2 Safety Instructions (Continued)

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 can be used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and 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 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 soft-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. 2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, press applications, or safety equipment.

- An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

- 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 measure 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.

- Ensure that the air supply system is filtered to 5 µm or better.

Caution

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

Warning

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

Danger

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

2 Specifications (Continued)

2.4 Limit switch specification

- Type of actuation: Normally closed
- Return method: Spring return
- Rated pressure: 1.6 MPa
- Contact load: 0.25 to 0.75 MPa (where applicable)
- Ambient & operating fluid temp: 0.0 to 40°C (No condensation)
- Acceleration: Not required
- Operating Frequency Max: 20 cycles per minute
- Operating Frequency Min: 1 cycle per week
- Response time: See 2.3.1
- Vibration: Impact resistance 150 m/s²
- Relative humidity: 10% to 90% (non-condensing)
- Air quality: Pure filtration or better
- Environment: Indoor use only
- Recurrence: 600,000 cycles
- Load: 10 g
- B10: 400,000 cycles
- Mean time: 3,000 cycles
- Weight: 2.8 kg

2.4.1 Notes

1) For the purposes of EN ISO 13849-2:2008 table D.2 the switch is de-rated from the figures specified by the switch manufacturer. The switch load must be limited in the application in order to maintain the specified safety performance, including the B10 and mission time.

2) The switch is subject to the following vibration and shock limitations specified by the manufacturer:

- Contact opening time should be less than a 1ms pulse under vibration of 7.5 single amplitude, 10 to 55 Hz, 10 cycles in each direction for 45 minutes.
- Shock: 300 m/s² (Contact open time: 1ms maximum pulse)

2.5 Safety specification

Safety function: When the valve is de-energised the protected circuit is vented to atmosphere.

The product is capable of Category 4 PL e 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 2.9.

2.6 Declaration of Conformity

The content of the Declaration of Conformity (DoC) used for this product is shown below as a sample. The actual DoC is supplied with each product.
2.9 Safety System

2.9.1 The System Interface

2.9.2 Timing Diagram

2.9.3 Relationship of flow and response performance to safety function

The time taken for the air to vent and remove the hazard is a function of:
- The flow capacity of the valve.
- The flow restriction of silencers fitted to the valve.
- The volume of the protected system.
- The pressure of the air in the protected system.
- The flow restrictions in air supply and the protected system.

The end user is expected to establish the time taken to vent the application system by testing and ensure that this time is consistent with the requirement of the overall safety system. This includes the selection of suitable silencers.

The performance of the system should be validated by test after each installation to ensure that the actual performance of the valve is consistent with the safety function.

2.9.4 Mission time according to the Safety Standard

The operational life of the product 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 duty cycle of the application. After the mission time has expired for the component it should be replaced with a completely new unit.

2.9.5 MTTFd according to the Safety Standard

The B10d for the component given in section 2.1 is derived from product knowledge and based on specific life tests. The system integrator should use this data to determine MTTFd and the Performance Level (PL) of the system using the methods described in the Safety Standard.

2.9.6 Diagnostic Coverage according to the Safety Standard

This valve is fitted with 'direct monitoring' according to Table E1 of the Safety Standard. When properly integrated this valve contributes to a DC value of 99% for the safety function.

2.9.7 Common Cause Failures according to the Safety Standard

CCF analysis is the responsibility of the system integrator. This valve has 2 channels made of identical valves. The use of this valve might not allow the system calculation to include CCF points for diversity.

3 Installation

3.1 Installation

- Do not install the product unless the safety instructions have been read and understood.
- Do not install the product if it appears to have been damaged during transport.
- Do not paint the product.
- Do not remove or cover up warnings or specifications printed or affixed to the product.
- Ensure sufficient space for maintenance activities. When installing the products, allow access for maintenance.
- Ensure that the connections of pipework and cables to the unit do not result in a residual trip hazard to system operators or maintainers.
- If air leakage increases or equipment does not operate properly, stop operation.
- Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.
3 Installation (Continued)

### 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 use in a location subject to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact. Check the product specifications.
- Do not mount in a location exposed to radiant heat.
- Do not install in a location subject to strong magnetic fields.
- Do not install in an EMC environment other than 'industrial' according to the scope of standard listed on the Declaration of Conformity.
- If it is used in an environment where there is possible contact with oil, solder, spatter, etc., exercise preventive measures.
- When the solenoid valve is mounted in a control panel or is energized for a long time, make sure ambient temperature is within the specification of the valve.

### 3.3 Piping

**Warning**

- Before 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 to 2 threads exposed on the end of the pipe fitting.
- Tighten fittings to the specified tightening torque.

<table>
<thead>
<tr>
<th>Thread</th>
<th>Tightening Torque, N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC/G 1/4 NPT</td>
<td>7 to 9</td>
</tr>
<tr>
<td>RC/G 3/8 NPT</td>
<td>28 to 30</td>
</tr>
</tbody>
</table>

- The valve must be protected from contamination from the downstream system when air is vented through the valve.

### 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, use turbine oil Class 1 (no additive), SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- Do not install in a location subject to strong magnetic fields.
- Do not mount in a location exposed to radiant heat.
- Do not use in an explosive atmosphere.
- Do not use in water or steam are present.
- Do not use in an environment where there is possible contact with oil, water or steam are present.

### 3.5 Air Supply

**Caution**

- Type of fluids
  - Please consult with SMC when using the product in applications other than compressed air.
  - When there is a large amount of drainage.
  - Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
- Drain flushing
  - If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment.
  - If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.
- Use clean air
  - Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause malfunctions or malfunction.
- External pilot
  - The external pilot variant has 2 pilot ports – see diagram in section 2.7. Both pilot ports need to be connected to an air supply for the valve to function.

### 3.6 Noise

**Caution**

- The valve must be fitted with silencers to protect personnel from transient noise when the valve is de-energized. The recommended silencer is ANA-106. The pressure drop of silencers must be taken into account during the design and testing of the application system to ensure that the safety function is maintained.
- The valve will also create some transient noise when energized. The end user is responsible for installing the valve with silencers in a suitable location so that noise is not a hazard to personnel.

### 3.7 Electrical Connection

**Caution**

- When electric power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.
- Check if the connections are correct after completing all wiring.

#### 3.7.1 Pilot Valve

**3.7.1.1 Surge voltage suppression**

![Diagram of Pilot Valve Connections]

**3.7.1.2 Pilot valve connections**

Terminals with lamp and surge protection have been built in wiring connections. Connect as per figure.

**3.7.1.3 Electrical connection to pilot valve**

**Disassembly**

1. Loosen screw 1 and pull housing 2 directly upward to remove connector from the device.
2. Remove screw 1 from housing 2 and retain.
3. Notch 9 indicated by an arrow at the bottom of terminal block 3. Insert screwdriver in the clearance between housing 2 and terminal block 3, and pry housing 2 off to remove terminal block 3.
4. Remove cable gland screw 4, and take out washer 5 and rubber gland 6.

**3 Wiring**

1. Pass cable gland screw 4, washer 5 and rubber gland 6 over cable 7 and insert into housing 2.
2. Peel off a correct length of the coating of cable 7 and connect the cable with crimp-style terminal 10.
3. Remove screw 1 (or loosen Y-shaped terminal) from terminal block 3, mount crimp-style terminal 10 to terminal block 3 and tighten screw 11 securely. Note: Tighten screw with torque range of 0.5 N·m +/-20%.

**Remarks**

- Wiring can be carried out with bare cables. If so, loosen screw (with washer) 11, insert lead wires in bracket 12 and tighten the screw.
- Maximum outer diameter of cable 7 should range from ø4.5mm to ø7.0mm.
- Applicable crimp-style terminals 10 are shown below.
  - 'O' terminal: R1.25-4M (JIS C 2805 specification)
  - 'Y' terminal: 1.25-3L (supplied by JST Mfg. Co., Ltd)

**Assembly**

1. Pass parts through cable 7 as follows: cable gland 4, washer 5, rubber packing 6 and housing 2. Connect cable 7 to terminal block 3. Then press terminal block 3 into housing 2 until it clicks in place.
2. Insert parts into the cable inlet of housing 2 as follows: rubber packing 6 and washer 5, and tighten cable gland 4 securely.
3. Place gasket 8 between the bottom part of terminal block 3 and plug or device. Insert and tighten screw 1 over the housing 2. Note: Tighten screw with torque range of 0.5 N·m +/-20%.

**Remark**

- Connector orientation can be changed through an angle of 180 degrees depending on the assembly of housing 2 and terminal block 3.  

### 3.7.2 Limit Switch: Omron D4N-9B31

**View on valve side**

**Applicable cable dia: ø4.5 - ø7 mm**

**Warning**

- 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.
- Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.
- Compressed air contains a large amount of drainage can cause malfunction of pneumatic equipment such as valves.
- If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.
- If excessive carbon dust is generated by the compressor it may adhere to the inside of a valve and cause it to malfunction.
- The supply should be DN19 minimum for the internal pilot variant. If DN19 is not possible, the external pilot variant should be used. When the external pilot variant is used, ensure the pilot supply is not subject to transient pressures that might interfere with the function of the valve. Minimise the distance between the valve and the air supply and between the valve and the protected system. Do not place any devices between the valve and the protected system that might interfere with the safety function. The exhaust ports must remain open to vent the protected system but should be suitably connected to prevent the ingress of dirt and erosion of noise.

**Caution**

- Do not install in a location subject to strong magnetic fields.
- Do not mount in a location exposed to radiant heat.
- Do not use in an explosive atmosphere.
- Do not use in water or steam are present.
- Do not use in an environment where there is possible contact with oil, water or steam are present.
- Do not use in an environment where there is possible contact with oil, water or steam are present.
- Do not use in an environment where there is possible contact with oil, water or steam are present.
- Do not use in an environment where there is possible contact with oil, water or steam are present.
4.1 Mounting
- Installation orientation: free.
- The valve can be mounted using 3 x M8 bolts. 
- Tighten bolts to achieve a secure mounting. Maximum torque 25 Nm.

5. Maintenance

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

5.2 Pilot Valve
- Under no circumstances attempt to change the solenoid of the pilot valve as this is an integral part of the valve and doing so will negate any such SMC warranty.
- Do not remove 2x M4 screws securing each solenoid coil to pilot valve body.

5.3 Periodic testing
The product should be tested for proper operation of the safety function once per month or whenever considered necessary for the purposes of the end user. The test should consist of operation of the safety system and observation of the following:
- When the connected control system is energising the solenoids:
  - Check that the solenoid indicator lamps are illuminated.
  - Check that the connected downstream system is properly pressurised.
  - Check that the switch contacts are open.
  - Check that when only one channel (solenoid) is energised the protected system does not become pressurised. Check for this on both channels.
  - When the connected control system is not energising the solenoids:
  - Check that the solenoid indicator lamps are not illuminated.

5.4 Silencers
- Ensure that silencers fitted to the valve remain clean and uncontaminated if in operation because blockages will affect the safety function. There are 2 silencers fitted to the pilot vent ports of the valve during manufacture and 2 silencers to be fitted to the main valve vent ports during installation by the end user.
- Examine all the silencers at least once per month and more frequently if necessary due to the nature of the application environment.

5.5 Troubleshooting guide

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible fault</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve does not open</td>
<td>Pilot valve is not energised</td>
<td>Check pilot solenoid indicator</td>
</tr>
<tr>
<td>Valve does not close</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve remains energised</td>
<td>Replace individual pilot valve(s)</td>
<td></td>
</tr>
<tr>
<td>Switch contacts do not open</td>
<td>Switch has failed</td>
<td>Replace valve body</td>
</tr>
<tr>
<td>Switch contacts do not close</td>
<td>Switch has failed</td>
<td>Replace valve body</td>
</tr>
<tr>
<td>Supply pressure too low</td>
<td></td>
<td>Increase supply pressure</td>
</tr>
<tr>
<td>Pilot valve has failed</td>
<td>Replace individual pilot valve(s)</td>
<td></td>
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<tr>
<td>Pilot valve is jammed</td>
<td>Replace valve body</td>
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<tr>
<td>Valve is slow to pressurise</td>
<td>Supply flow is inadequate</td>
<td>Increase supply pressure</td>
</tr>
<tr>
<td>Switch operation is noisy or erratic</td>
<td>Supply flow is inadequate</td>
<td>Increase supply pressure</td>
</tr>
<tr>
<td>Valve is slow to vent</td>
<td></td>
<td></td>
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<tr>
<td>Switch operation is noisy or erratic</td>
<td></td>
<td>Increase supply pressure</td>
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</tbody>
</table>

6. Maintenance (Continued)
- Check that the connected downstream system is properly pressurised and that the condition of the silencers is not causing an extension of the vent time.
- Check that the switch contacts are closed.
- Check that when only one channel (solenoid) is energised the protected system is vented to atmosphere. Check this for both channels.

The specification of the valve requires the valve to be cycled (energised and de-energised) at least once per week.

6.1 Limitations of Use

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. 

The valve may only be used to provide the stated safety function for the supply and removal of pressure from all or part of a pneumatic system, under the total control of a supervisory device. The valve can only perform as a safety component when properly installed in a system conforming to the appropriate safety standards. Any such use must be within the specified limits and application conditions for the product.

In order to meet a required performance level as defined by the appropriate safety standards, 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.

7. Contacts

<table>
<thead>
<tr>
<th>Country</th>
<th>Phone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
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<td>(43) 2260-62260-0</td>
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<tr>
<td>BELGIUM</td>
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<td>BULGARIA</td>
<td>(359) 2-7474492</td>
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<td>CZECH REP.</td>
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<td>DENMARK</td>
<td>(45) 7025200</td>
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<td>ESTONIA</td>
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<td>GERMANY</td>
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<td>SWITZERLAND</td>
<td>(41) 52 396 3131</td>
<td></td>
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<tr>
<td>UNITED KINGDOM</td>
<td>(44) 13018 03688</td>
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