

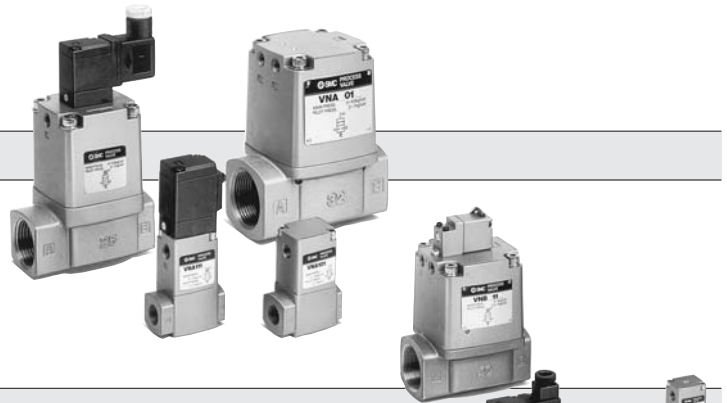
For General Purpose 2/3 Port Valve

Process Valve/Series VN

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

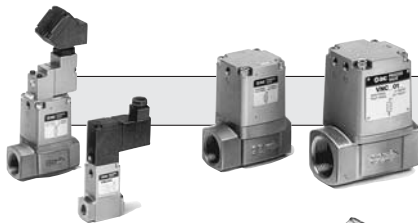
Series VNA

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

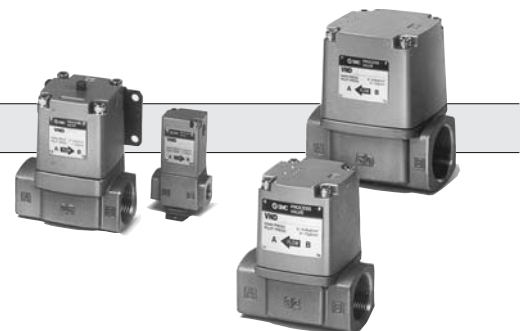


Series VNH

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 Compressed Air and Air-hydro Circuit Control Process Valve Series VNA

Universal 2 Port Valve

Exclusively for air pressure system and air-hydro circuit control

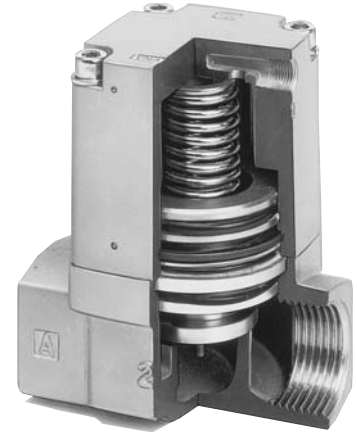
The cylinder operation by external pilot air

The balance poppet permits normal and reverse flow.

Operation from 0 MPa is possible

Wide variations

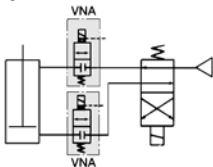
N.C., N.O., C.O., are available. Screw-in styles, 6A to 50A, are standardized.



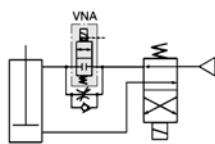
Compressed Air

Air pressure circuit: Application examples

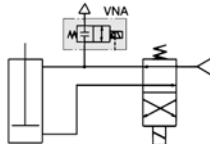
Actuator stop valve
Emergency stop, intermediate stop, inching



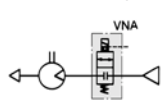
Actuator skip valve
Terminal deceleration, intermediate deceleration, accelerative start



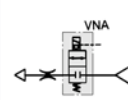
Actuator exhaust valve
High speed operation, high-speed exhaust



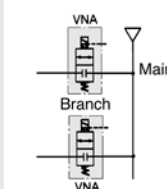
Air motor driving valve



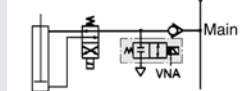
Air blow valve



Line stop valve

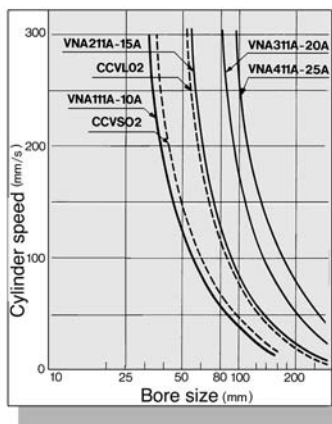


Residual line pressure exhaust valve



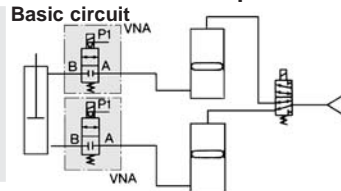
Air-hydro

Operation capacity when used in air-hydro units



This series can supplement the capacity of conventional air-hydro valve units. They are suited to operate large bore cylinders as well as to simultaneously operate multiple cylinders and suspend their operation. Thus they can be used in the same as the conventional air-hydro units.

Air-hydro circuit: Application example



Condition

Supply Pressure	0.49MPa
Hydraulic fluid	ISO VG32
Load	No load
Piping length	1m

Piping dia.	VNA111A CCVSO2	3/8B(9 mm)
	VNA111A CCVSO2	1/2B(13 mm)
	VNA311A	3/4B(19 mm)
	VNA411A	1B(25 mm)

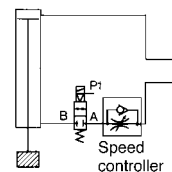
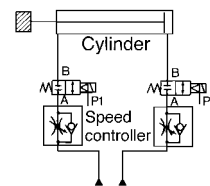


Refer to Best Pneumatics 2 for further information on air-hydro.

Caution

When speed controller is mounted

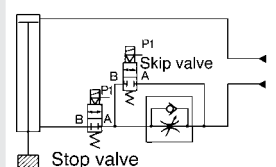
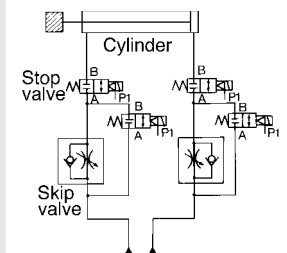
Connect a speed controller (Series AS etc.) to A port (cast in body A) of VNA*11 (in order to protect the speed control valve from surges when cylinder operation is suspended, thus improving stopping accuracy)



Caution

Skip valve function

Combination of 2 or more valves of Series VNA provides a skip valve function. Connect the skip valve to the A port side of a stop valve as in the case of the speed control valve.



VX

VN□

VQ

VDW

VC

LV

PA

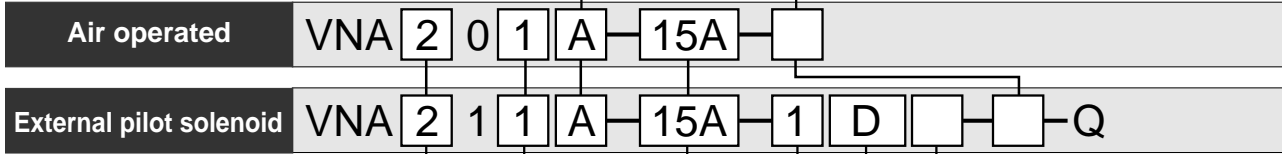
How to Order

Seal material	
A	NBR seal
B	FPM seal
C	EPR seal

Refer to Table ① for application.

Bracket	
—	Without bracket
B	With bracket

Only valve size 1, 2, 3, 4.



Symbol	Orifice size (mm)	Symbol			Symbol	Port size RC(PT)
		1	2	3>Note)		
		N.C.	N.O.	C.O.		
1	ø10	●	●	●	6A	1/8
		●	●	●	8A	1/4
		●	●	●	10A	3/8
2	ø15	●	●	●	10A	3/8
		●	●	●	15A	1/2
		●	●	●	20A	3/4
3	ø20	●	●	●	25A	1
4	ø25	●	●	●	32A	1 1/4
5	ø32	●	●	●	40A	1 1/2
6	ø40	●	●	●	50A	2
7	ø50	●	●	●		

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	Less than 250 VAC and 50 VDC

Electrical entry/Indicator light and surge voltage suppressor	
D	DIN connector
DL	DIN connector with indicator light and surge suppressor

Note) Only air operated type.

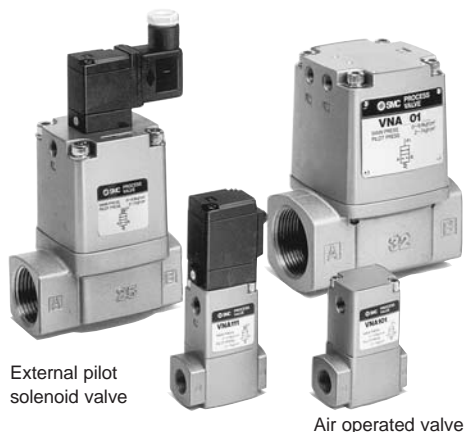
Order code Contact SMC for other voltages (9)

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

Table ① Applicable fluids

Model	VNA□□□A (Valve material: NBR seal)	VNA□□□B (Valve material: FPM seal)	VNA□□□C (Valve material: EPR seal)
Applicable fluids	Air(standard dry) CO ₂ (0.7 MPa Max.) Nitrogen gas(N ₂) Freon 11, 113, 114, Turbine oil(40 to 100 cst), Hydraulic fluid	Argon, Helium, Turbine oil, Hydraulic fluid (99°C)	CO ₂ (0.7 MPa max.)

Caution Contact SMC on other fluids, operating conditions, etc.



External pilot solenoid valve

Air operated valve

Model

Model	Port Size Rc(PT)	Orifice size ø (mm)	Flow rate		Weight (kg)	
			Nl/min	Effective area (mm ²)	Air operated	Solenoid
VNA1□□□-6A	1/8	10	687.05	13	0.1	0.2
VNA1□□□-8A	1/4		1275.95	23		
VNA1□□□-10A	3/8		1963.00	35		
VNA2□□□-10A	3/8	15	3729.70	70	0.3	0.4
VNA2□□□-15A	1/2		4907.50	90		
VNA3□□□-20A	3/4	20	7852.00	140	0.5	0.6
VNA4□□□-25A	1	25	11778.00	220	0.8	0.9
VNA5□□□-32A	1 1/4	32	17667.00	320	1.3	1.4
VNA6□□□-40A	1 1/2	40	27482.00	500	2.1	2.2
VNA7□□□-50A	2	50	42204.00	770	3.1	3.2

Valve Specifications

Fluid		Refer to table ① on page 4.2-4.
Fluid temperature	VNA□□□A	-5 to 60°C (1)
	VNA□□□B/□□□C	-5 to 99°C (1) (Only air operated)
Ambient temperature		-5 to 50°C (Air operated: 60°C) (1)
Proof pressure		1.5MPa
Operating pressure range		0 to 1MPa
External pilot air	Pressure range	0.2 to 0.7MPa
	Lubrication	Not required (Use turbine oil No.1 (ISO VG32) if lubricated) (2)
	Temperature	-5°C to 50°C(Air operated: 60°C)



Note 1) No freezing

Note 2) Lubrication is not allowed in case of seal material EPR.

Symbol

Valve Style	N.C.	N.O.	C.O.
	Normally closed	Normally open	Double acting
Air operated	VNA□□01 	VNA□□02 	VNA□□03
	VNA□□11 	VNA□□12 	

Pilot Solenoid Valve 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(V)	AC(50/60Hz)	100V, 200V	Others(Optional)
	DC	24V, Others(Optional)	
Allowable voltage		-15% to +10%(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)	12VA(50Hz), -10.5VA(60Hz)
		Holding 3.4VA(50Hz), 2.3VA(60Hz)	7.5VA(50Hz), 6VA(60Hz)
Power consumption	DC	1.8W	4.8W
Manual override		Non-locking push style Others (Option)	Non-locking push style

VX

VN□

VQ

VDW

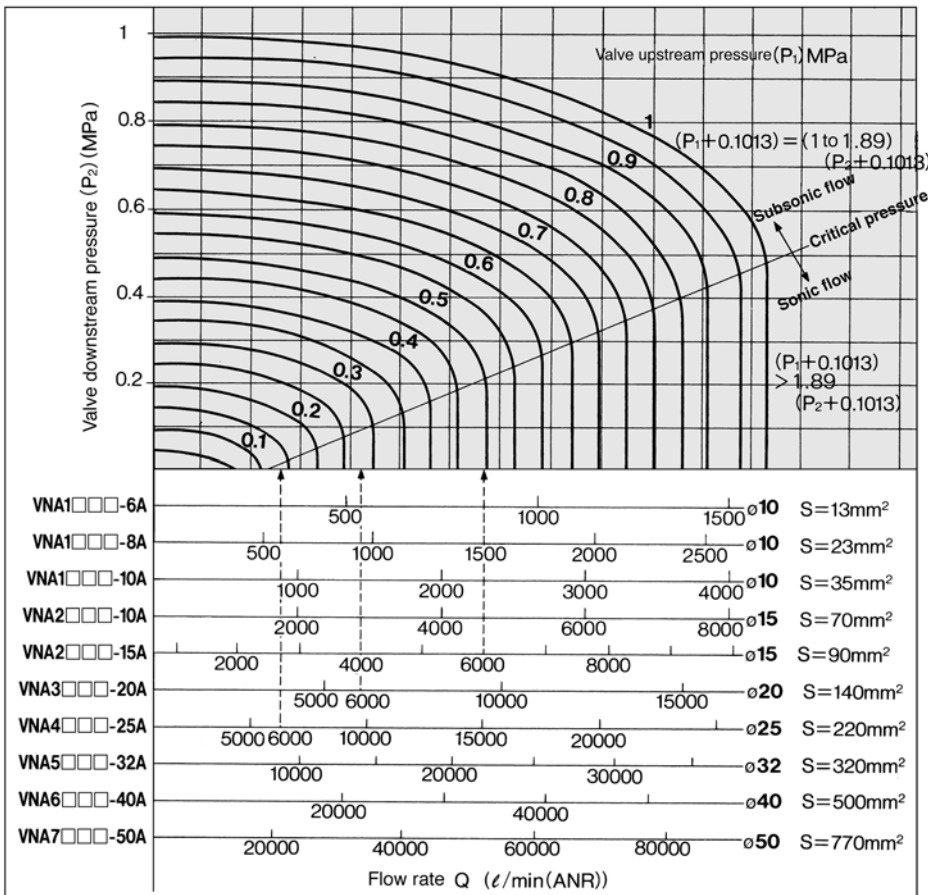
VC

LV

PA

Flow Characteristics

Air



How to Read The Graph

In the sonic flow region: For a flow of 6000 (l/min)
 VNA4mm(Orificeø25)...P1 ≅ 0.14MPa
 VNA4mm(Orificeø20)...P1 ≅ 0.28MPa
 VNA4mm(Orificeø15)...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

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

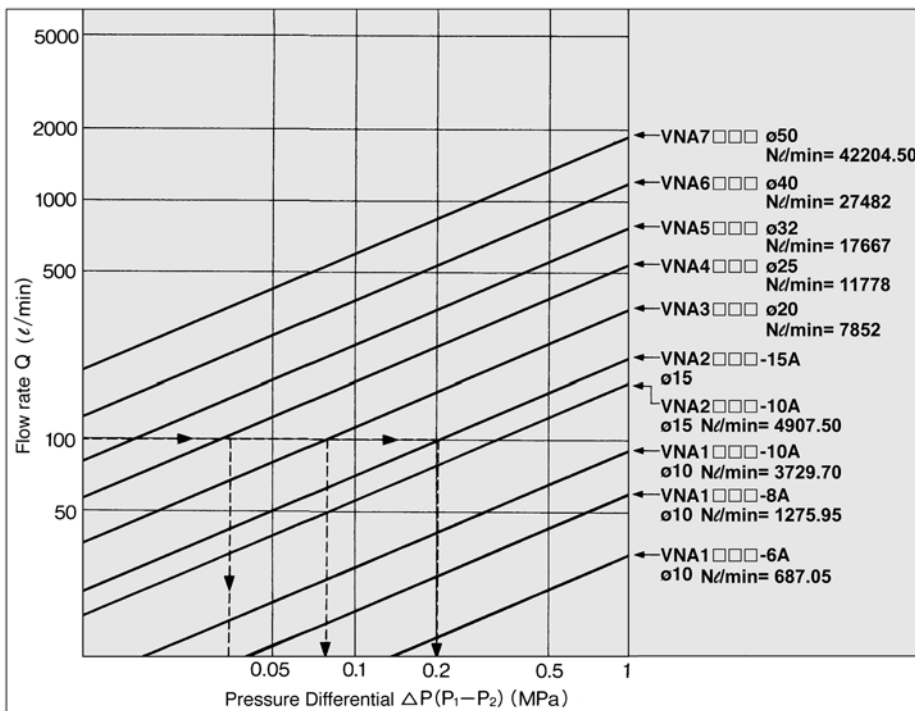
..... l/min (ANR)

• 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)

Turbine oil (ISO VG32)



How to Read The Graph

In case of a flow of oil 100 l/min:
 VNA4□□□(Orificeø24)...ΔP ≅ 0.035MPa
 VNA4□□□(Orificeø20)...ΔP ≅ 0.08MPa
 VNA4□□□(Orificeø15)...ΔP ≅ 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 50 cSt or less will be very small.

Symbol

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

ΔP: Pressure differential (P1-P2)

P1 : Upstream pressure (MPa)

P2 : Downstream pressure (MPa)

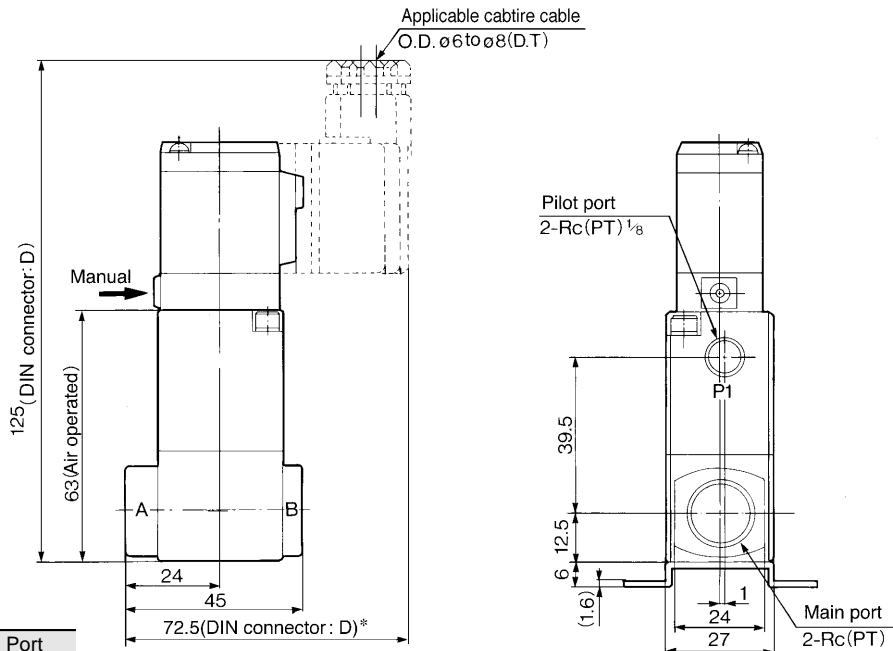
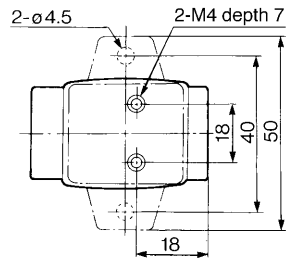
θ : Temperature of air and other gases (°C)

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


Cv : Cv factor (/)

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

Port size 6A, 8A, 10A

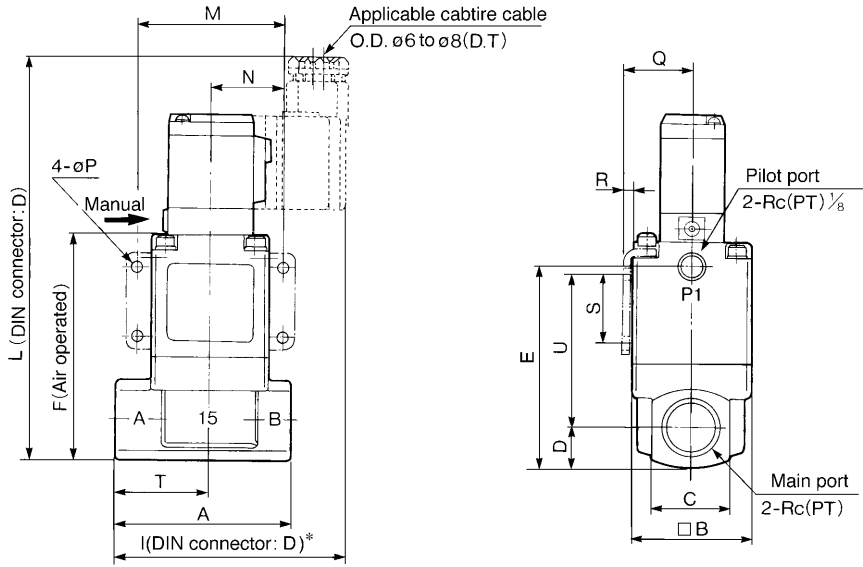


Model	Main Port Rc(PT)
VNA1□□□-6A	1/8
VNA1□□□-8A	1/4
VNA1□□□-10A	3/8

 * DZ: 9mm longer

- VX
- VN□**
- VQ
- VDW
- VC
- LV
- PA

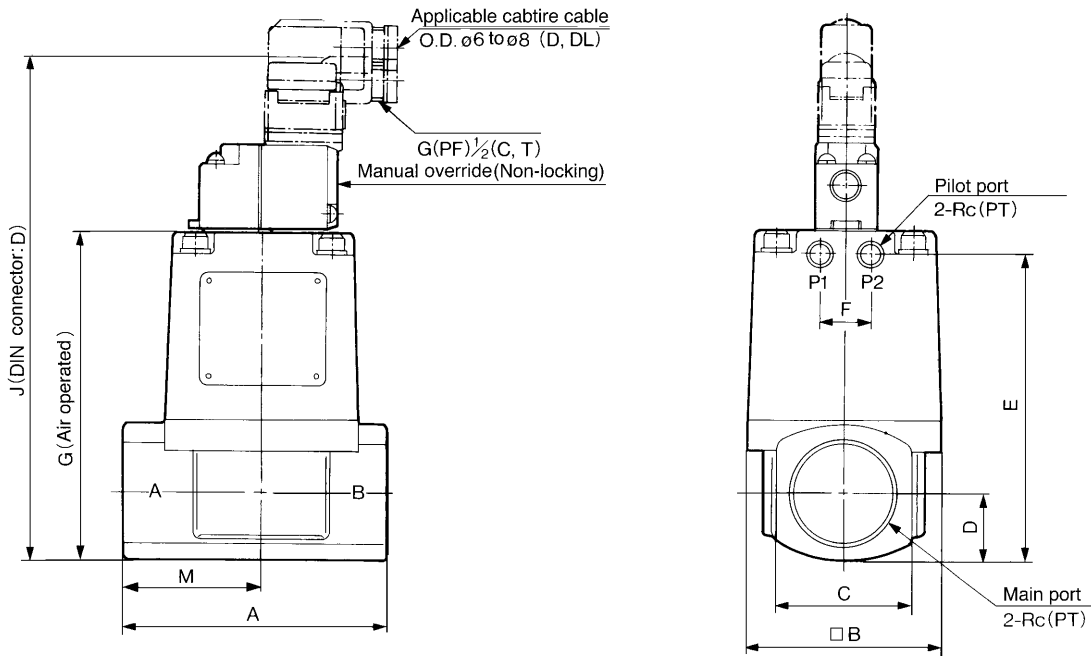
Port size 10A, 15A, 20A, 25A



* DZ: 9mm longer

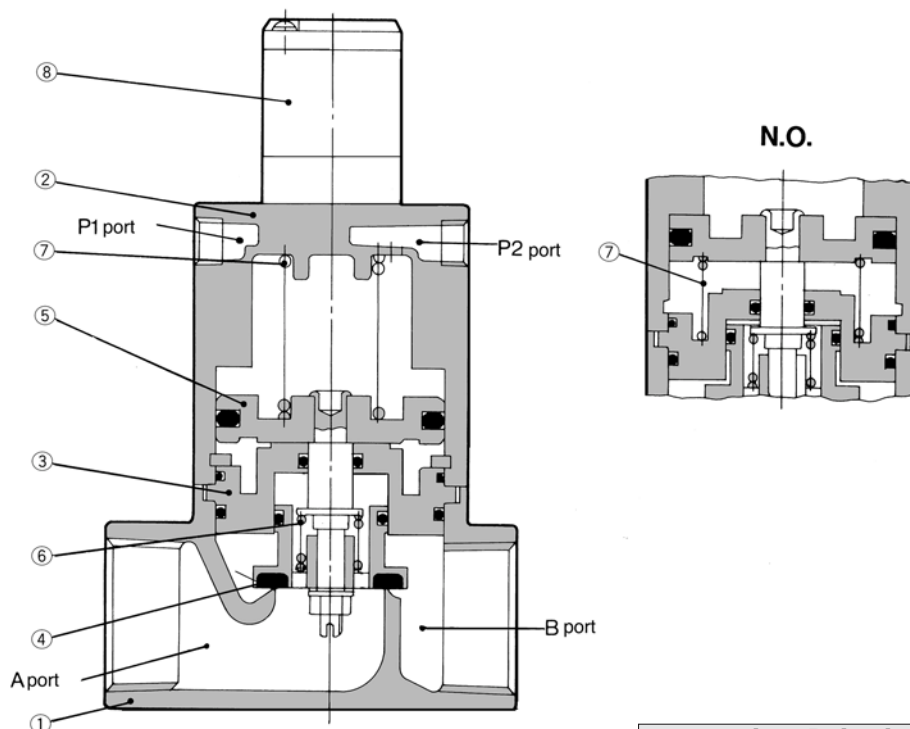
Model	Main Port Rc(PT)	A	B	C	D	E	F	I	L	M	N	P	Q	R	S	T	U
VNA2□□□-10A	3/8	63	42	28	14	72.5	80.5	82.5	142.5	52	26	4.5	24.3	2.3	25	34	55
VNA2□□□-15A	1/2																
VNA3□□□-20A	3/4	80	50	35	17.5	84	92	91.5	154	62	31	5.5	28.3	2.3	30	43	60.5
VNA4□□□-25A	1	90	60	40	20	100	108	97.5	170	72	36	6.5	33.3	2.3	35	49	73

Port size 32A, 40A, 50A



Model	Main Port Rc(PT)	Pilot port Rc(PT)	A	B	C	D	E	F	G	J	M
VNA5□□□-32A	1 1/4	1/8	105	77	53	26.5	120.5	20	129.5	219.5	55
VNA6□□□-40A	1 1/2	1/4	120	96	60	30	137	24	147	237	63
VNA7□□□-50A	2	1/4	140	113	74	37	160	24	170	260	74

Construction



Component Parts

No.	Description	Material	Note
①	Body	Aluminium alloy	Platinum silver painted
②	Cover assembly	Aluminium alloy	Platinum silver painted
③ ⁽¹⁾	Plate assembly	Aluminium alloy	Valve material(NBR, FPM, EPR)
④ ⁽¹⁾	Valve element	Aluminium alloy	Valve material(NBR, FPM, EPR)
⑤	Piston assembly	Aluminium alloy	—
⑥	Travel spring	Stainless steel	—
⑦	Return spring	Piano wire	—
⑧	Pilot solenoid valve	—	—



Note 1) Parts ③, ④ are for selection of valve composition.

Replacement Parts

No.	Description		Part No.							
			VNA1□□A -6A, 8A, 10A	VNA2□□□ -10A, 15A	VNA3□□□ -20A	VNA4□□□ -25A	VNA5□□□ -32A	VNA6□□□ -40A	VNA7□□□ -50A	
③	Plate assembly	Valve material	NBR	VN1-A3AA	VN2-A3AA	VN3-A3AA	VN4-A3AA	VN5-A3AA	VN6-A3AA	VN7-A3AA
		FPM	VN1-A3AB	VN2-A3AB	VN3-A3AB	VN4-A3AB	VN5-A3AB	VN6-A3AB	VN7-A3AB	
		EPR	VN1-A3AC	VN2-A3AC	VN3-A3AC	VN4-A3AC	VN5-A3AC	VN6-A3AC	VN7-A3AC	
④	Valve disc (Valve disc a'ssy for 25A-50A)	Valve material	NBR	VN1-4AA	VN2-4AA	VN3-4AA	VN4-A4AA	VN5-A4AA	VN6-A4AA	VN7-A4AA
		FPM	VN1-4AB	VN2-4AB	VN3-4AB	VN4-A4AB	VN5-A4AB	VN6-A4AB	VN7-A4AB	
		EPR	VN1-4AC	VN2-4AC	VN3-4AC	VN4-A4AC	VN5-A4AC	VN6-A4AC	VN7-A4AC	
⑧	Pilot solenoid valve		SF4-□□□-23 (Refer to p.4.2-10 for details)				VO301-00□□□ (Refer to p.4.2-10 for details)			

Operation Principles

VNA□01□, □11□ (N.C.)

When the pilot solenoid valve ⑧ is not energized (or when air is exhausted from the P1 port of the air operated style), the valve element ④ linked to the piston ⑤ is closed by the return spring ⑦.

●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 it upward to open the valve element.

●When valve element closes

When the power to the pilot solenoid valve is turned off (or when air 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.

VNA□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.

VNA□03□ (C.O.)

The valve element of 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).

VX

VN□

VQ

VDW

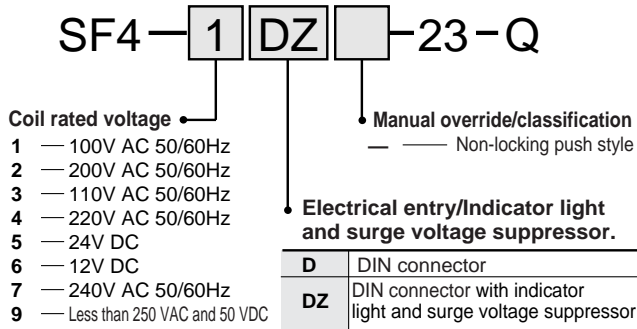
VC

LV

PA

How to Order Pilot Solenoid Valve

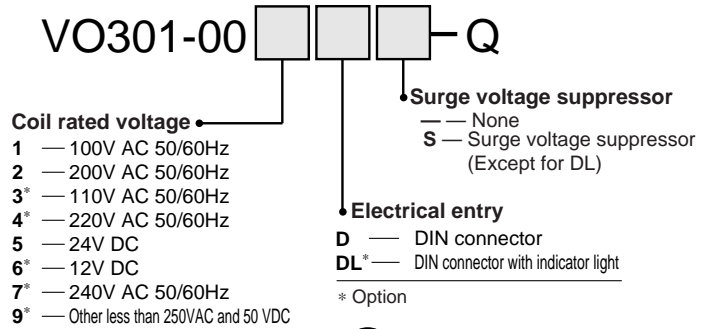
Valve size 1, 2, 3, 4



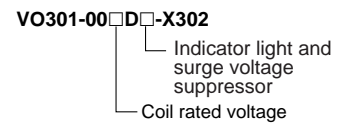
Contact SMC for other voltages (9)

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

Valve size 5, 6, 7



Note 1) When the electrical entry is D, the pilot solenoid valve parts are as follows:



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.

Port	VNA□01□	VNA□02□	VNA□03□	VNA□1□
P ₁	External pilot	Bleed port	External pilot	Pilot exhaust
P ₂	Bleed port	External pilot	External pilot	Pilot exhaust

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

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.

Use with Air-hydro Unit

Warning

1.Piping
When operation is suspended, surge pressure will be generated between the cylinder and VNA□11A. To directly thread in the cylinder, use durable fittings (SUS square nipples etc.) instead of ductile iron fittings (JIS B 2301) or steel pipe fittings (JIS B 2302).

When VNA□11A is to be installed away from the cylinder, use a high-pressure rubber hose (JIS B 6349) instead of steel pipe as much as possible.

Caution

1.Air bleeding

Valves of Series VNA have no air bleeding port. Bleed air from the middle piping. Bleeding by a vacuum pump is more effective.

2.Hydraulic fluid

Turbine oil, Grade 1, ISO VG32, with petroleum hydraulic fluid is recommended.

3.Speed control valve

The combination shown in the following table is recommended to bring the best of Series VNA.
(Piping: JIS K 6349 high pressure hose)

Combination of Series VNA and flow control valve (Series AS)

	VNA	AS	Piping (I.D.)
10A	111	420-03	3/8 B(ø9.5)
15A	211	420-04	1/2 B(ø12.7)
20A	311	500-06	3/4 B(ø19.1)
25A	411	600-10	1B(ø25.4)
32A	511	800-12	1 1/4 B(ø31.8)
40A	611	900-14	1 1/2 B(ø38.1)
50A	711	900-20	2B(ø50.8)