	Inrush	5.6VA(50Hz), 5.0VA(60Hz)
	DC	Holding	3.4VA(50Hz), 2.3VA(60Hz)
Power consumption		1.8W	4.8W
Manual override		Non-locking push style Others (Option)	Non-locking push style

VX

VN□

VQ

VDW

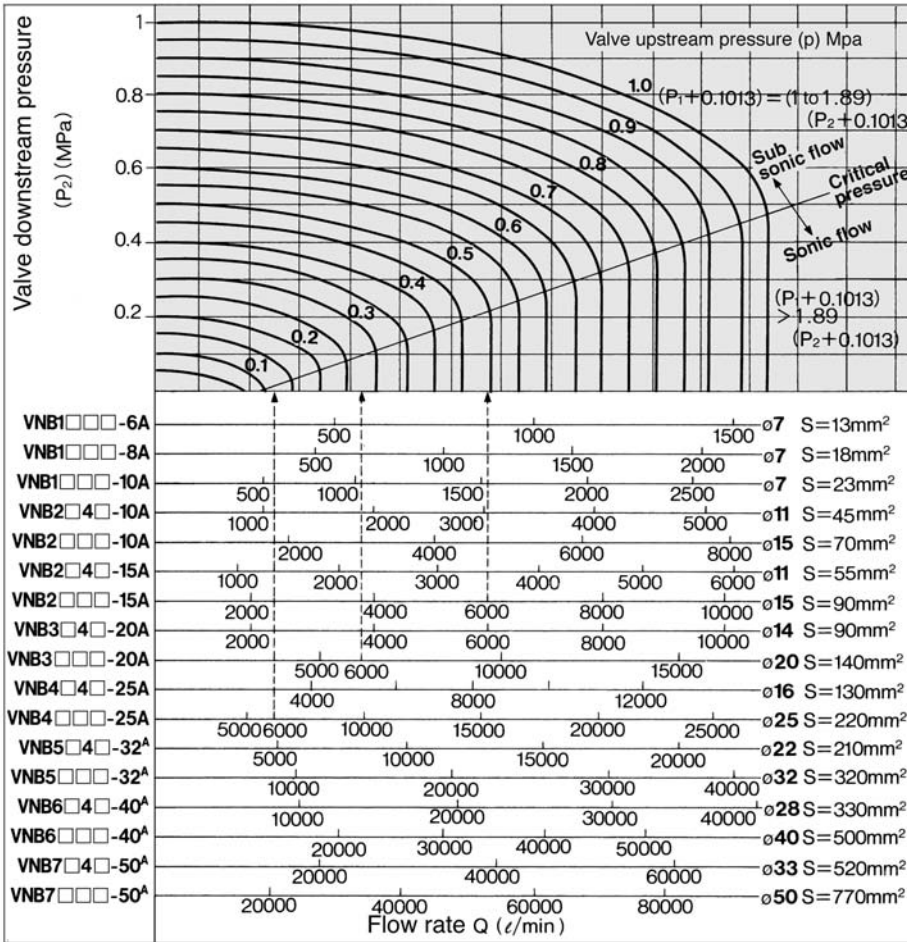
VC

LV

PA

## 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

$$Q = 4080 \cdot C_v \cdot \sqrt{\frac{\Delta P (P_2 + 0.1013)}{G}} \cdot \sqrt{\frac{273}{273 + \theta}}$$

..... l/min (ANR)

• Calculation by effective area

$$Q = 226 \cdot S \cdot \sqrt{\frac{\Delta P (P_2 + 0.1013)}{G}} \cdot \sqrt{\frac{273}{273 + \theta}}$$

..... l/min (ANR)

② Equation in the domain of sonic flow

• Calculation by Cv factor

$$Q = 2040 \cdot C_v \cdot (P_1 + 0.1013) \cdot \frac{1}{\sqrt{G}} \cdot \sqrt{\frac{273}{273 + \theta}}$$

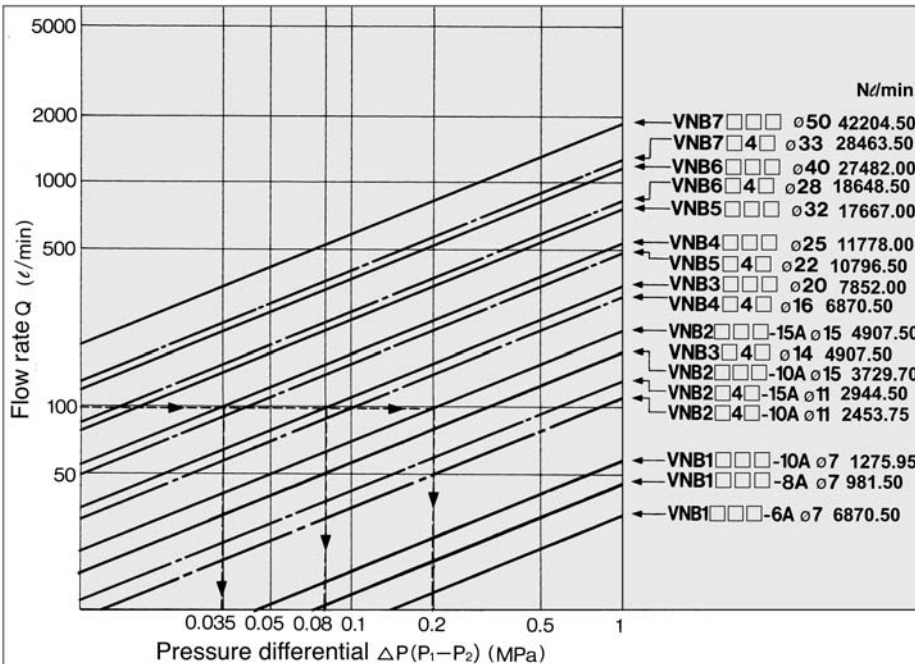
..... l/min (ANR)

• Calculation by effective area

$$Q = 113 \cdot S \cdot (P_1 + 0.1013) \cdot \frac{1}{\sqrt{G}} \cdot \sqrt{\frac{273}{273 + \theta}}$$

..... 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

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

• Calculation by effective area

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

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)

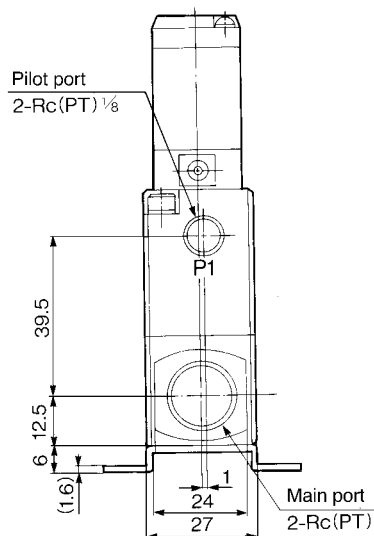
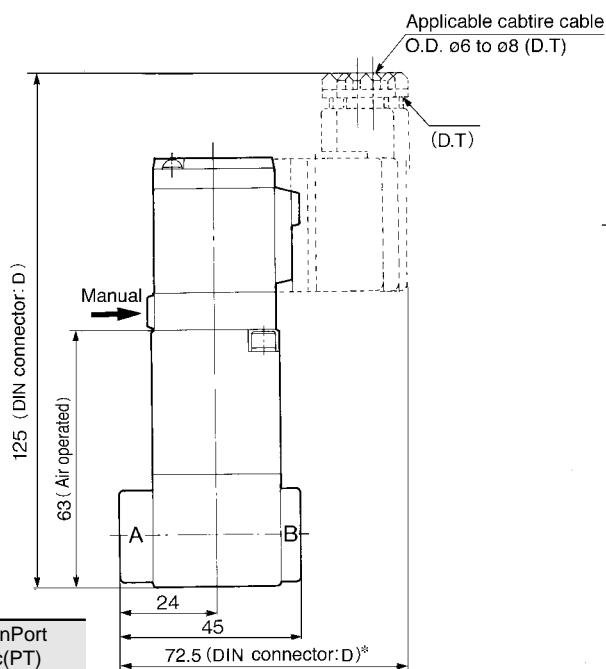
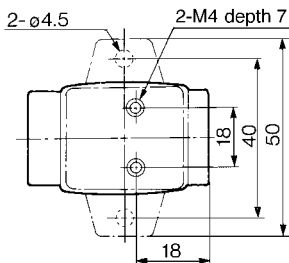
S : Effective area(mm<sup>2</sup>) S ≅ 17667. Nl/min

Cv : Cv factor ( / )

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

**Port size 6A, 8A,10A**

**Standard**



\* DZ is 9mm longer

Model	MainPort Rc(PT)
VNB1□□□-6A	1/8
VNB1□□□-8A	1/4
VNB1□□□-10A	3/8

- VX
- VN□
- VQ
- VDW
- VC
- LV
- PA

## ⚠ Precautions

Be sure to read before handling. Refer to p.0-33 for Safety Instructions and p.0-37 to 0-40 for common 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

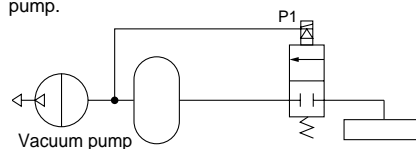
Port	VNB□01□V	VNB□02□V	VNB□1□□V
P1	Bleed port	External pilot	External pilot
P2	External pilot	Bleed port	Pilot exhaust

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.



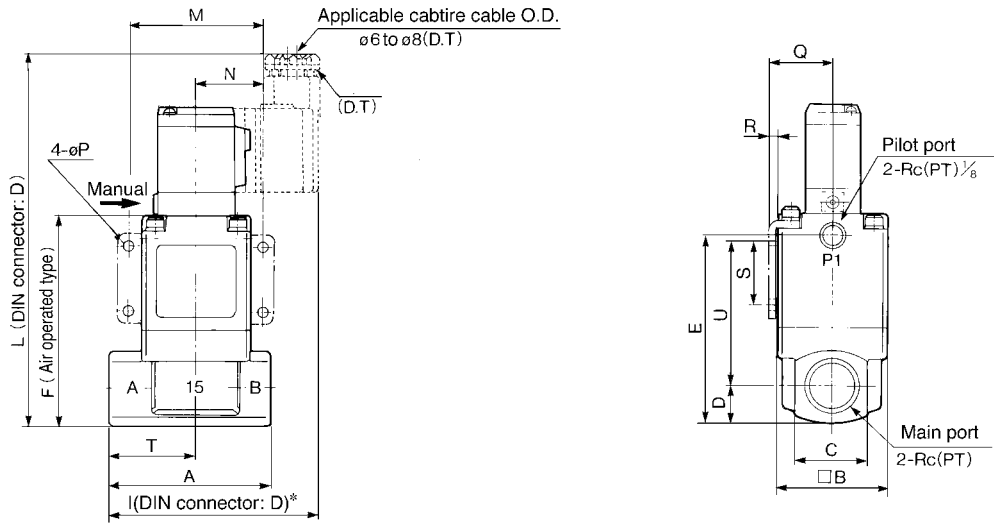
### Piping

#### ⚠ Caution

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

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

### Standard

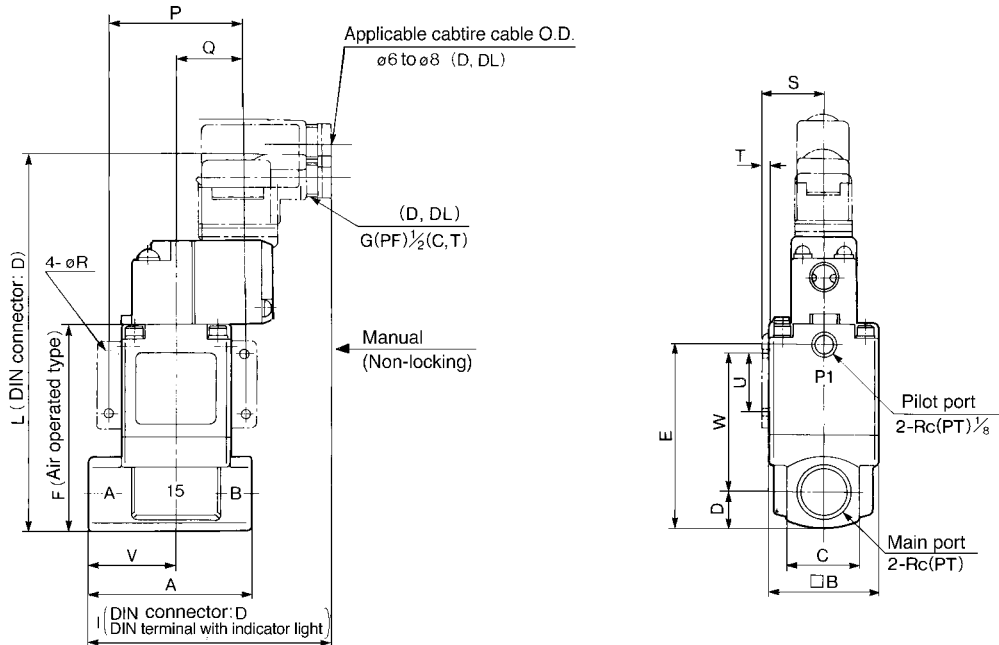


\* DZ is 9 mm longer.

Model	Main port Rc(PT)	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	80	50	35	17.5	84	92	91.5	154	62	31	5.5	28.3	2.3	30	43	60.5
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

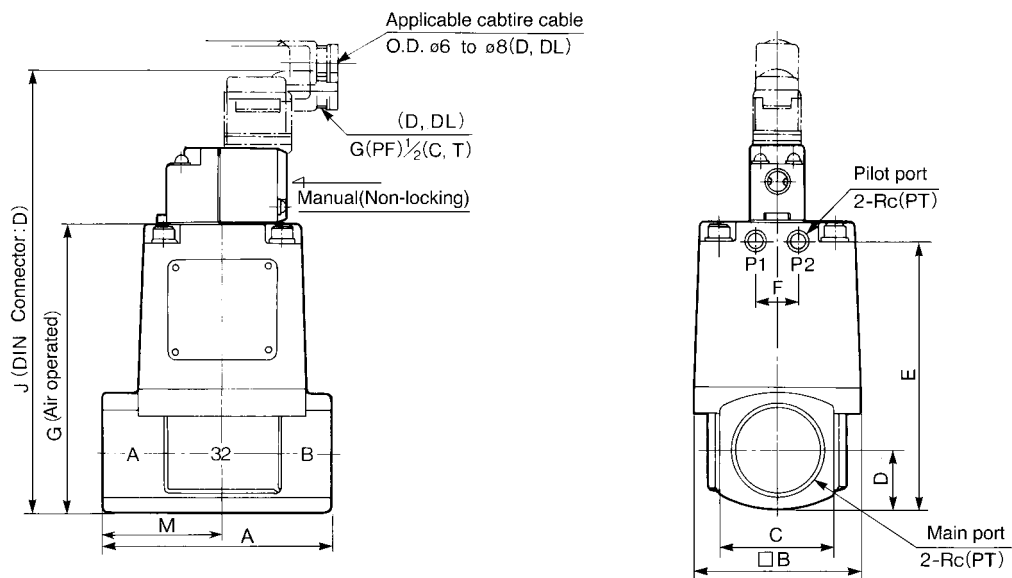


Model	Main port Rc(PT)	A	B	C	D	E	F	I	L	P	Q	R	S	T	U	V	W
VNB2□□□V-10A	3/8	63	42	28	14	72.5	80.5	97	170.5	52	26	4.5	24.3	2.3	25	34	55
VNB2□□□V-15A	1/2	80	50	35	17.5	84	92	102	182	62	31	5.5	28.3	2.3	30	43	60.5
VNB3□□□V-20A	3/4	80	50	35	17.5	84	92	102	182	62	31	5.5	28.3	2.3	30	43	60.5
VNB4□□□V-25A	1	90	60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

VX

VN□

VQ

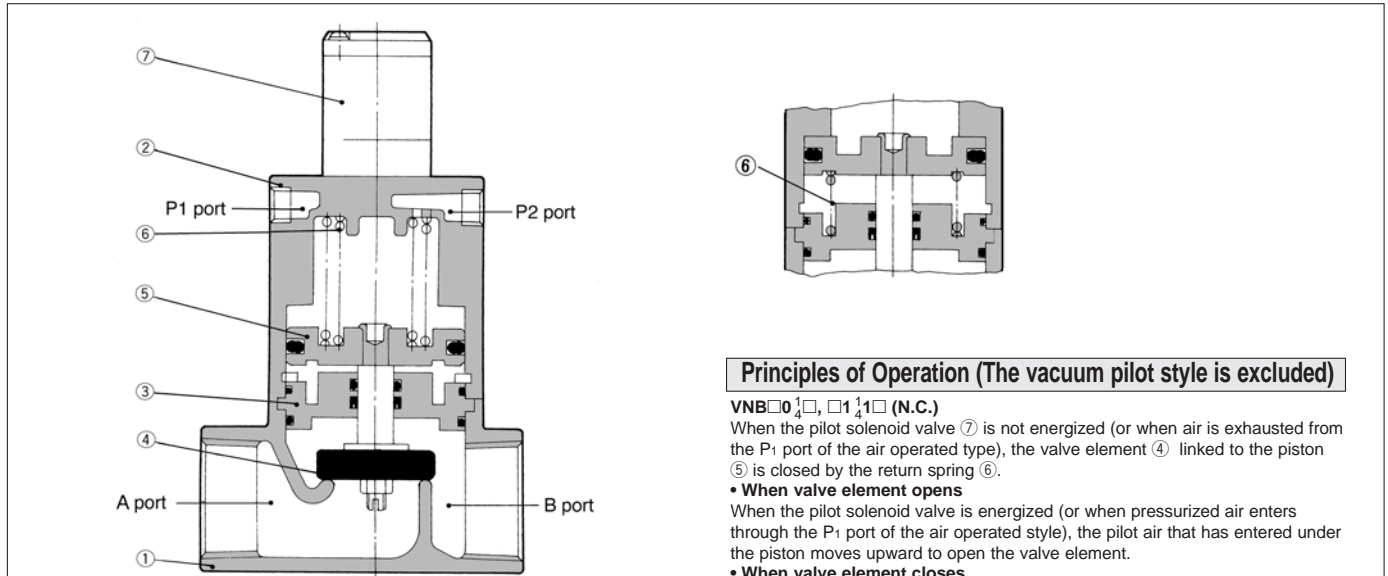
VDW

VC

LV

PA

## Construction



### Principles of Operation (The vacuum pilot style is excluded)

#### VNB□0<sup>1</sup>/<sub>4</sub>□, □1<sup>1</sup>/<sub>4</sub>□ (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□02□, □12□ (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 □03□ (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, FPM, EPR)
④	Valve element	(NBR, FPM, 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 aluminum.

## Replacement Parts

No.	Description	Part No.											
		VNB1□□□ -6A, 8A, 10A	VNB2□□□ -10A, 15A	VNB3□□□ -20A	VNB4□□□ -25A	VNB5□□□ -32A	VNB5□4□ -32A	VNB6□□□ -40A	VNB6□4□ -40A	VNB7□□□ -50A	VNB7□4□ -50A		
③(1)	Plate assembly	Valve material	NBR	VN1-A3BA	VN2-A3BA	VN3-A3BA	VN4-A3BA	VN5-A3BA	VN5-A3BA	VN6-A3BA	VN7-A3BA	VN7-A3BA	
			FPM	VN1-A3BB	VN2-A3BB	VN3-A3BB	VN4-A3BB	VN5-A3BB	VN5-A3BB	VN6-A3BB	VN7-A3BB	VN7-A3BB	
			EPR	VN1-A3BC	VN2-A3BC	VN3-A3BC	VN4-A3BC	VN5-A3BC	VN5-A3BC	VN6-A3BC	VN7-A3BC	VN7-A3BC	
④(1)	Valve element	(2) Valve material	NBR	VN1-4BA	VN2-4BA	VN3-4BA	VN4-4BA	VN5-A4BA	VN5-A4BA-3	VN6-A4BA	VN6-A4BA-3	VN7-A4BA	VN7-A4BA-3
			FPM	VN1-4BB	VN2-4BB	VN3-4BB	VN4-4BB	VN5-A4BB	VN5-A4BB-3	VN6-A4BB	VN6-A4BB-3	VN7-A4BB	VN7-A4BB-3
			EPR	VN1-4BC	VN2-4BC	VN3-4BC	VN4-4BC	VN5-A4BC	VN5-A4BC-3	VN6-A4BC	VN6-A4BC-3	VN7-A4BC	VN7-A4BC-3
⑦	Pilot solenoid valve	SF4-□□□-23-Q					VO301□-00□□□-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□□

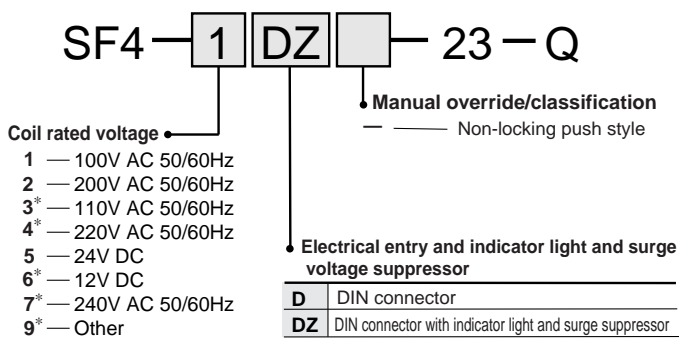
Note 2) 32<sup>A</sup> to 50<sup>A</sup> come in valve element assembly

□ L: Aluminum, 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



Contact SMC for other voltages (9)

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

### Valve size 5, 6, 7

