



ORIGINAL INSTRUCTIONS

Refer to Declaration of Conformity for relevant Directives



\*(Electrical entry D or DZ and with -Q suffix only)

**Instruction Manual**  
**2 Port Valve for Compressed Air and Air-hydro Circuit Control**  
**Series VNA solenoid operated**



The intended use of this product is to control flow in pneumatic systems or air-hydro circuits. A balanced poppet permits normal and reverse flow.

**1 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)<sup>(1)</sup>, and other safety regulations.

<sup>(1)</sup> 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.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

<b>Caution</b>	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
<b>Warning</b>	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
<b>Danger</b>	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

**Warning**

- Always ensure compliance with relevant safety laws and standards.
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

**2 Specifications**

**2.1 Valve Specifications**

Fluid	See Table 3	
Fluid temperature	VNA□1□A/ VNA□1□B/ VNA□1□C/	-5 to 60 °C <sup>Note 1)</sup>
Ambient temperature	-5 to 50 °C <sup>Note 1)</sup>	
Proof pressure	1.5 MPa	
Min. operating pressure	0	
Max. operating pressure	1 MPa	
External pilot air	Pressure range	0.2 to 0.7 MPa
	Lubrication	Not required (See also 3.4) <sup>Note 2)</sup>
	Temperature	-5 to 50 °C
Flow	Refer to catalogue	
Weight	Refer to catalogue	
Vibration resistance	30 m/s <sup>2</sup>	
Impact resistance	150 m/s <sup>2</sup>	
Min. operating frequency	1 cycle/30 days	
Max. operating frequency	1 cycle/1 second	
Duty cycle	Contact SMC	
Response time	Contact SMC	
Mounting Orientation	Pilot solenoid to be oriented either vertically upward or horizontally	

Table 1.

**2 Specifications - continued**

**Notes:**

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

**2.2 Pilot Solenoid Valve Specifications**

Port Size	6A to 25A		32A to 50A
Pilot solenoid valve	SF4-□□□-23 SF4-□ <sup>D</sup> -23-Q		VO307-□□□1 VO307-□ <sup>D1</sup> -Q
Electrical entry	Grommet, Grommet terminal Conduit terminal DIN terminal		Grommet, DIN terminal
Coil rated voltage (V)	AC (50/60 Hz)	100 V, 200 V (Semi-standard: 110, 220, 240 V)	
	DC	24 V (Semi-standard: 12 V)	
Allowable voltage fluctuation	-15% to +10% of rated voltage		
Temperature rise	35 °C or less (When rated voltage is applied)		50 °C or less (When rated voltage is applied)
	Apparent power	AC	Inrush
Holding		3.4 VA (50 Hz), 2.3 VA (60 Hz)	12.7 VA (50 Hz), 10.7 (60 Hz)
Power consumption	DC	1.8 W (without light), 2 W (with light)	4 W (without light), 4.2 W (with light)
		Manual override	Non-locking push type, Other (Semi-standard)

Table 2.

Note: Refer to catalogue for "How to order" of pilot solenoid valve.

**2.3 Applicable Fluids**

Model	VNA□1□A (Valve material: NBR seal)	VNA□1□B (Valve material: FKM seal)	VNA□1□C (Valve material: EPR seal)
Fluid	Air (Standard, Dry) Carbon dioxide (CO <sub>2</sub> ) (Less than 0.7 MPa) Nitrogen gas (N <sub>2</sub> ) Turbine oil <sup>Note 1)</sup> , Hydraulic fluid	Argon Helium Turbine oil <sup>Note 1)</sup> , Hydraulic fluid	Carbon dioxide (CO <sub>2</sub> ) (0.7 MPa or more)

Table 3.

Note 1) Kinematic Viscosity 40 to 100 mm/s<sup>2</sup>

**Caution**

This product cannot be used for water application.

**2.4 Port Size**

VNA Series	Port 1(A), 2(B)	Port 12 (P1) Port 10 (P2) (If available)
	Threaded Fitting size (Rc, G, NPT or NPTF)	Threaded Fitting size (Rc)
VNA11□□ - 6A	1/8	1/8
VNA11□□ - 8A	1/4	1/8
VNA11□□ - 10A	3/8	1/8
VNA21□□ - 10A	3/8	1/8
VNA21□□ - 15A	1/2	1/8
VNA31□□ - 20A	3/4	1/8
VNA41□□ - 25A	1	1/8
VNA51□□ - 32A	1 1/4	1/8
VNA61□□ - 40A	1 1/2	1/4
VNA71□□ - 50A	2	1/4

Table 4.

**2 Specifications - continued**

**2.5 Symbols**

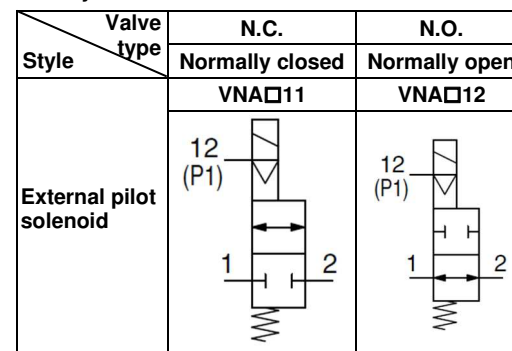


Table 5.

**Caution**

Special Products might have specifications different from those shown in this section. Contact SMC for specific drawings.

**3 Installation**

**3.1 Installation**

**Warning**

- Do not install the product unless the safety instructions have been read and understood.
- Pilot solenoid valves are not splash proof specification, so take care not to get fluid on them when performing maintenance.

**3.2 Environment**

**Warning**

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in

temperatures in excess of the product's specifications.

**3.3 Piping**

**Caution**

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Thread	Appropriate tightening torque (N·m)
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38
Rc 1 1/4	40 to 42
Rc 1 1/2	48 to 50
Rc 2	48 to 50

Table 6.

**Warning**

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

**3.4 Lubrication**

**Caution**

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, refer to catalogue for details.

**3.5 Mounting**

**Warning**

- Do not apply external force to the coil section.

**3 Installation - continued**

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

- Do not warm the coil assembly with a heat insulator, etc. Use tape, heaters, etc., for freeze prevention on the piping and body only. They can cause the coil to burn out.
- Avoid sources of vibration or adjust the arm from the body to the minimum length so that resonance will not occur.

**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.

**3.5.1 Bracket (Optional)**

Valve series 1, 2, 3 and 4 can be mounted using a bracket (optional).

Thread	Appropriate tightening torque (N·m)
M4	1.5
M5	3.0
M6	5.2

Table 7.

For details, refer to catalogue.

**3.6 Air supply**

**Warning**

**Use clean air**

If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas etc., it can lead to damage or malfunction.

**Caution**

**Install an air filter**

Install an air filter upstream of the valve. Select an air filter with a filtration size of 5µm or smaller.

**3.7 Polarity**

**3.7.1 VNA1 to 4 (Valve size 1 to 4)**

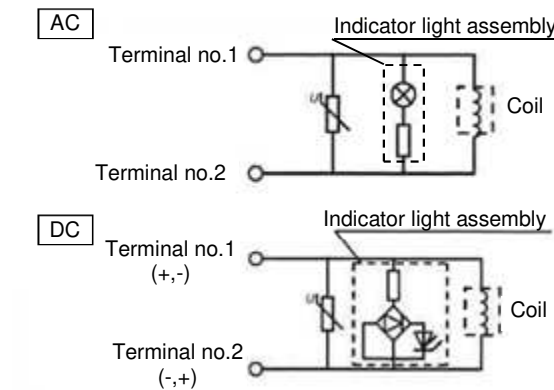


Figure 1

**3.7.2 VNA5 to 7 (Valve size 5 to 7)**

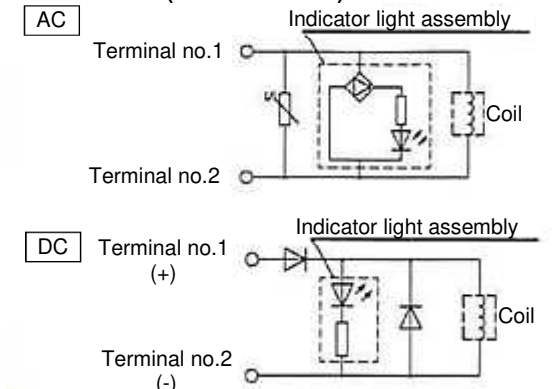


Figure 2

### 3 Installation - continued

#### 3.8 Electrical Connection

##### Caution

- When electrical power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.
- After completing the wiring, confirm that the connections are correct.
- When DC power is connected to a solenoid valve equipped with light and/or surge voltage suppressor, check for polarity indications.
- For polarity indications:  
**No diode to protect polarity:** if polarity connection is wrong, the diode in the valve or switching device at control equipment or power supply may be damaged.  
**With diode to protect polarity:** if polarity connection is wrong, the valve does not switch.
- Applied voltage:  
 When electric power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.
- Confirm the connections.  
 After completing the wiring, confirm that the connections are correct.

#### 3.8.1 DIN connector

Refer to catalogue of pilot solenoid valve for additional details.

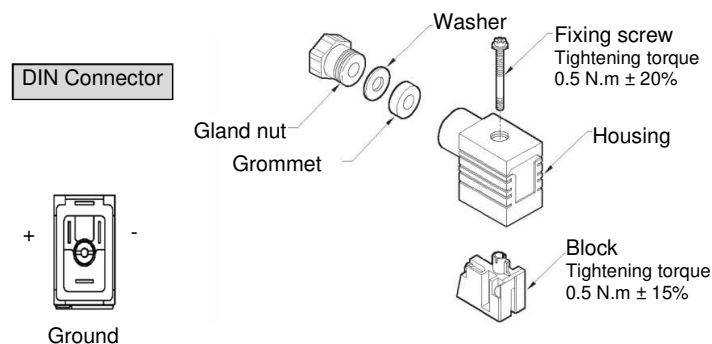


Figure 3 DIN Connector

##### Warning

The ground terminal is connected to the coil assembly only and does not provide a protective earth for the body of the valve.

#### 3.9 External Pilot

##### Caution

- Pilot port piping  
 12 (P1) and 10 (P2) piping should be as follows according to the model.

Port	VNA□1 <sup>1</sup> / <sub>2</sub> □
12 (P1)	External pilot
10 (P2)	Pilot exhaust

Table 8.

(\*) If the pilot air is not supplied, the valve position will not be held. Pressurize Port 12 (P1) or Port 10 (P2) when using the product.

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

#### 3.10 Use with an Air-Hydo Unit

##### Warning

- Piping  
 Surge pressure is generated between the cylinder and the VNA during intermediate stoppage. To directly thread in the cylinder, use durable fittings (Stainless steel square nipples, etc.) instead of ductile iron fittings (JIS B 2301) or steel pipe fittings (JIS B 2302). When VNA is installed away from the cylinder, use a high-pressure rubber hose (JIS B 6349) instead of steel pipe, when possible.

### 3 Installation - continued

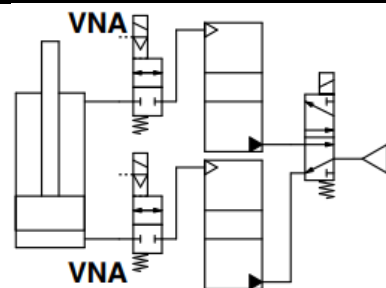


Figure 4. Application example of Air-hydro circuit

- Air bleeding  
 Series VNA valves have no air bleeding port to discharge the air remaining in the hydraulic circuit. Use a vacuum pump to discharge the air from the cylinder or piping effectively.
- Hydraulic fluid  
 Turbine oil, Grade 1 ISO VG32, with petroleum hydraulic fluid is recommended.
- Speed control valve  
 The combination shown in the following table is recommended for best performance of the series VNA. (Piping: JIS K 6349 high pressure hose)

Combination between Series-VNA and Speed controller (Series AS)

	VNA	AS	Piping (I.D.)
10A	VNA111	AS420-03	3/8B (ø9.5)
15A	VNA211	AS420-04	1/2B (ø12.7)
20A	VNA311	AS500-06	3/4B (ø19.1)
25A	VNA411	AS600-10	1B (ø25.4)
32A	VNA511	AS800-12	1 1/4B (ø31.8)
40A	VNA611	AS900-14	1 1/2B (ø38.1)
50A	VNA711	AS900-20	2B (ø50.8)

Table 9.

#### 3.11 Manual Override

##### Warning

Since connected equipment will operate when the manual override is

activated, confirm that conditions are safe prior to activation.

##### 3.11.1 Non-Locking Push Type

**VNA1-4:** See Figure 5. Push on the manual override button using a small-bladed screwdriver until it stops ON.

Hold this position for the duration of the check (ON position).

Release the button and the override will re-set to OFF position.

**VNA5-7:** No tool needed. See Figure 5.

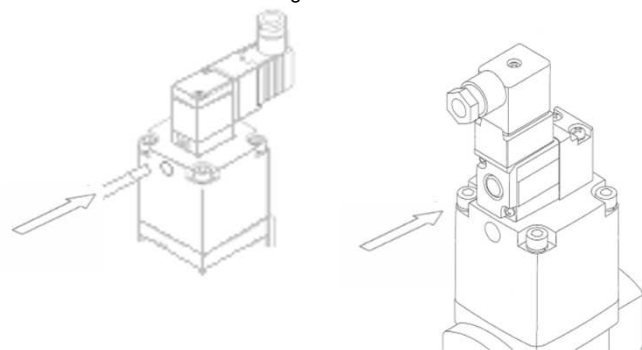


Figure 5. Manual Override for VNA1-4 (Left) & VNA5-7 (Right)

##### 3.11.2 Push-Locking Slotted Type

- To lock  
 Using a small-bladed screwdriver in the slot, push the manual override button until it stops. Turn the override button 90° in the direction of the arrow until it stops (ON position). Remove the screwdriver.

##### Warning

In this position the manual override is in the locked 'ON' position.

- To unlock  
 Place a small-bladed screwdriver in the slot and push the manual override button. Turn the override button 90° in the reverse direction of the arrow. Remove the screwdriver and the manual override will re-set to the OFF position.

### 3 Installation - continued

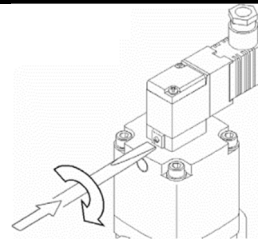


Figure 6. Push locking slotted type manual override

### 4 How to Order

#### 4.1 Standard Products

Refer to catalogue for 'How to Order'.

#### 4.2 Special Products

For special products (-X number) refer to product drawing for "How to Order" and specification details.

### 5 Outline Dimensions (mm)

Refer to *catalogue* for outline dimensions.

### 6 Maintenance

#### 6.1 General Maintenance

##### Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.

- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

#### 6.2 Filters and Strainers

- Be careful regarding clogging of filters and strainers.
- Replace filter elements after one year of use, or earlier, if the pressure drop reaches 0.1 MPa.
- Clean strainers when the pressure drop reaches 0.1 MPa.
- Remove condensate from the filter bowl on a regular basis.

#### 6.3 Replacing Spare Parts

##### 6.3.1 Replacing Plate Assembly and Valve Element

- Remove body mounting screws
- Apply sufficient air pressure to pilot port to release plate assembly.
- Place well-fitting slotted screwdriver into slot in piston rod and unscrew seal mounting nut with spanner.
- If spring pin is used, slide pin out and remove valve element.
- Slide off valve element, washer and plate assembly.
- Refitting is reverse of removal (use correct tightening torque).

##### 6.3.2 Replacing Pilot Valve Assembly

- Remove pilot valve mounting screws.
- Remove pilot valve (retain DIN plug if necessary).
- Fitting of new pilot valve is reverse of removal assembly (use correct tightening torque).

##### Caution

- Never remove inner circlip from valve.
- When replacing external pilot valve, ensure it is mounted in the correct direction. If mounted in the wrong direction, it may malfunction or leak air.

#### Tightening Torque (N·m)

Valve Size	VNA1	VNA2	VNA3	VNA4	VNA5	VNA6	VNA7
Seal Mounting Nut	0.63	3	3	3	3	5.2	12.5
Piston cover Mounting Screw	1.5	1.5	3	5.2	5.2	12.5	12.5
Pilot Valve Mounting Screw	0.63	0.63	0.63	0.63	1.5	1.5	1.5

Table 10.

### 6 Maintenance - continued

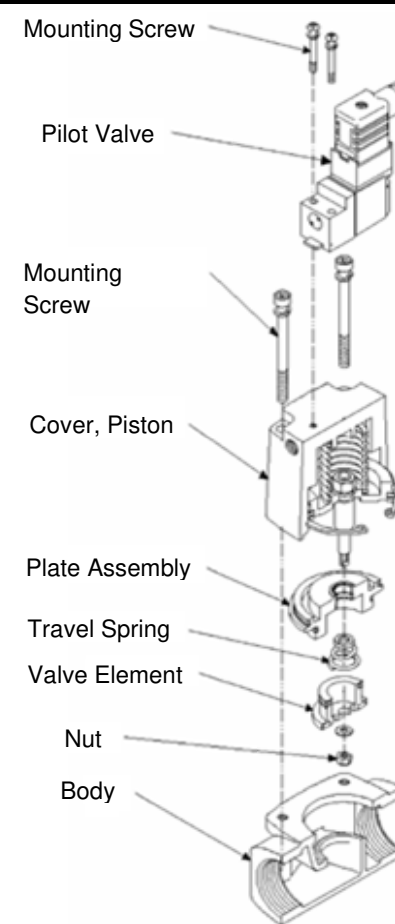


Figure 7.

### 7 Limitations of Use

#### 7.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

##### Warning

- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.

##### Warning

#### 7.2 Extended periods of continuous energization

If a valve is continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil. This will likely adversely affect the performance of the solenoid valve and any nearby peripheral equipment. Should a valve be continuously energized for an extended period of time or its daily energized state exceeds its non-energized state, please use an energy saving type valve with DC specification. If an AC type is expected to be energized continuously for long periods of time, select the air-operated valve and use the continuous duty type of the VT307 for a pilot valve.

### 8 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

### 9 Contacts

Refer to [www.smworld.com](http://www.smworld.com) or [www.smc.eu](http://www.smc.eu) for contacts.

## SMC Corporation

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