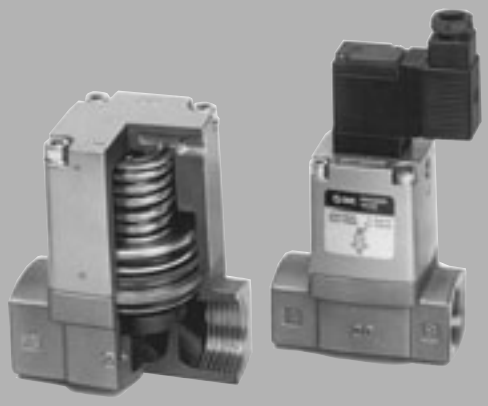
Process Valve

Series VNB

2 Port Valve For Flow Control



Air operated | External pilot solenoid

A wide variety of 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.

Cylinder actuation by external pilot air

Wide variations

N.C., N.O., C.O., types are available. Screw-in type (6A to 50A) and the flange (32F to 50F) are standardized.

Selection Procedure

1 Applicable fluids

- Refer to "Table (1)" to check that the desired fluid is applicable.
- Select the body and sealing materials, depending on the fluid.

2 Flow characteristics (Air, Water)

- To find the flow rate of air or water, refer to the table of flow rate characteristics on page 10 to 16. 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 threaded type (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. 1 MPa (normally closed) types. Select the proper one according to the operating conditions.

4 Power voltage and electrical entry (External pilot solenoid)

- Select the AC/DC power source and choose the electrical entry according to "Table (3)".

Table (1) Applicable Fluids Check List

Wetted part Body material	Copper alloy: Standard			Aluminum: L			Stainless steel: S		
Wetted part Seal material	NBR : A	FKM : B	EPR : C	NBR : A	FKM : B	EPR : C	NBR : A	FKM : B	EPR : C
Fluid									
Air (Standard, Dry)	●	●		●	●		●	●	
Low vacuum (Up to –101kPa)	●	●		●	●		●	●	
Carbon dioxide (CO_2, 0.7 MPa or less)	●			●			●		
Carbon dioxide (CO_2, 0.7 to 1 MPa)			●			●			●
Nitrogen gas (N_2)	●	●	●	●	●	●	●	●	●
Argon	●	●		●	●		●	●	
Helium		●			●			●	
Water (standard, up to 60°C)	●						●		
Water (up to 99°C air operated type only)		●	●					●	●
Turbine oil	●	●		●	●		●	●	
Spindle oil		●			●			●	
Fuel oil Class 3 (C fuel oil)		●			●			●	
Brake oil Note)			●			●			●
Silicon oil		●						●	
Naphtha		●						●	
Ethylene glycol (up to 80°C)			●						●
Boiler water							●		●

⚠ Caution

Note 1) When fluid permits application of multiple body and sealing materials, select the most suitable one according to the ambient environment (FKM or EPR seal material for high temperature) and other conditions (corrosion resistance and viscosity), etc.

Note 2) Test fluids to see if it will wash out cleaning liquid such as grease.

Note 3) Some brake oils are not allowed.

Table (2) Combinations between Valve Size and Port Size

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

Table (3) Combinations between Electrical Entry and Light/Surge Voltage Suppressor

Valve size	Electrical entry						Light/Surge voltage suppressor			Manual override
	G	E	C	T	D	DL	S	Z	L	
1, 2, 3, 4	●	●	●	●	●	●	●	●	●	●
5, 6, 7	●	●	●	●	●	●	●	●	●	●

(Only "G") (Except "G")

(Except "DL") (Only "T") (Only "T")

Process Valve: 2 Port Valve For Flow Control

Series VNB

How to Order

Seal material

A	NBR seals
B	FKM seals
C	EPR seals

Refer to Table (1) for availability.

Body material option

Nil	Standard
S*	Stainless steel body
L*	Aluminum body

* Threaded port only

Pilot system option

Nil	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

Nil	Rc
F	G
N	NPT
T	NPTF

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

Nil	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)

Air operated VNB 2 0 1 A □ □ – □ 15A – □

External pilot solenoid VNB 2 1 1 A □ □ – □ 15A – 1 T □ – □

Valve size

Valve type

Port size

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

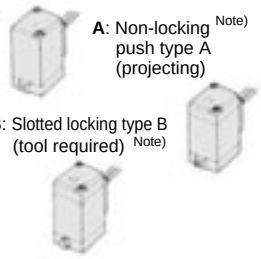
Note 1) Air operated only
Note 2) The valve type symbols for vacuum pilot type are 1 (N.C.) and 2 (N.N.) only.

Rated voltage

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

* Semi-standard

Manual override

Nil: Non-locking push type **A**: Non-locking push type A (projecting) Note) **B**: Slotted locking type B (tool required) Note)		Valve size 1 to 4
Nil: Non-locking push type		Valve size 5 to 7

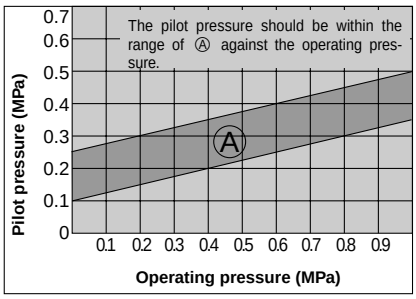
Note) Semi-standard

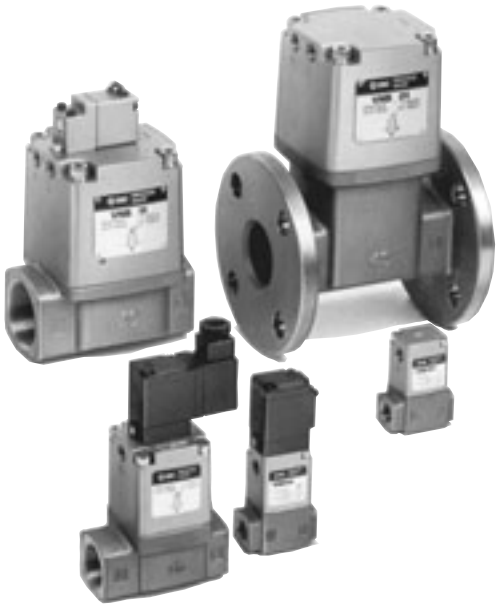
Electrical entry/With light/surge voltage suppressor

G	Grommet	Valve size 1 to 4
GS	Grommet with surge voltage suppressor	
E	Grommet terminal	
EZ	Grommet terminal with light/surge voltage suppressor	
T	Conduit terminal	
TZ	Conduit terminal with light/surge voltage suppressor	
D	DIN terminal	
DZ	DIN terminal with light/surge voltage suppressor	
G	Grommet	Valve** size 5 to 7
GS	Grommet with surge voltage suppressor	
C	Conduit	
T	Conduit terminal	
TS	Conduit terminal with surge voltage suppressor	
TZ*	Conduit terminal with light/surge voltage suppressor	
TL*	Conduit terminal with indicator light	
D	DIN terminal	
DL	DIN terminal with indicator light	

* Except rated voltage 6, 7, 9.
** DZ: For DIN terminal with light/surge suppressor protection circuit, be sure to suffix -X200 at the end of the part number. In this case, pilot solenoid valve is VO307-□DZ.

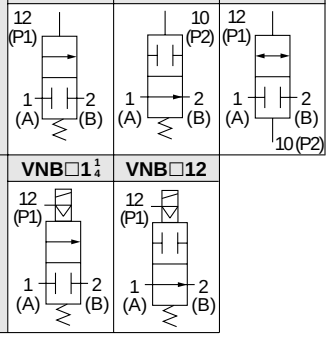
Graph (4) VNB□□$\frac{2}{3}$□ Pilot Pressure (N.O. and C.O. types)





JIS Symbol

Type \ Valve type	N.C. Normally closed	N.O. Normally open	C.O. Double acting
Air operated	**VNB□0$\frac{1}{4}$**	**VNB□02**	**VNB□03**
External pilot solenoid	**VNB□1$\frac{1}{4}$**	**VNB□12**	



Note) To maintain vacuum, maintain vacuum in Port 1 (A).

Option Specifications
Vacuum pilot valve VNB□□□□V

(Valve size 2 to 7)

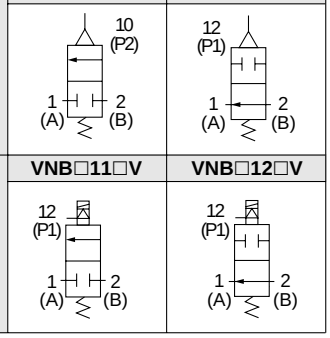
It is used when the valve is to be operated by the main vacuum in the absence of pressurized air.

Specifications (Vacuum pilot type)

Fluid	Vacuum
Operating pressure range	–101 kPa to Atmospheric pressure
Pilot pressure range	–101 to – 47.9 kPa

JIS Symbol (Vacuum pilot type)

Type \ Valve type	N.C. Normally closed	N.O. Normally open
Air operated	**VNB□01□V**	**VNB□02□V**
External pilot solenoid	**VNB□11□V**	**VNB□12□V**



Model

Model	Port size Rc	Orifice dia. ø (mm)	Flow characteristics: Measured by air C [dm³/(bar·sec)]	b	Cv	Measured by water Av x 10^{-6} m²	Mass (kg): Air operated	External pilot solenoid
VNB1□□□-6A	1/8	7	3.3	0.29	0.80	25	0.3	0.4
VNB1□□□-8A	1/4		4.6	0.17	1.0	29		
VNB1□□□-10A	3/8		4.7	0.18	1.1	31		
VNB2□4□-10A		11	9.6	0.40	2.6	71	0.6	0.7
VNB2□□□-10A		15	17	0.32	4.0	110		
VNB2□4□-15A	1/2	11	9.6	0.40	2.6	76		
VNB2□□□-15A		15	19	0.24	4.8	140		
VNB3□4□-20A	3/4	14	18	0.42	5.4	140	0.9	1.0
VNB3□□□-20A		20	35	0.13	7.4	270		

Model	Port size Rc	Port size Flange[Note]	Orifice dia. ø (mm)	Flow characteristics Cv	Flow characteristics Effective area (mm²)	Mass (kg): Air operated	External pilot solenoid
VNB4□4□-25A	1	–	16	7	130	1.4	1.5
VNB4□□□-25A			25	12	220		
VNB5□4□-32A	1 1/4	–	22	11	210	2.5	2.6
VNB5□□□-32A			32	18	320		
VNB5□4□-32F	–	32	22	11	210	5.7	5.8
VNB5□□□-32F			32	18	320		
VNB6□4□-40A	1 1/2	–	28	19	330	4.1	4.2
VNB6□□□-40A			40	28	500		
VNB6□4□-40F	–	40	28	19	330	7.7	7.8
VNB6□□□-40F			40	28	500		
VNB7□4□-50A	2	–	33	29	520	6.3	6.4
VNB7□□□-50A			50	43	770		
VNB7□4□-50F	–	50	33	29	520	11.4	11.5
VNB7□□□-50F			50	43	770		

Note) The flange should be JIS B 2210 10K (ordinary style) or its equivalent.

Specifications

Fluid			Water/Oil/Air/Vacuum, etc.
Fluid temperature	**VNB□□□A, VNB□1□$^{B}_{C}$**		–5 to 60°C [Note 1]
	VNB□0□$^{B}_{C}$		–5 to 99°C [Note 1] (Water, Oil etc. Air Operated only)
Ambient temperature			–5 to 50°C [Note 1] (Air operated type: 60°C)
Proof pressure			1.5 MPa
Applicable pressure range [Note 4]	**VNB□□1□**		Low vacuum to 0.5 MPa
	VNB□□$\frac{3}{4}$□		Low vacuum to 1 MPa
External pilot air	Pressure	**VNB□□$\frac{1}{4}$□**	0.25 to 0.7 MPa
		VNB□□$\frac{2}{3}$□	0.1 + 0.25 x (Operating pressure) to 0.25 + 0.25 x (Operating pressure) MPa [Note 3] Refer to "Graph (1)" on page 366.
	Lubrication		Not required (Use turbine oil Class 1 ISO VG32, if lubricated. [Note 2])
	Temperature		–5 to 50°C (Air operated type: 60°C)
Mounting orientation			Unrestricted [Note 5]

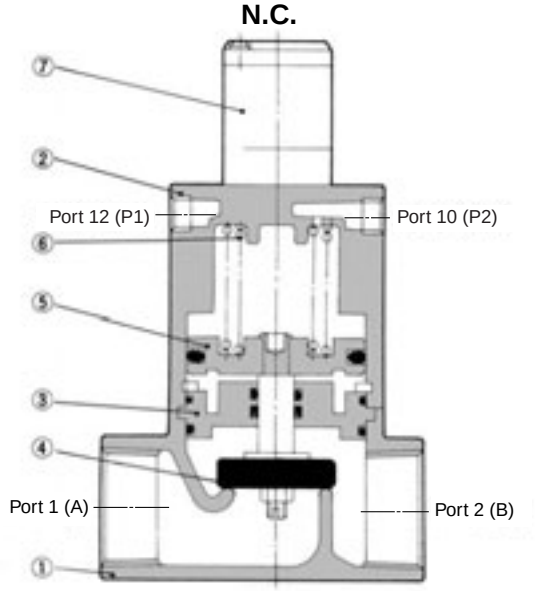
Note 1) No freezing
Note 2) Lubrication is not allowed in the case of seal material EPR.
Note 3) Adjust the operating pressure to 0.1 MPa for low vacuum.
Note 4) The pressure differential between Port 1 (A) and 2(B) must not exceed the maximum operating pressure.
Note 5) For external pilot solenoid, it is recommended that the pilot solenoid valve be oriented either vertically upward or horizontally.
Note 6) Non-lubricant specifications are not available for this product.

Pilot Solenoid Valve Specifications

Port size			6A to 25A	32A to 50A, 32F to 50F
Pilot solenoid valve			**SF4-□□□-23**	**VO301□-00□□□**
Electrical entry			Grommet, Grommet terminal, Conduit terminal, DIN terminal	Grommet, Conduit, DIN terminal, Other (Option)
Coil rated voltage (V)	**AC (50/60 Hz)**		100 V, 200 V, other voltage (Option)	
	DC		24 V, other voltage (Option)	
Allowable voltage fluctuation			–15% to +10% of rated voltage	
Coil insulation type			Class B or equivalent (130°C)	
Temperature rise			35°C or less (when rated voltage is applied.)	70°C or less (when rated voltage is applied.)
Apparent power	**AC**	**Inrush**	5.6 VA (50 Hz), 5.0 VA (60 Hz)	12 VA (50 Hz), 10.5 VA (60 Hz)
		Holding	3.4 VA (50 Hz), 2.3 VA (60 Hz)	7.5 VA (50 Hz), 6 VA (60 Hz)
Power consumption	**DC**		1.8 W (without light), 2W (with light)	4.8 W (without light), 5 W (with light)
Manual override			Non-locking push type Other (Option)	Non-locking push type

Note 1) For "How to Order" pilot solenoid valves, refer to page 368.
Note 2) Vacuum pilot type pilot solenoid valves will become VO301V-00□□□.

Construction



Component Parts

No.	Description	Material	Note
1	**Body**	Bronze*	Clear coated
2	**Cover assembly**	Aluminum alloy	Platinum silver painted
3 Note)	**Plate assembly**	Brass*	Valve material (NBR, FKM, EPR)
4 Note)	**Valve element**	Valve material (NBR, FKM, EPR)	Stainless steel or brass*
5	**Piston assembly**	Aluminum 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.

Working Principle (Vacuum pilot type is excluded)

VNB□0$\frac{1}{4}$□, □1$\frac{1}{4}$□ (N.C.)
When the pilot solenoid valve ⑦ is not energized (or when air is exhausted from the port P1 of the air operated type), the valve element ④ linked to the piston ⑤ is closed by the return spring ⑥.

- **When valve opens**
  When the pilot solenoid valve is energized (or when pressurized air enters through the port P1 of the air operated style), the pilot air that has entered under the piston moves upward to open the valve element.
- **When valve closes:**
  When the power to the pilot solenoid valve is turned off (or when fluid is exhausted from the port P1 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 port P2 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 port P2 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 ports P1 and P2. When pressurized air enters the port P1 (exhaust from the port P2), the valve element opens, and it closes when pressurized air enters the port P2 (exhaust from the port P1).

Replacement Parts

No.	Description			Part no.									
				VNB1□□□ -6A, 8A, 10A	VNB2□□□ -10A, 15A	VNB3□□□ -20A	VNB4□□□ -25A	VNB5□□□ -32A, 32F	VNB5□ 4 □ -32A, 32F	VNB6□□□ -40A, 40F	VNB6□ 4 □ -40A, -40F	VNB7□□□ -50A, 50F	VNB7□ 4 □ -50A, 50F
3 Note 1)	Plate assembly	Seal material	NBR	Refer to Note 2)	VN2-A3BA	VN3-A3BA	VN4-A3BA	VN5-A3BA	VN5-A3BA	VN6-A3BA	VN6-A3BA	VN7-A3BA	VN7-A3BA
			FKM		VN2-A3BB	VN3-A3BB	VN4-A3BB	VN5-A3BB	VN5-A3BB	VN6-A3BB	VN6-A3BB	VN7-A3BB	VN7-A3BB
			EPR		VN2-A3BC	VN3-A3BC	VN4-A3BC	VN5-A3BC	VN5-A3BC	VN6-A3BC	VN6-A3BC	VN7-A3BC	VN7-A3BC
4 Note 1)	Valve element [32A to 50A come in valve element assembly]	Seal material	NBR		VN2-4BA	VN3-4BA	VN4-4BA	VN5-A4BA	VN5-A4BA-3	VN6-A4BA	VN6-A4BA-3	VN7-A4BA	VN7-A4BA-3
			FKM		VN2-4BB	VN3-4BB	VN4-4BB	VN5-A4BB	VN5-A4BB-3	VN6-A4BB	VN6-A4BB-3	VN7-A4BB	VN7-A4BB-3
			EPR		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 (Refer to the table below.)				VO301□-00□□□ (Refer to the table below.)					

Note 1) In the case of body options "S" and "L", the materials of the part nos. ③ and ④ are as follows: (Example): **VN1-A3B□A**
However all brackets of valve element VNB 1 to 4 are made of stainless steel. (No need to add options "S" and "L".) └ **L**: Aluminum, **S**: Stainless steel
Note 2) Please request a factory repair.

How to Order Pilot Solenoid Valves

Valve size 1/2/3/4

SF4 − 1 DZ □ − 23

Coil rated voltage

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

∗ Semi-standard

Manual override

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

∗ Semi-standard

Electrical entry/With indicator light/ surge voltage suppressor

G	Grommet
GS	Grommet with surge voltage suppressor
E	Grommet terminal
EZ	Grommet terminal with light/surge voltage suppressor
T	Conduit terminal
TZ	Conduit terminal with light/surge voltage suppressor
D	DIN terminal
DZ	DIN terminal with light/surge voltage suppressor

Valve size 5/6/7 and vacuum pilot type

VO301 □ − 00 □ □ □

Body option

Nil	Standard
V	Vacuum pilot

Coil rated voltage

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

∗ Semi-standard

Accessory
Function plate (D sealing, with thread)
: DXT060-32-4A

Electrical entry

G	Grommet
C	Conduit
T Note)	Conduit terminal
D	DIN terminal
DL *	DIN terminal with indicator light

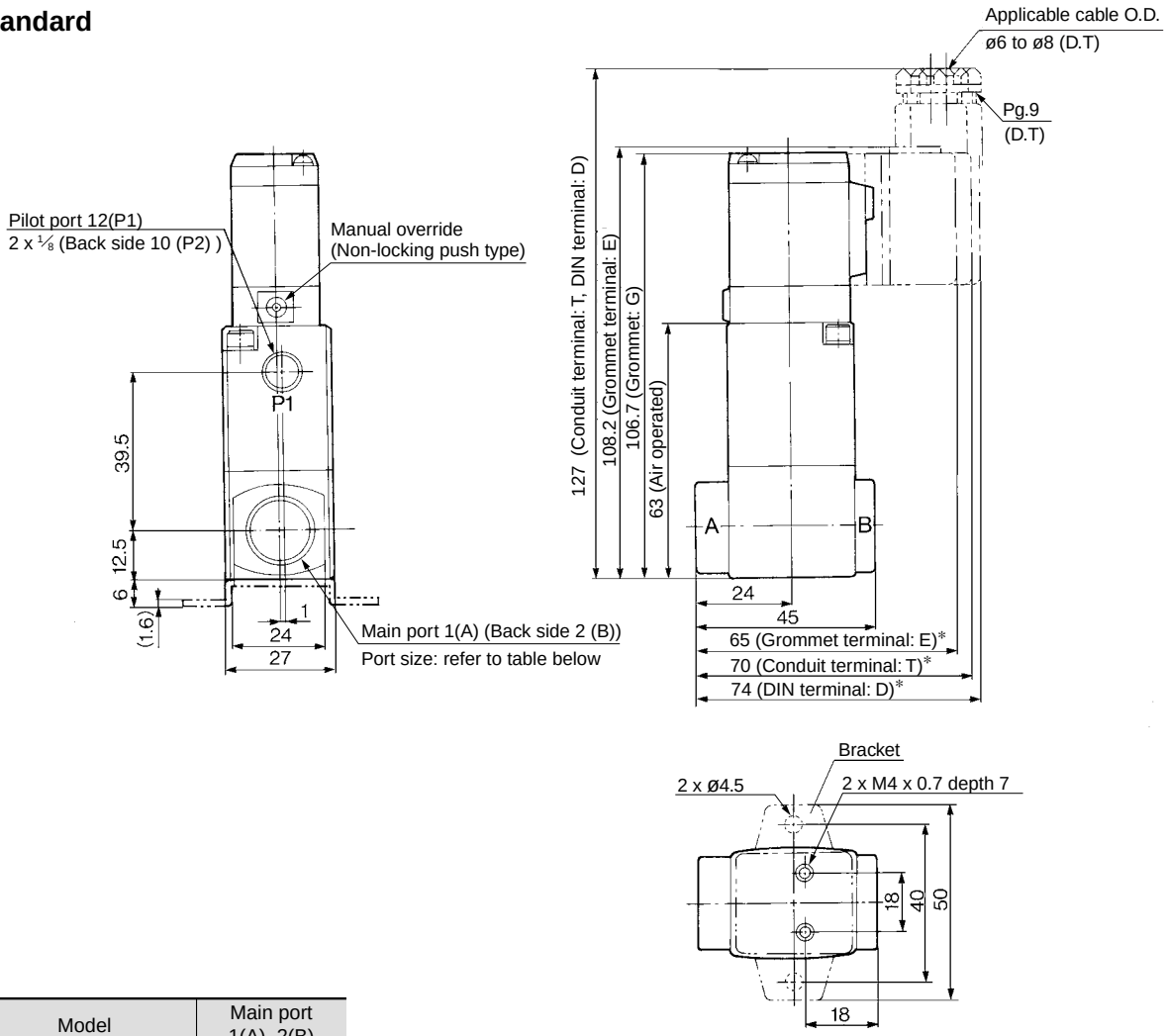
Note) When the electrical entry is T, the pilot solenoid valve parts are as follows;
VO301□-00□T□-X302
Coil rated voltage └ └ Light/Surge voltage suppressor
∗ Semi-standard

With surge voltage suppressor

Nil	None
S	Surge voltage suppressor (Except "DL")

Port size: 6A, 8A, 10A

Standard

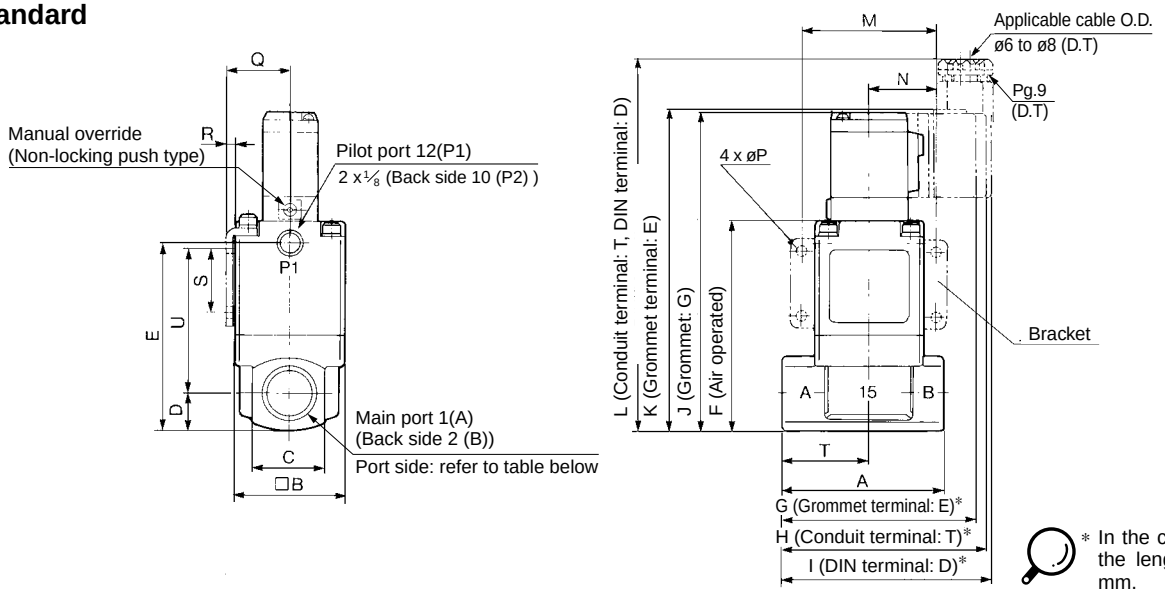


Model	Main port 1(A), 2(B)
VNB1□□□-6A	1/8
VNB1□□□-8A	1/4
VNB1□□□-10A	3/8

∗ In the case of “EZ” or “TZ”, the length is longer by 10 mm.
For “DZ”, the length is longer by 17 mm.

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

Standard

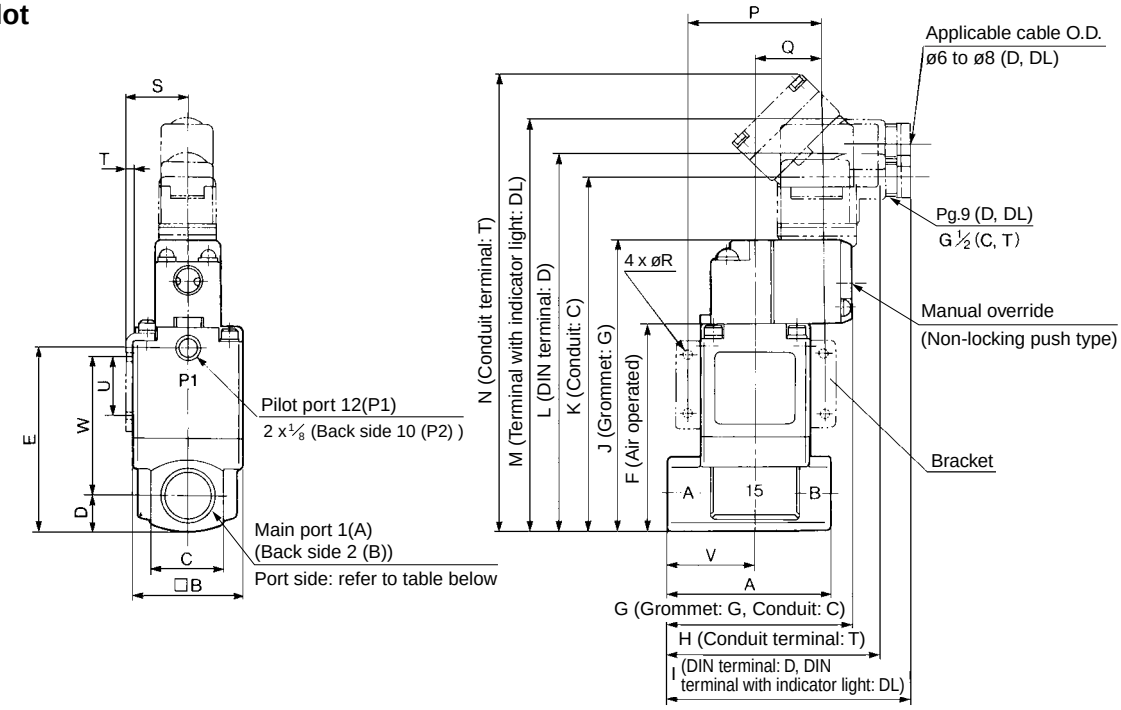


* In the case of "EZ" or "TZ", the length is longer by 10 mm.
For "DZ", the length is longer by 17 mm.

Model	Main port 1(A), 2(B)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U
VNB2□□□-10A	3/8	63	42	28	14	72.5	80.5	75	80	84.5	124	125.5	144.5	52	26	4.5	24.3	2.3	25	34	55
VNB2□□□-15A	1/2																				
VNB3□□□-20A	3/4	80	50	35	17.5	84	92	84	89	93.5	135.5	137	156	62	31	5.5	28.3	2.3	30	43	60.5
VNB4□□□-25A	1	90	60	40	20	100	108	90	95	99.5	151.5	153	172	72	36	6.5	33.3	2.3	35	49	73

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

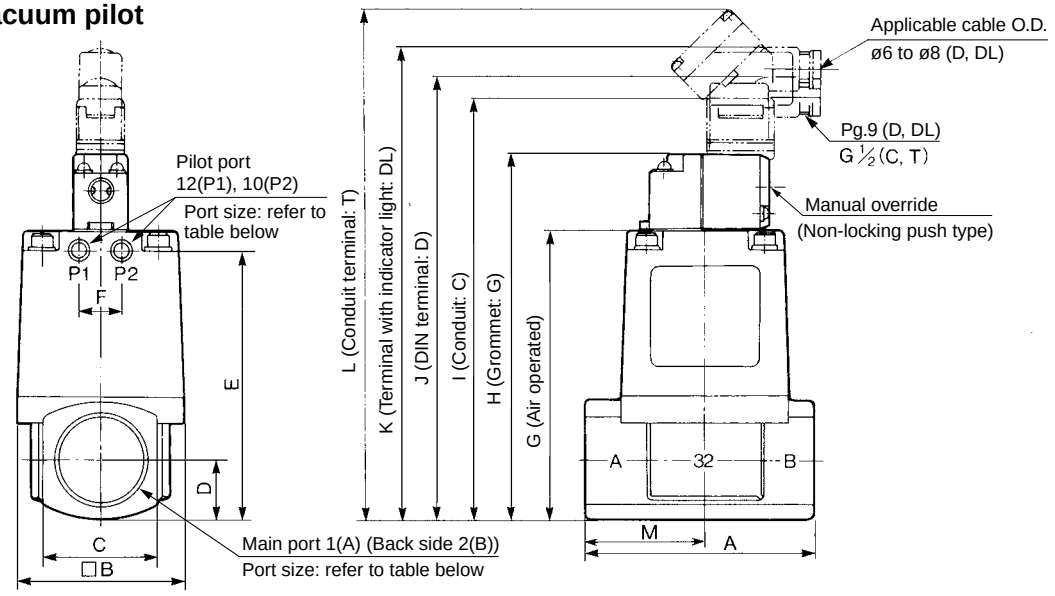
Vacuum pilot



Model	Main port 1(A), 2(B)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V	W
VNB2□□□V-10A	3/8	63	42	28	14	72.5	80.5	75	87	97	114	126.5	170.5	173.5	180.5	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	80	92	102	125.5	138	182	185	192	62	31	5.5	28.3	2.3	30	43	60.5
VNB4□□□V-25A	1	90	60	40	20	100	108	81	93	103	141.5	154	198	201	208	72	36	6.5	33.3	2.3	35	49	73

Port size: 32A, 40A, 50A

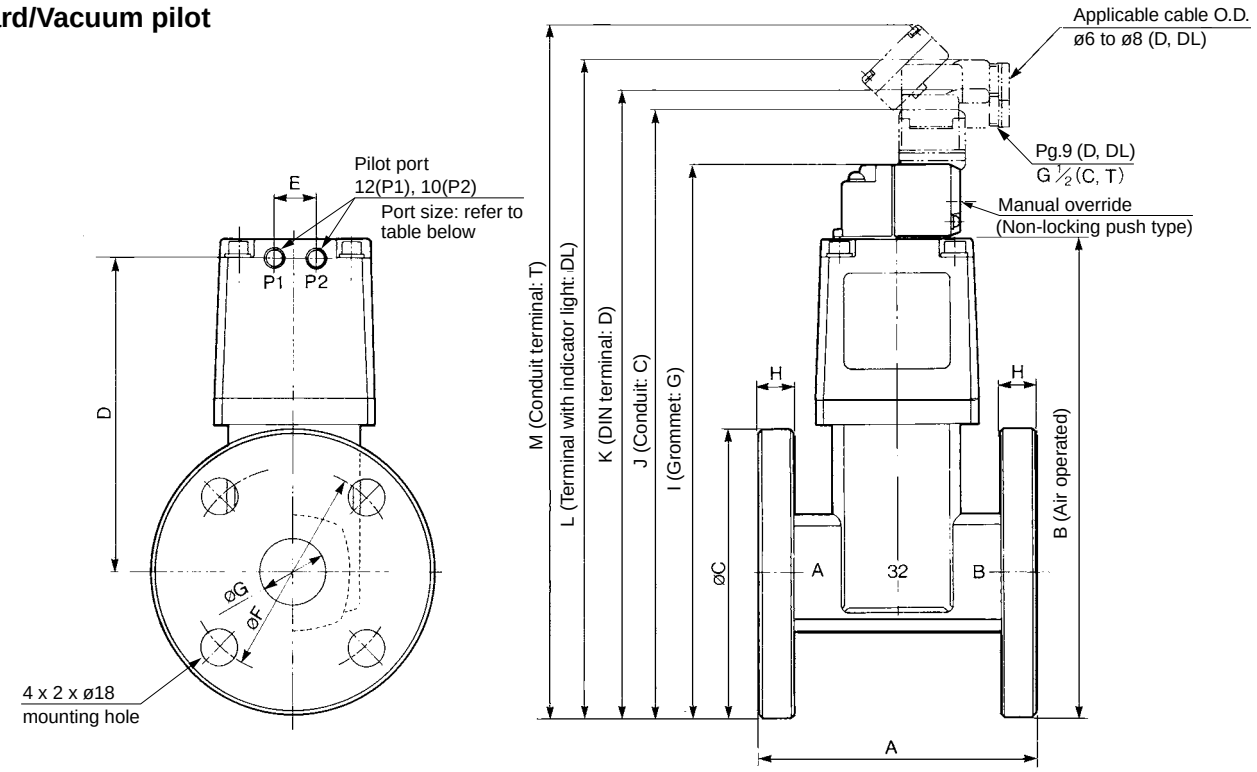
Standard/Vacuum pilot



Model	Main port 1(A), 2(B)	Pilot port 12(P1), 10(P2)	A	B	C	D	E	F	G	H	I	J	K	L	M
VNB5□□□□-32A	1 1/4	1/8	105	77	53	26.5	120.5	20	129.5	163	175.5	218.5	223	229.5	55
VNB6□□□□-40A	1 1/2	1/4	120	96	60	30	137	24	147	180.5	193	236	240.5	247	63
VNB7□□□□-50A	2	1/4	140	113	74	37	160	24	170	203.5	216	259	263.5	270	74

Port size: Flange: 32F, 40F, 50F

Standard/Vacuum pilot



Model	Applicable flange 1(A), 2(B)	Pilot port 12(P1), 10(P2)	A	B	C	D	E	F	G	H	I	J	K	L	M
VNB5□□□□-32F	32	1/8	130	210.5	135	134	20	100	36	12	244	256.5	299.5	304	310.5
VNB6□□□□-40F	40	1/4	150	226	140	146	24	105	42	12	259.5	272	315	319.5	326
VNB7□□□□-50F	50	1/4	180	250	155	162.5	24	120	54	14	283.5	296	339	343.5	350

Series VNB
Specific Product Precautions

Be sure to read before handling. Refer to front matters 42 and 43 for Safety Instructions, and pages 17 to 19 for 2 Port Solenoid Valves for Fluid Control Precautions.

External Pilot

⚠ Caution

Pilot port P1 and P2 piping

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

Standard

Port	VNB□0$^{1}_{4}$□	VNB□02□	VNB□03□	VNB□1$^{1}_{4}$□
12 (P1)	External pilot	Bleed port	External pilot	External pilot
10 (P2)	Bleed port	External pilot	External pilot	Pilot exhaust

Vacuum pilot

Port	VNB□01□V	VNB□02□V	VNB□1$^{1}_{2}$□V
12 (P1)	Bleed port	External pilot	External pilot
10 (P2)	External pilot	Bleed port	Pilot exhaust

Installing a silencer to the exhaust port and the bleed port is recommended for noise reduction and for dust entry prevention.

Piping

⚠ Caution

When high temperature fluids are used, use fittings and tube with heat resistant features.
(Self-align fittings, Teflon® tubing, Copper piping, etc.)

Mounting Direction of Pilot Solenoid Valve

⚠ Warning

With external pilot solenoids, the pilot solenoid valves are not splash proof specifications, and so care must be taken not to get fluid on oneself such as when performing maintenance.

⚠ Caution

Direction of mounting

When replacing a valve, if an external pilot solenoid valve is mounted in the wrong direction, it may malfunction or leak air.

Vacuum Pilot

⚠ Caution

When using the VNB□ $^{0}_{1}$ 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.