1 Safety Instructions (Continued)

- 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 can be used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet 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 personnel.
- Do not service machinery/equipment or attempt to remove components until safety is confirmed.
  1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
  2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off all 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. (Supply air into the system gradually to create back pressure. (i.e. incorporate a slow-start valve).
- Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:
  1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.
  2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
  3) An application which has the possibility of having negative effects on people, property, or animals.
- The end user is expected to analyse and ensure the safe use of the product in all circumstances, including operation A maintenance.

This product is intended for use in a safety related part of a control system and is capable of providing the stated safety function to the category stated in the Declaration of Conformity, when correctly used. Any system using this product must be designed and validated by a properly qualified and responsible person, to meet the requirements of the relevant standards, laws and regulations applicable to the equipment in which it is installed.

Extended periods of continuous energisation
For applications such as mounting a valve on a control panel, incorporate measures to limit the heat radiation so that it is within the operating temperature range.

Do not disassemble the product or make any modifications, including additional machining. It may cause human injury and/or an accident.

Caution: Indicates a hazard with a medium level of risk, which if not avoided, could result in minor or moderate injury.

Warning: Indicates a hazard with a high level of risk, which if not avoided, could result in death or serious injury.

1.2 Notes

Vibration / Impact resistance 150 / 30 m/s²
Pollution degree Level 3 (EN60947-5-1)
Maximum permitted load inductance 0.5 H
Maximum permitted load current 50 mA
Minimum permissible load 5 VDC 1mA (resistive load)

Caution
Avoid using the valve when it is de-energised. When properly integrated into a suitable safety system the duplex VP#42 valve is compatible for use in systems up to Category 4, and the single VP#42 valves is compatible for use in systems up to Category 2 as defined by EN ISO 13849-1:2008.

Installation and Maintenance Manual

Monitored dump valve for use in safety related systems

Product Names: (25A-)VP542(R)-X536, VP544(R)-X538 (25A-)VP742(R)-X536, VP744(R)-X538

Safety component as defined by the Machinery Directive 2006/42/EC article 2c

The intended use of this valve is to vent a protected system to atmosphere when it is de-energised. When properly integrated into a suitable safety system the duplex VP#42 valve is compatible for use in systems up to Category 4, and the single VP#42 valves is compatible for use in systems up to Category 2 as defined by EN ISO 13849-1:2008.

Safety Performance, including the B10d and mission time.

2.1 Valve specifications

<table>
<thead>
<tr>
<th>Type of Valve</th>
<th>VP542</th>
<th>VP544</th>
<th>VP742</th>
<th>VP744</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve pressure</td>
<td>0.03 MPa</td>
<td>0.03 MPa</td>
<td>0.07 MPa</td>
<td>0.07 MPa</td>
</tr>
<tr>
<td>Typical response time</td>
<td>&lt; 0.4 s</td>
<td>&lt; 0.4 s</td>
<td>&lt; 1.2 s</td>
<td>&lt; 1.2 s</td>
</tr>
<tr>
<td>Inrush/outrush pressure</td>
<td>0.02 MPa for the specified application</td>
<td>0.02 MPa for the specified application</td>
<td>0.07 MPa for the specified application</td>
<td>0.07 MPa for the specified application</td>
</tr>
<tr>
<td>Ambient &amp; operating fluid temperature</td>
<td>-10~50°C (no freezing / no condensation)</td>
<td>-10~50°C (no freezing / no condensation)</td>
<td>-10~50°C (no freezing / no condensation)</td>
<td>-10~50°C (no freezing / no condensation)</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>1 cycle per week</td>
<td>1 cycle per week</td>
<td>1 cycle per week</td>
<td>1 cycle per week</td>
</tr>
<tr>
<td>Valve life</td>
<td>1,000,000 cycles</td>
<td>1,000,000 cycles</td>
<td>1,000,000 cycles</td>
<td>1,000,000 cycles</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-10~+50°C (no freezing / no condensation)</td>
<td>-10~+50°C (no freezing / no condensation)</td>
<td>-10~+50°C (no freezing / no condensation)</td>
<td>-10~+50°C (no freezing / no condensation)</td>
</tr>
<tr>
<td>Pressure range</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
</tr>
<tr>
<td>Response time</td>
<td>See 2.10.2.1</td>
<td>See 2.10.2.2</td>
<td>See 2.10.2.1</td>
<td>See 2.10.2.2</td>
</tr>
<tr>
<td>Operating pressure range</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
</tr>
<tr>
<td>Pilot pressure</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
<td>0.25 to 0.7 MPa</td>
</tr>
<tr>
<td>External pilot pressure</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
<td>0.25 to 0.7 MPa (where applicable)</td>
</tr>
<tr>
<td>Maximum permitted load</td>
<td>0.5 H</td>
<td>0.5 H</td>
<td>0.5 H</td>
<td>0.5 H</td>
</tr>
<tr>
<td>Maximum permitted load current</td>
<td>50 mA</td>
<td>50 mA</td>
<td>50 mA</td>
<td>50 mA</td>
</tr>
<tr>
<td>Minimum permissible load</td>
<td>5 VDC 1mA (resistive load)</td>
<td>5 VDC 1mA (resistive load)</td>
<td>5 VDC 1mA (resistive load)</td>
<td>5 VDC 1mA (resistive load)</td>
</tr>
<tr>
<td>Air quality</td>
<td>3(100°C 100°C)</td>
<td>3(100°C 100°C)</td>
<td>3(100°C 100°C)</td>
<td>3(100°C 100°C)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>0.45 W</td>
<td>0.45 W</td>
<td>0.45 W</td>
<td>0.45 W</td>
</tr>
<tr>
<td>Surge voltage suppressor</td>
<td>Variator</td>
<td>Variator</td>
<td>Variator</td>
<td>Variator</td>
</tr>
</tbody>
</table>
| Extended periods of continuous energisation | Do not use for applications such as mounting a valve on a control panel, incorporate measures to limit the heat radiation so that it is within the operating temperature range.
| Do not disassemble the product or make any modifications, including additional machining. It may cause human injury and/or an accident.

2.2 Flow specifications

-10~+50°C (no freezing / no condensation)

2.3 Pilot valve specifications

2.4 Limit switch specifications

2.5 Safety specification

Safety function: When the valve is de-energised the protected circuit is vented to atmosphere. The valve can be continuously energised to provide this function, subject to the specified minimum operating frequency.

- The VP42 single valve is capable up to Category 2 according to the Safety Standard when integrated into a suitable safety system.
- The VP44 duplex valve assembly is capable up to Category 4 according to the Safety Standard when integrated into a suitable safety system.

In this section, the ‘Safety Standard’ refers to EN ISO 13849-1 and the Validation Safety Standard refers to EN ISO 13849-2 as referenced in the Declaration of Conformity.

Information about compatibility with the Safety Standard is given in section 2.10

2.6 Declaration of Conformity

Below is a sample Declaration of Conformity (DoC) used for this product. An actual DoC will be supplied with each product.

Statement: The VP#42 single valve is capable up to Category 2 according to the Safety Standard when integrated into a suitable safety system.

The VP#42 single valve is capable up to Category 2 according to the Safety Standard when integrated into a suitable safety system.

The VP#44 duplex valve assembly is capable up to Category 4 according to the Safety Standard when integrated into a suitable safety system.

In this section, the ‘Safety Standard’ refers to EN ISO 13849-1 and the Validation Safety Standard refers to EN ISO 13849-2 as referenced in the Declaration of Conformity.

Information about compatibility with the Safety Standard is given in section 2.10
2 Specifications (Continued)

2.7 Interfaces (Dimensions are in mm)

2.7.1 VP#42 single valve

<table>
<thead>
<tr>
<th>VP#42</th>
<th>VP#44</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25.60</td>
</tr>
<tr>
<td>B</td>
<td>56.30</td>
</tr>
<tr>
<td>C</td>
<td>80.50</td>
</tr>
<tr>
<td>D</td>
<td>7.00</td>
</tr>
<tr>
<td>E</td>
<td>25.70</td>
</tr>
<tr>
<td>F</td>
<td>41.10</td>
</tr>
<tr>
<td>G</td>
<td>51.50</td>
</tr>
<tr>
<td>H</td>
<td>47.50</td>
</tr>
</tbody>
</table>

Note: The above drawing shows the VP#42 single valve. Other variations are available; the port threads on the VP#42 are 3/8" instead of 1/2", and all ports are available in a range of different thread types.

2.7.2 VP#44 duplex valve assembly

<table>
<thead>
<tr>
<th>VP#44</th>
<th>VP#44</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30.50</td>
</tr>
<tr>
<td>B</td>
<td>72.50</td>
</tr>
<tr>
<td>C</td>
<td>104.00</td>
</tr>
<tr>
<td>D</td>
<td>9.00</td>
</tr>
<tr>
<td>E</td>
<td>34.70</td>
</tr>
<tr>
<td>F</td>
<td>51.50</td>
</tr>
<tr>
<td>G</td>
<td>51.00</td>
</tr>
<tr>
<td>H</td>
<td>70.70</td>
</tr>
</tbody>
</table>

Note: The above drawing shows the VP#44 duplex valve assembly. Other variations are available; the port threads on the VP#44 are 3/8" instead of 1/2", and all ports are available in a range of different thread types as shown in the table in section 2.7.1.

2.8 Duplex valve identification

VP#44 valves are marked with mounting arrows, which are designed to point towards a mating arrow on the sub plate.

2.9 Product label (example)

The diagram shows the valve in the dotted line box connected to a safety relay in dual channel mode following the principles of the Safety Standard.

2.10 Safety System

2.10.1 The System Interface

The diagram shows the valve in the dotted line box connected to a safety relay in dual channel mode following the principles of the Safety Standard.

Note: The monitor switches are Normally Closed, i.e. closed when the valve solenoids are de-energised. The monitor signals are therefore shown ‘High’ when the valve is de-energised.
2 Specifications (Continued)

1. VP544 Valve & Switch Response

The volume of the protected system should be limited to the mission time stated in section 2.1. The mission time is given in cycles, the user is expected to calculate an equivalent figure in time units based on the operational frequency of the application. After the mission time has expired for the component it should be replaced with a new unit.

2. Pilot Valve

The volume of the protected system should be limited to the mission time stated in section 2.1. The mission time is given in cycles, the user is expected to calculate an equivalent figure in time units based on the operational frequency of the application. After the mission time has expired for the component it should be replaced with a new unit.

3. Surge Voltage Suppression

For DIN terminal:

- Organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
- • Malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
- • When there is a large amount of drainage.
- • Do not install in a location subject to strong magnetic fields.

3.6 Lubrication

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

3.7 Electrical Connection

- It is recommended that silencers or noise reduction devices are fitted to protect personnel from transient noise when the valves are de-energised. The pressure drop of silencers or devices must be taken into account during the design and testing of the application system to ensure that the safety function is maintained.

3.8 Pilot Valve

- When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.
- Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 μm or smaller.

3.9 Noise

- It is recommended that silencers or noise reduction devices are fitted to protect personnel from transient noise when the valves are de-energised. The pressure drop of silencers or devices must be taken into account during the design and testing of the application system to ensure that the safety function is maintained.

3.10 Pilot Valve

- When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.
- Install an air filter upstream near the valve. Select an air filter with a filtration size of 5 μm or smaller.
### 3 Installation (Continued)

#### 3.7.1 Pilot valve connections
- **DIN interchangeability**

  The ‘Y’ type DIN terminal corresponds to the DIN connector with a terminal pitch of 8 mm, which complies with EN175301-803C. The pitch is different from the ‘D’ type DIN connector (which has a pitch of 9.4 mm); the two types are therefore not interchangeable.

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarity</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

**Applicable cable dia:** Ø3.5 ~ Ø7 mm

#### 3.7.1.3 Leakage voltage

Ensure that any leakage current when the switching element is OFF causes < 3% of the rated voltage across the valve.

#### 3.7.1.4 Using DIN connector with the pilot valve

**Connection**
1. Loosen the holding screw and pull the connector out of the solenoid valve terminal block.
2. After removing the holding screw, insert a flat head screwdriver, etc., into the notch on the bottom of the terminal block and pry it open, separating the terminal block and the housing.
3. Loosen the terminal screws (slotted screws) on the terminal block, insert the cores of the lead wires into the terminals according to the connection method, and fasten them securely with the terminal screws.

4. Secure the cord by fastening the ground nut.

- **Caution**

  When making connections, take note that using other than the supported size (Ø3.5 to Ø7) heavy duty cord will not satisfy IP65 (enclosure) size manufacturer model applicable cable diameter. Do not push crimp terminals into gaps in the case interior. Doing so may remain between the socket and the plug.

**Changing the entry direction**

After separating the terminal block and housing, the cord entry can be changed by attaching the housing in the desired direction (4 directions at 90° intervals).

* When equipped with a light, be careful not to damage the light with the cord’s lead wires.

**Precautions**

Plug in and pull out the connector vertically without tilting to one side.

**Compatible cable**
Cord O.D.: Ø3.5 to Ø7 (Reference) 0.5 mm²; 2-core or 3-core, equivalent to JIS C 3306

---

### 3 Installation (Continued)

#### 3.7.2 Omron Limit Switch

**PRO-53.7 (F type) VP500-TFP16F**

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarity</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

**Applicable cable dia:** Ø3.5 ~ Ø7 mm

**Changing the entry direction**

After separating the terminal block and housing, the cord entry can be changed by attaching the housing in the desired direction (4 directions at 90° intervals).

* When equipped with a light, be careful not to damage the light with the cord’s lead wires.

**Precautions**

Plug in and pull out the connector vertically without tilting to one side.

**Compatible cable**
Cord O.D.: Ø3.5 to Ø7 (Reference) 0.5 mm²; 2-core or 3-core, equivalent to JIS C 3306

---

### 3 Installation (Continued)

#### 3.7.3 Conduct Opening

- **Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.**
- **Use a cable with a suitable diameter for the connector.**

**3.7.4 Recommended Connectors**

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended connectors to ensure conformance to the stated IP level.

<table>
<thead>
<tr>
<th>Size</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Applicable cable diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1/2</td>
<td>LAPP</td>
<td>ST-PF1/2</td>
<td>5380-1002</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.0 to 12.0 mm</td>
</tr>
<tr>
<td></td>
<td>Ohm Denki</td>
<td>DA-W1609</td>
<td>7.0 to 9.0 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9.0 to 11.0 mm</td>
</tr>
</tbody>
</table>

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer, Ohm Denki is a Japanese manufacturer.

---

### 3 Installation (Continued)

#### 3.7.4 Limit Switch: Omron M12 connector type

**3.7.4.1 Socket tightening (Connector type)**

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection may not be maintained and vibration may loosen the socket connector.

---

### 4 Outline Dimensions

#### 4.1 VP#42 single valve outline dimensions (mm)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Type</th>
<th>Wire size</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.S.T.</td>
<td>PRO-53.7 (F type)</td>
<td>AWG20 (0.5 mm)</td>
</tr>
<tr>
<td>J.S.T.</td>
<td>VR0-53.7 (straight type)</td>
<td></td>
</tr>
</tbody>
</table>

J.S.T. is a Japanese manufacturer.

---

Note 1: M4 limit switch retaining screws secured into position with adhesive. Do not remove.
### 4 Outline Dimensions (Continued)

#### 4.1.2 VP444 duplex valve assembly outline dimensions (mm)

<table>
<thead>
<tr>
<th>Part</th>
<th>VP500</th>
<th>VP700</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.20</td>
<td>6.20</td>
</tr>
<tr>
<td>B</td>
<td>47.00</td>
<td>67.00</td>
</tr>
<tr>
<td>C</td>
<td>5.00</td>
<td>6.50</td>
</tr>
<tr>
<td>D</td>
<td>9.50</td>
<td>9.50</td>
</tr>
<tr>
<td>E</td>
<td>201.80</td>
<td>204.20</td>
</tr>
<tr>
<td>F</td>
<td>52.00</td>
<td>80.00</td>
</tr>
<tr>
<td>G</td>
<td>91.50</td>
<td>118.00</td>
</tr>
<tr>
<td>H</td>
<td>112.00</td>
<td>135.90</td>
</tr>
<tr>
<td>I</td>
<td>90.40</td>
<td>88.90</td>
</tr>
<tr>
<td>J</td>
<td>94.50</td>
<td>95.00</td>
</tr>
<tr>
<td>K</td>
<td>79.00</td>
<td>95.00</td>
</tr>
<tr>
<td>L</td>
<td>104.80</td>
<td>124.80</td>
</tr>
</tbody>
</table>

Note 1: M4 limit switch retaining screws secured into position with adhesive. Do not remove.

#### 5 Maintenance

##### 5.1 General Maintenance

- **Caution**
  - Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
  - Never disassemble the product, unless required by installation or maintenance instructions.
  - **Warning**
    - Under no circumstances should the equipment be turned off when the solenoid of the pilot valve is energised, as this is an integral part of the safety system and does not become pressurised. Check this for both channels.
  - **Warning**
    - In order to meet a required performance level as defined by the appropriate safety standard, the user must provide all the other necessary components to complete function of the safety system. The user is responsible for the specification, design, implementation, validation and maintenance of the safety system.

##### 5.2 Maintainable parts

- **Caution**
  - The valve assembly must not be modified or damaged. Disassemble the product, unless required by installation or maintenance instructions.

##### 5.3 Periodic testing

- **Caution**
  - The valve assembly must be tested for proper operation of the safety function once per month or whenever necessary for the purposes of the end user.

- **Warning**
  - There are no replaceable parts on these safety products.

### 5.5 Troubleshooting guide

#### 5.6 Valve operation is noisy or erratic

- Supply flow is inadequate
- Increase supply pressure and/or flow.

#### 5.7 Valve is slow to close protected system

- Supply flow is inadequate
- Increase supply pressure and/or flow.

#### 5.8 Valve is slow to vent protected system

- Supply flow is inadequate
- Increase supply pressure and/or flow.

### 6 How to order

#### 6.1 VP442 single valve – how to order

#### 6.2 VP444 duplex valve assembly – how to order

### 7.1 Safety relays

- **Warning**
  - If a safe output from a safety relay or PLC is used to operate this valve, ensure that any output test pulse duration is shorter than 1 ms to avoid the valve solenoid responding.

### 7.2 Limitations

- **Caution**
  - This product is CE marked as a safety component as defined under the Machinery Directive 2006/42/EC. For details please refer to the Declaration of Conformity supplied with the product.
  - Any such use must be within the specified limits and application conditions for the product.

### 8 Contacts

- **Europe**
  - AUSTRIA: +43 2202 62929-0
  - BELGIUM: +32 3 355 1614
  - BULGARIA: +359 2 974 4942
  - CZECH REP.: +420 514 244 611
  - DENMARK: +45 70 253 200
  - ESTONIA: +372 651 0370
  - FINLAND: +358 (0) 207 512 013
  - FRANCE: +33 1 674 1 1000
  - GERMANY: +49 69 603 4020
  - GREECE: +30 210 771 7265
  - HUNGARY: +36 20 511 390
  - IRELAND: +353 1 403 9800
  - ITALY: +39 02 9271 9271

- **Outside Europe**
  - JP: +81 3 5207 8271
  - USA: +1 317 899 4440

### SMC Corporation

URL: [http://www.smcoworld.com](http://www.smcoworld.com) [Global]  [http://www.smar.eu](http://www.smar.eu) [Europe]  [http://www.smc.eu](http://www.smc.eu) [Europe]  [http://www.smc.com](http://www.smc.com) [SMC Corporation, Akihabara UDX15F, 4-1-4, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN]  Specifications are subject to change without prior notice from the manufacturer.

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