Large Size 3 Port Solenoid Valve
VP3145/3165/3185 Series
Rubber Seal

Large flow capacity, small exhaust resistance
(Refer to “Flow Rate Characteristic” table.)

Easy conversion to N.C. or N.O.
Function plate makes it possible to use as a N.C. or N.O. valve with the port unchanged.

Possible to use in vacuum or under low pressures
Vacuum: Up to 101.2 kPa
Low pressure: 0 to 0.2 MPa

Free mounting orientation

Note) The pilot valve assembly shown above includes the function plate and gasket.

How to Order Pilot Valve Assembly

VP3 1 4 5 04 1 G A

How to Order

VP series 3 port solenoid valve
Number of solenoids 1 Single
Body size
4 1/2
6 1
8 1 1/2

Body type
8 Body ported

Valve option
 Nil For general
 V For vacuum/low pressure

Port size (IN, OUT port)
Symbol
Rc (Nominal size)

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

Electrical entry
G Grommet —
T Conduit terminal —
D DIN terminal —

Note) CE-compliant: D/DL/DS/DZ only (Electrical entry)

Grommet
Conduit terminal
DIN terminal

Note) CE-compliant: D/DL/DS/DZ only (Electrical entry)

Made to Order
(Refer to pages 1313 to 1315 for details.)
**External Pilot**

Use external pilot model in the following cases:
- Vacuum or low pressure (0.2 MPa or less): Vacuum/Low pressure type
- Using the valve with supply port external throttle: General type
- Air pressure of supply port is slow: General type
- Resistance in outlet side is small in case of air blowing or filling an air tank: General type

Note 1) Keep external pilot pressure within the pressure range below.
Note 2) Conversion of internal pilot and external pilot can not be done.

**Specifications**

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of actuation</td>
<td>N.C. or N.O. (Convertible)</td>
</tr>
<tr>
<td>Pilot type</td>
<td>Internal pilot</td>
</tr>
<tr>
<td>Operating pressure range (MPa)</td>
<td>Main pressure</td>
</tr>
<tr>
<td></td>
<td>0.2 to 0.6</td>
</tr>
<tr>
<td></td>
<td>0.2 to 0.3</td>
</tr>
<tr>
<td>Ambient and fluid temperature (°C)</td>
<td>0 (No freezing) to 60</td>
</tr>
<tr>
<td>Response time (ms)</td>
<td>(at the pressure of 0.5 MPa)</td>
</tr>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>AC 30 or less</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td>Max. operating frequency (Hz)</td>
<td>3</td>
</tr>
<tr>
<td>Lubrication</td>
<td>(2)</td>
</tr>
<tr>
<td>Manual override</td>
<td>Required (Equivalent to turbine oil Class1 ISO VG32)</td>
</tr>
<tr>
<td>Mounting orientation</td>
<td>N.C. or N.O. (Convertible)</td>
</tr>
<tr>
<td>N.C. or N.O. (Convertible)</td>
<td>0 (No freezing) to 60</td>
</tr>
</tbody>
</table>

**Solenoid Specifications**

**Electrical entry**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit terminal with indicator light (TL), Conduit terminal with surge voltage suppressor (TS), Conduit terminal with light/surge voltage suppressor (TZ), DIN terminal with indicator light (DL), DIN terminal with surge voltage suppressor (DS), DIN terminal with light/surge voltage suppressor (DZ)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coil rated voltage (V)</th>
<th>AC (% of Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100, 200, 110°, 220°, 240°</td>
</tr>
<tr>
<td></td>
<td>DC 12°, 24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Allowable voltage fluctuation</th>
<th>AC</th>
<th>Inrush</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>73 VA (50 Hz), 58 VA (60 Hz)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apparent power (VA)</th>
<th>DC</th>
<th>Holding</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 VA (50 Hz), 17 VA (60 Hz)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power consumption (W)</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 W</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) Based on dynamic performance test, JIS B 8419: 2010. (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)

**Flow Rate Characteristics/Weight**

**Valve model**

<table>
<thead>
<tr>
<th>Valve model</th>
<th>Port size</th>
<th>Flow rate characteristics</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP3145</td>
<td>3/4, 3/8</td>
<td>1 → 2 (IN → OUT) b ∗ C [dm³/(s·bar)]</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 → 3 (OUT → EXH) b ∗ C [dm³/(s·bar)]</td>
<td>1.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve model</th>
<th>Port size</th>
<th>Effective area (mm²)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP3165</td>
<td>1 1/4</td>
<td>230</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>1 1/2</td>
<td>310</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>570</td>
<td>2.8</td>
</tr>
</tbody>
</table>

* For grommet
Conduit terminal: +0.2 kg
As in the figure below, this pilot-operated solenoid valve consists of a compact 3 port solenoid valve as the pilot valve and a large 3 port valve as the main valve. The pilot valve controls opening and closing the main valve. N.C. or N.O. function conversion can be done by switching the pilot passage.

Note) Pilot valve and body are shown in a different direction from the actual product in order to show the construction and air passage.

**Piping (Vacuum Use)**

1. Piping in general:
   - EXH port = Vacuum pump/Blower (Suction side)
   - OUT port = Tank/Vacuum pad (Load side)
   - IN port = Air releasing/Plug (2 port valve)

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)

**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.
With indicator light (TL, TZ)

Note) External pilot port (PA port) 1/4 is processed for threads in external pilot model only.

Dimensions: VP3145

Grommet: VP3145□-□□G□□

Conduit terminal: VP3145□-□□T□□

DIN terminal: VP3145□-□□D□□

Note) External pilot port (PA port) 1/4 is processed for threads in external pilot model only.

[ ]: With indicator light (TL, TZ)
Large Size 3 Port Solenoid Valve VP3165 Series

**Dimensions: VP3165**

Grommet: VP3165[□-□G□]

![Diagram of the VP3165 Series valve](image)

**Note:** External pilot port (PA port) 1/4 is processed for threads in external pilot model only.

**Conduit terminal: VP3165[□-□T□□]**

**DIN terminal: VP3165[□-□D□□]**

- Light position
  - (For TL, TZ)
- Lead wire length: 200 mm
- Manual override
  - (PA port)
- External pilot specification
- Applicable cable ø6 to ø12
- IN, OUT port
- EXH port

[□]: With indicator light (TL, TZ)
With indicator light (TL, TZ)

Note) External pilot port (PA port) 1/4 is processed for threads in external pilot model only.

Conduit terminal: VP3185□-□□T□□

DIN terminal: VP3185□-□□D□□
How to Order Pilot Valve Assembly

VP31 4 5-06 1 D Z A 1-N-X81

**Main Value Double Acting Type**

<table>
<thead>
<tr>
<th>Body size</th>
<th>Port size (IN, OUT port)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1/2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1 1/2</td>
</tr>
</tbody>
</table>

**Port size**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Port size</th>
<th>VP3145</th>
<th>VP3165</th>
<th>VP3185</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>3/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>3/4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1 1/4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1 1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Symbol**

- X80, -X81

**Thread type**

- Nil
- Rc
- F
- G
- N
- NPT
- T
- NPTF

**Type of actuation**

- X80 Double solenoid
- X81 Single solenoid

**External pilot**

**Passage, Type of actuation**

- Grommet (300 mm)
- Grommet (600 mm)
- Conduit terminal
- DIN terminal
- L plug connector
- M plug connector
- With connector
- Without connector
- With lead wire
- Without lead wire

**Light/Surge voltage suppressor**

- Nil
- DC without light/surge voltage suppressor
- U With light/surge voltage suppressor
- Z With light/surge voltage suppressor

**Electrical entry**

- U, Z spec
- DC
- AC

**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)

**Type of actuation**

1. Single (X81)
2. Double (X80)

**Pressure specification**

K: High pressure type

** 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)

**How to Order Pilot Valve Assembly**

VF3 1 40 K 1 D Z 1

**Light/Surge voltage suppressor**

- Nil
- With light/surge voltage suppressor
- With light/surge voltage suppressor

**Electrical entry**

- Grommet
- L plug connector
- M plug connector
- DIN terminal
- Conduit terminal
- With connector
- Without connector
- With lead wire
- Without light/surge voltage suppressor
- With light/surge voltage suppressor

**Note 1**

- AC type has a surge voltage suppressor, since a rectifier is built into the product.
- In the case of -X80, only N.C. is available.
- In the DIN terminal type, since a light is installed in the connector, DOU and DOZ are not available.

**Note 2**

- E: Grommet terminal type has been discontinued. Please replace it with conduit terminal type.

Please contact SMC for detailed dimensions, specifications and lead times.
VP3145/3165/3185 Series

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve configuration</td>
<td>External pilot 3 port solenoid valve</td>
</tr>
<tr>
<td>Type of actuation</td>
<td>Double solenoid (-X80), Single solenoid (-X81)</td>
</tr>
<tr>
<td>Fluid</td>
<td>Air</td>
</tr>
<tr>
<td>Operating pressure range</td>
<td>–101.2 kPa to 0.8 MPa</td>
</tr>
<tr>
<td>Pilot pressure</td>
<td>85 to 115% of main pressure, Min. 0.2 MPa</td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>0 to 50°C (No freezing)</td>
</tr>
<tr>
<td>Lubrication (Note 1)</td>
<td>Required (Equivalent to turbine oil Class 1 ISO VG32)</td>
</tr>
<tr>
<td>Mounting orientation</td>
<td>Unrestricted</td>
</tr>
<tr>
<td>Impact/Vibration resistance (Note 2)</td>
<td>150/50 m/s²</td>
</tr>
</tbody>
</table>

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 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)

Solenoid Specifications

<table>
<thead>
<tr>
<th>Electrical entry</th>
<th>Grommet, Conduit terminal, DIN terminal L plug connector, M plug connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coil rated voltage (V)</td>
<td>AC (50/60 Hz) 100, 200, 110, 220, 240</td>
</tr>
<tr>
<td>Allowable voltage fluctuation</td>
<td>±10% of rated voltage</td>
</tr>
<tr>
<td>Apparent power (VA) (Note)</td>
<td>AC 1.55 (With indicator light: 1.65)</td>
</tr>
<tr>
<td>Power consumption (W) (Note)</td>
<td>DC 1.5</td>
</tr>
</tbody>
</table>

* A rectifying circuit is used in the AC type.
Note) At rated voltage

Caution

Piping and other usage are the same as standard products.

Dimensions

VP3145-□□DZA1-X81

- In the case of B spec. of -X81 (N.O. spec.), VF3140K solenoid has to be positioned at left, when looking at the EXH port in the front face.
- In the case of -X80, VF3240K-□□□□ (Pilot valve) will be mounted.
### Dimensions

**VP3165-□□DZA1-X81**

- In the case of B spec. of -X81 (N.O. spec.), VF3140K solenoid has to be positioned at left, when looking at the EXH port in the front face.
- In the case of -X80, VF3240K-□□□□1 (Pilot valve) will be mounted.

**VP3185-□□DZA1-X81**

- In the case of B spec. of -X81 (N.O. spec.), VF3140K solenoid has to be positioned at left, when looking at the EXH port in the front face.
- In the case of -X80, VF3240K-□□□□1 (Pilot valve) will be mounted.
Caution

Piping
If supply port air pressure drops to less than 0.2 MPa, the valve may malfunction. In such a case, use external pilot type. (When throttling IN port, or operating with OUT port open to the atmosphere or in a similar operation.)

Pressure balance among each port
This solenoid valve is pressure-unbalanced type. Operate it within this pressure range: IN ≥ OUT ≥ EXH. If not operated in the range, the valve will malfunction.

Use as 2 port valve
1. Plug EXH port in case of pressure-in and plug IN port in case of vacuum use.
2. This valve has slight air leakage and can not be used for such purposes as holding air pressure (including vacuum) in the pressure container.

Supply air
Install an air filter and a lubricator on the upstream side.

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

Environment
If using the valve in a dusty environment, install a silencer at EXH port and PE port to prevent dust from entering.

N.C./N.O. conversion
When converting from N.C. to N.O. and vice versa, note that the equipment to be connected will act reversely.

How to Calculate the Flow Rate
For obtaining the flow rate, refer to front matter.

VP3145/3165/3185 Series
Specific Product Precautions
Be sure to read this before handling the products.
Refer to back page 50 for Safety Instructions and pages 3 to 9 for 3/4/5 Port Solenoid Valve Precautions.

Light/Surge Voltage Suppressor

<table>
<thead>
<tr>
<th></th>
<th>Grommet (G)</th>
<th>Conduit terminal (T)</th>
<th>DIN terminal (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With indicator light (L)</td>
<td>None</td>
<td>Neon bulb</td>
<td>48 VDC or less</td>
</tr>
<tr>
<td>Surge voltage suppressor (S)</td>
<td>Varistor</td>
<td>Neon bulb</td>
<td>100 VAC or more</td>
</tr>
<tr>
<td>With light/surge voltage suppressor (Z)</td>
<td>None</td>
<td>Varistor</td>
<td>48 VDC or less</td>
</tr>
</tbody>
</table>

*Items that are marked “With indicator light,” “With surge voltage suppressors,” and “With light/surge voltage suppressor” are all non-polar types.

How to Use DIN Terminal

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

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

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

   Note: a) It is possible to wire even in the state of bare wire. In that case, loosen the screw ⑧ and place a lead wire into the bracket ⑥, and then tighten it once again.
   b) The maximum size for the round terminal ⑨ is 1.25 mm²—3.5 and for the Y terminal is 1.25 mm²—4.
   c) Cable ⑧ outside diameter: ø8 to ø12 mm

3. Assembly
   1) Terminal block ③ connected with housing ④ should be reinstated. (Push it down until you hear the click sound.)
   2) 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.
   3) By inserting gasket ② 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%.

Changing the entry direction
The cable entry direction of a connector can be changed as desired (4 directions at 90° intervals), depending on the combination of a housing ④ and a terminal block ③.

Exploded view