



## Installation and Maintenance Manual

VP3145/VP3165/VP3185, Large Size 3 Port Solenoid Valve, Rubber Seal  
VP3145/VP3165/VP3185-X80/X81, Main Valve Double Acting Type



Read this manual before using this product

- The information within this document is to be used by pneumatically trained personnel only.
- For future reference, please keep manual in a safe place.
- This manual should be read in conjunction with the current catalogue.

## 1 SAFETY

### 1.1 General recommendation

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO4414 (Note1), JIS B 8370 (Note2) and other safety practices.

Note 1:ISO 4414:Pneumatic fluid power - General rules relating to systems.

Note 2:JIS B 8370:Pneumatic system axiom.

**CAUTION:** Operator error could result in injury or equipment damage.

**WARNING:** Operator error could result in serious injury or loss of life.

**DANGER:** In extreme conditions, there is a possible result of serious injury or loss of life.

### WARNING:

- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
  - Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
- Only trained personnel should operate pneumatically operated machinery and equipment.
  - Compressed air can be dangerous if an operator is unfamiliar with it Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.
- Do not service machinery/equipment or attempt to remove components until safety is confirmed.
  - Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
  - When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
  - Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Bleed air into the system gradually to create backpressure, i.e. incorporate a soft-start valve).
- Contact SMC if the product is to be used in any of the following conditions:
  - Conditions and environments beyond the given specifications, or if product is used outdoors.
  - Installations on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
  - An application, which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

### CAUTION:

- Ensure that the air supply system is filtered to 5 micron.

### 1.2 Conformity to standard

This product is certified to and complies with the following standards:

EMC Directive 89/336/EEC	EN50082-2, EN55011
Low voltage directive 93/68/EEC	DIN VDE 0580

## 2 INTENDED CONDITIONS OF USE

### 2.1 Specifications

VP3145/3165/3185 Specifications

Fluid		Air					
Type of actuation		N.C. or N.O. (Convertible)					
Pilot type		Internal pilot			External pilot		
		For general			For vacuum/low pressure		
Operating pressure range (MPa)	Main pressure	0.2 to 0.8			-101.2 kPa to 0.2		
	Pilot pressure	0.2 to 0.3			Refer to the graph below		
Ambient and fluid temperature (°C)		0 (No freezing) to 60					
Response time (ms) <sup>(1)</sup> (at the pressure of 0.5 MPa)	On	AC	30 or less	Off	AC	30 or less	
	DC	40 or less	DC	30 or less			
Max. operating frequency (Hz)		3					
Lubrication <sup>(2)</sup>		Required (Equivalent to turbine oil Class 1 ISO VG32)					
Manual override		Yes (Non-locking)					
Mounting orientation		Unrestricted					
Shock/Vibration resistance (m/s <sup>2</sup> ) <sup>(3)</sup>		150/50					

(Note 1) IBased on dynamic performance test, JIS B 8374-1981. (Coil temperature: 20°C, at rated voltage, without surge voltage suppressor)

(Note 2) This solenoid valve requires lubrication. Use turbine oil Class 1 (ISO VG32).

(Note 3) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every once for each condition. (Values at the initial period)

Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 1000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)

VP3145/3165/3185-X80/X81 Specifications

Valve configuration		External pilot 3 port solenoid valve	
Type of actuation		Double solenoid (-X80), Single solenoid (-X81)	
Fluid		Air	
Operating pressure range		-101.2 kPa to 0.8MPa	
Pilot pressure		85% to 115% of main pressure, minimum 0.2 MPa	
Ambient and fluid temperature		0 to 50°C (not freezing)	
Lubrication <sup>(1)</sup>		Required (Equivalent to turbine oil class 1, ISO VG32)	
Mounting orientation		Unrestricted	
Impact/Vibration resistance <sup>(2)</sup>		150/50 m/s <sup>2</sup>	

(Note 1) This solenoid valve requires lubrication. Use turbine oil Class 1 (ISO VG32).

(Note 2) Impact resistance: No malfunction occurred when it is tested with a drop tester in the axial direction and at the right angles to the main valve and armature in both e energized and de-energized states every once for each condition. (Values at the initial period)

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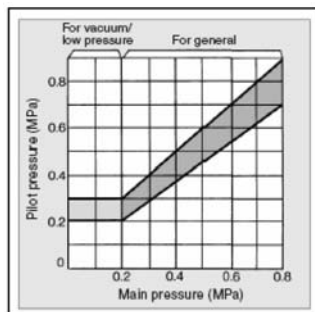
### 2.2 External Pilot

Please use external pilot type in the following cases.

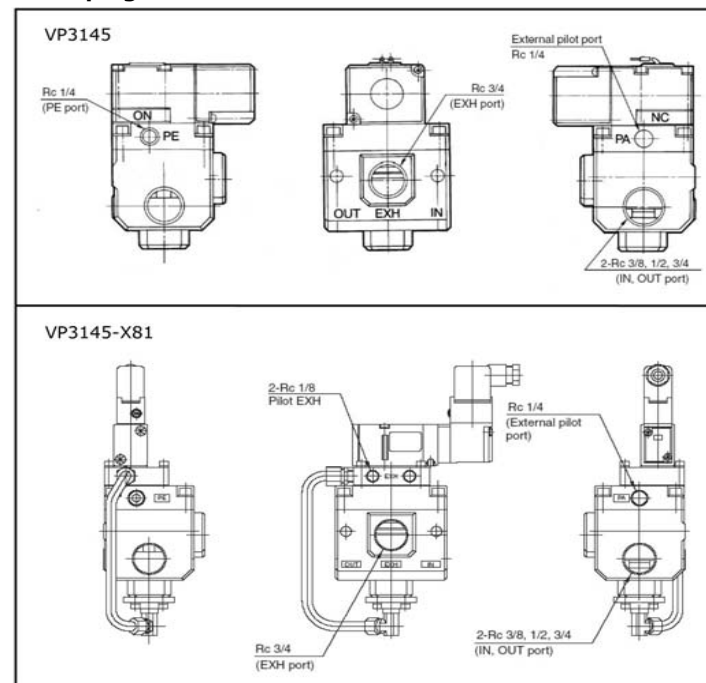
- In vacuum, or low pressure of 0.2MPa or under: External pilot type for vacuum/low pressure
- In cases where the IN port will be extremely constricted: External pilot type for general use
- In cases where startup of the IN port side pressure is slow (takes a long time for pressure to be established).: External pilot type for general use
- In cases where the secondary side piping resistance is small, for example where it is used for blow-off or tank filling etc.: External pilot type for general use

Note 1. Please use with external pilot pressure within the range shown by the diagram below.

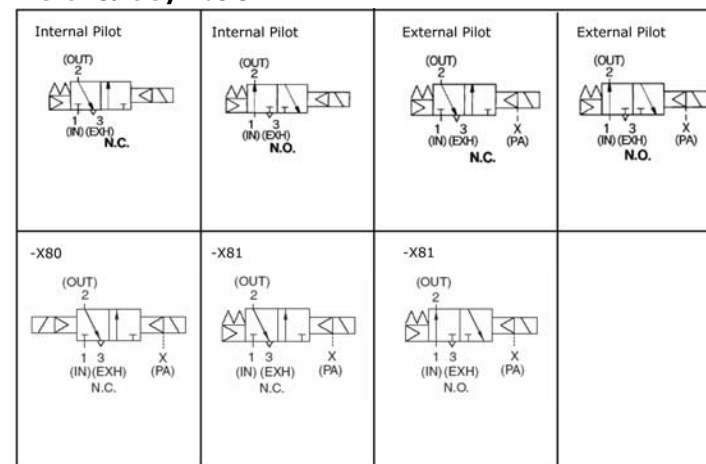
Note 2. It is not possible to recombine an external pilot type in place of an internal pilot type, or vice versa.



### 2.3 Piping



### 2.3 Circuit Symbols



## 3 INSTALLATION

### WARNING:

- Do not install unless the safety instructions have been read and understood.

### 3.1 Environment

#### WARNING:

- Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.
- Do not use in an explosive atmosphere.
- The product should not be exposed to prolonged sunlight. Use a protective cover.
- Do not mount the product in a location where it is subject to strong vibrations and/or shock. Check the product specifications for above ratings.
- Do not mount the product in a location where it is exposed to radiant heat.

### 3.2 Piping

#### CAUTION:

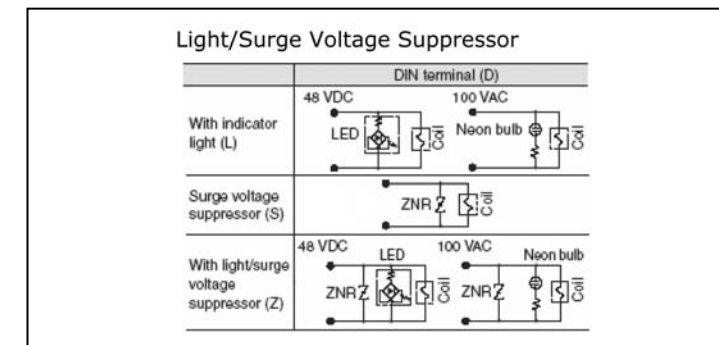
- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fitting into a port, ensure that sealant material does not enter the port inside. When using seal tape, leave 1.5 to 2 threads exposed on the end of pipe/fitting.

Thread	Appropriate tightening torque (Nm)
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

### 3.3 Electrical connection

#### CAUTION:

- 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.



### How to use DIN terminal

#### 1. Disassembly

- After loosening the thread (1), then if the cover (4) is pulled in the direction of the thread, the connector will be removed from the body of equipment (solenoid, etc.).
- Pull out the screw (1), then remove the gasket (2a) or (2b).
- On the bottom part of the terminal block (3), there's a cut-off part (indication of an arrow) (3a). If a small flat head screwdriver is inserted between the opening in the bottom, terminal block (3) will be removed from the cover (4). (Refer to the figure below.)
- Remove the cable gland (5) and plain washer (6) and rubber seal (7) .

#### 2. Wiring

- Pass them through the cable (8) in the order of cable ground (5), washer (6), rubber seal (7), and then insert into the housing (4).
- Dimensions of the cable (8) are the figure as below. Skin the cable and crimp the crimped terminal (9) to the edges.
- Remove the screw with washer (3e) from the bracket (3e). (Loosen in the case of Y-shape type terminal.) As shown in the below figure, mount a crimped terminal (9), and then again tighten the screw (3e).

Note) Tighten within the tightening torque of 0.5 N·m±15%.

- It is possible to wire even in the state of bare wire. In that case, loosen the screw with washer (3e) and place a lead wire (3d) into the bracket, and then tighten it once again.
- Maximum size of crimped terminal (9) is up to 1.25 mm<sup>2</sup> -3.5 when O terminal. For Y terminal, it is up to 1.25 mm<sup>2</sup> -4.
- Cable (8) external: ø6 to ø12 mm

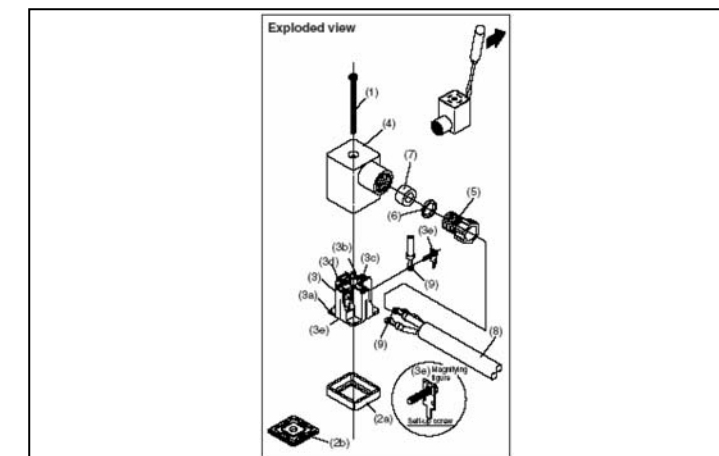
Note) For the one with the external dimension ranged between 9 to 12mmø, remove the inside parts of the rubber seal (7) before using.

#### 3. Assembly

- Terminal block (3) connected with housing (4) should be reinstated. (Push it down until you hear the click sound.)
- Putting rubber seal (7), plain washer (6), in this order into the cable introducing slit on the housing (4), then further tighten the cable gland (5) securely.
- By inserting gasket (2a) or (2b) between the bottom part of the terminal block (3) and a plug on an equipment, screw in (1) on top of the housing (4) and tighten it.

Note) Tighten within the tightening torque of 0.5 N·m ±20%.

- The orientation of a connector can be changed arbitrarily, depending on the combination of a housing (4) and a terminal block (3).



### 3.4 Mounting

- **If air leakage increases or equipment does not operate properly, stop operation**  
After mounting or maintenance, etc., connect the compressed air and power supplies, and perform appropriate function and leakage inspections to confirm that the unit is mounted properly.
- **Instruction manual**  
Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.
- **Painting and coating**  
Warnings or specifications printed or pasted on the product should not be erased, removed or covered up.

### 3.5 Lubrication

#### CAUTION:

- SMC products have been lubricated for life at manufacturer, and do not require lubrication in service.
- If a lubricant is used in the system, use turbine oil Class 1 (no additive), ISO VG32. Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

## 4 MAINTENANCE

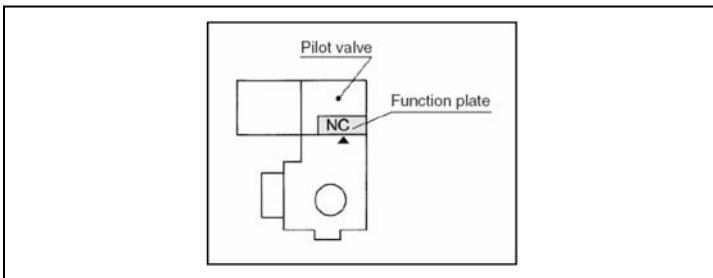
#### WARNING:

- Not following proper procedures could cause the product to malfunction and could lead to damage to the equipment or machine.
- If handled improperly, compressed air can be dangerous. Assembly, handling and repair of pneumatic system should be performed by qualified personnel only.
- Drain: remove condensate from the filter bowl on a regular basis.
- Shut-down before maintenance: before attempting any kind of maintenance make sure the supply pressure is shut off and all residual air pressure is released from the system to be worked on.
- Start-up after maintenance: apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, please verify product set-up parameters.
- Do not make any modification to the product
- Do not disassemble the product, unless required by installation or maintenance instructions.
- **Maintenance procedures are shown in the operation manual.**  
If maintenance is not properly done, it may cause malfunction and damage of machine or equipment.
- **Machine maintenance and supply/exhaust of compressed air.**  
When machine is to be serviced, first check for removal of work pieces and run-away of equipment, etc. Then cut the supply pressure and power, and exhaust compressed air in the system through residual pressure release mechanism. When the machine is to be released, check first that actuators are in their proper start up position.
- **Low frequency position.**  
Valves should be switched at least once every 30 days to avoid malfunction. (Pay attention to air supply)

### N.C./N.O. Conversion

To convert valve operation from N.C. to N.O. or N.O. to N.C., remove the pilot valve, move the function plate along the gasket, both top and bottom until the mark > meets N.C. (N.O.)

Please note however, that the N.O. valve functions properly only when the appropriate pressure is applied to the valve.



### Piping (Vacuum Use)

1. Piping in general:

EXH port = Vacuum pump/Blower} (Suction side)

OUT port = Vacuum pad/Tank} (Load side)

IN port = Plug (2 port valve), Air releasing, Air pressure-in

2. Following the above piping, vacuum passage is switched between OUT and EXH, therefore, N.C./N.O. indication on the function plate and switching of the vacuum passage are reversed; N.C. (Normally closed) in vacuum passage are reversed:

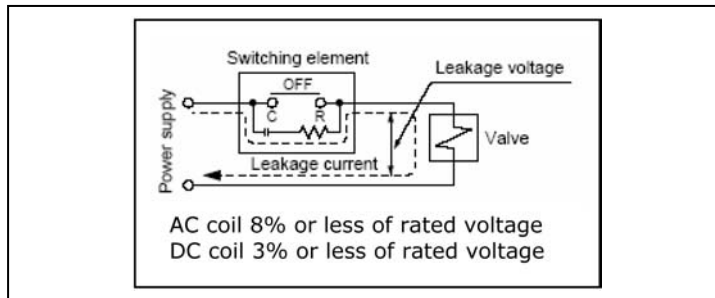
"N.C." indicated on the plate → N.O. in vacuum passage (Normally open)

"N.O." indicated on the plate → N.C. in vacuum passage (Normally closed)

## 5 LIMITATIONS OF USE

#### WARNING:

- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.
- **Leakage voltage**  
Particularly when using a C-R element (surge voltage suppressor) for protection of the switching element, take note that leakage voltage will increase due to leakage current flowing through the C-R element, etc.



- **Drive the solenoid valve for AC with SSR or triac output.**

- Leak current:  
If output element's surge circuit has C-R element, slight current flows even if turned OFF. This causes malfunction on valve reset. When the valve goes over allowable value shown above, install bleeder resistance.
- Minimum load capacity (minimum load current)  
When valve consumption current is less than minimum load capacity of output element, or when the margin is small, output element sometimes cannot change itself. Please consult SMC.

- **Surge voltage suppressor**

If a surge protection circuit contains non-ordinary diodes such as Zener diodes or ZNRs, a residual voltage that is in proportion to the protective elements and the rated voltage will remain. Therefore, give consideration to surge voltage protection of the controller. In the case of diodes, the residual voltage is approximately 1V.

- **Low temperature operation**

Avoid ambient temperatures outside the range of -10 to 60°C (-5°C minimum for rubber seals). At low temperatures, appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

- **Mounting direction**

All mounting postures are available

## 6 EUROPEAN CONTACT LIST

### 6.1 SMC Corporation

Country	Telephone	Country	Telephone
Austria	(43) 2262-62 280	Italy	(39) 02-92711
Belgium	(32) 3-355 1464	Netherlands	(31) 20-531 8888
Czech Republic	(420) 5-414 24611	Norway	(47) 67 12 90 20
Denmark	(45) 70 25 29 00	Poland	(48) 22-548 50 85
Finland	(358) 9-859 580	Portugal	(351) 22 610 89 22
France	(33) 1-64 76 1000	Spain	(34) 945-18 4100
Germany	(49) 6103 4020	Sweden	(46) 8 603 12 00
Greece	(30) 1- 342 6076	Switzerland	(41) 52-396 3131
Hungary	(36) 23 511 390	Turkey	(90) 212 221 1512
Ireland	(353) 1-403 9000	United Kingdom	(44) 1908-56 3888

### 6.2 Websites

SMC Corporation	www.smcworld.com
SMC Europe	www.smceu.com