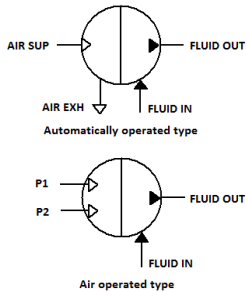




ORIGINAL INSTRUCTIONS

Instruction Manual  
56-PA3###/PA5###  
Process Pump



| Ex classification                             |  |                  |
|---|--|------------------|
| 56-PA3##0                                     | II 3 G Ex h IIB T6 Gc<br>II 3 D Ex h IIIB T68°C Dc | 0°C ≤ Ta ≤ +60°C |
| 56-PA3##3                                     | II 3 G Ex h IIB T5 Gc<br>II 3 D Ex h IIIB T89°C Dc |                  |
| 56-PA5##0                                     | II 3 G Ex h IIB T6 Gc<br>II 3 D Ex h IIIB T68°C Dc |                  |
| 56-PA5##3                                     | II 3 G Ex h IIB T6 Gc<br>II 3 D Ex h IIIB T78°C Dc |                  |
| 56-PA501#                                     | II 3 G Ex h IIB T6 Gc<br>II 3 D Ex h IIIB T78°C Dc |                  |
| Certificate reference: SMC. 19.0008 X         |  |                  |
| For special conditions of use see section 1.2 |  |                  |

The intended use of this process pump is to convert the potential energy provided by compressed air into a force which causes mechanical linear motion. The mechanical linear motion is then used to pump liquid through a system.

1 Safety Instructions

1.1 General 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) \*1), and other safety regulations.  
\*1) ISO 4414: Pneumatic fluid power - General rules relating to systems.  
ISO 4413: Hydraulic fluid power - General rules relating to systems. (Part 1: General requirements)  
IEC 60204-1: Safety of machinery - Electrical equipment of machines.  
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.

1.2 Special Conditions of Use.

- Clean only with damp cloth and allow to dry naturally.**
- Do not run the pump without fluid except for the self-priming operation.**
- Product must be earthed.**

2 Specifications

2.1 Specifications

56-PA Series Process Pump Specifications

Each of the values below are for normal temperatures and for transferred fluid fresh water.

| Model   | Automatically operated type                             |                                    |  |                                      | Air operated type  |                                      |                       |  |               |       |
|---|---|------------------------------------|--|--------------------------------------|--|--------------------------------------|-----------------------|--|---------------|-------|
|   | 56-PA31#0   | 56-PA32#0                          | 56-PA51#0                                      | 56-PA52#0                            | 56-PA5010  | 56-PA5113                            | 56-PA5213             | 56-PA5013                                |               |       |
| Port sizes  | Main fluid suction / discharge port                     | Rc, NPT, G, NPTF 3/8"              | Rc, NPT, G, NPTF -04: 1/2" -06: 3/4"           | Rc, NPT, G, NPTF -04: 1/2" -06: 3/4" | Rc, NPT, G, NPTF 3/8"  | Rc, NPT, G, NPTF -04: 1/2" -06: 3/4" | Rc, NPT, G, NPTF 1/4" | Rc, NPT, G, NPTF 1/4"                    |               |       |
|   |   | Rc, NPT, G, NPTF 1/4"              |  | Rc, NPT, G, 1/4"                     | Rc, NPT, G, NPTF 1/4"  |                                      | Rc, NPT, G, 1/4"      |  |               |       |
| Material  | Liquid contact areas                                    | ADC12                              | SCS14  | ADC12                                | SCS14  | PP                                   | ADC12                 | SCS14                                    | PP            |       |
|   | Diaphragm   | 56-PA##10: PTFE<br>56-PA##20: NBR  |  |                                      |  | PTFE                                 | PTFE                  |  | PTFE          |       |
|   | Check valve   | PTFE, PFA                          |  |                                      |  | PTFE, PP, PFA                        | PTFE, PFA             |  | PTFE, PP, PFA |       |
| Fluid   | Refer to 7. Applicable Fluids.                          |                                    |  |                                      |  |                                      |                       |  |               |       |
| Discharge rate  | 1 to 20 L/min   |                                    | -04: 5 to 50 L/min<br>-06: 5 to 60 L/min       |                                      | -04: 5 to 53 L/min<br>-06: 5 to 63 L/min   | 0.1 to 12 L/min                      |                       | -04: 1 to 45 L/min<br>-06: 1 to 50 L/min |               |       |
| Average discharge pressure                                  | 0 to 0.6MPa   |                                    |  |                                      | 0 to 0.4MPa  |                                      |                       |  |               |       |
| Pilot air pressure  | 0.2 to 0.7 MPa  |                                    |  |                                      | 0.1 to 0.5 MPa   |                                      |                       |  |               |       |
| Air consumption   | Refer to flow rate characteristics in Operation Manual. |                                    |  |                                      |  |                                      |                       |  |               |       |
| Suction lifting range <sup>1</sup>                          | Dry   | Up to 1m (when the pump is dry)    |  | Up to 2m (when the pump is dry)      |  | Up to 1m (when the pump is dry)      |                       | Up to 0.5m (when the pump is dry)        |               |       |
|   | Wet   | Up to 6m (when the pump is primed) |  |                                      |  |                                      |                       |  |               |       |
| Noise   | 80 dB(A) or less (Option: with silencer, AN20)          |                                    | 78 dB(A) or less (Option: with silencer, AN20) |                                      | 72 dB(A) or less (excluding the noise from the quick exhaust and solenoid valve) |                                      |                       |  |               |       |
| Withstand pressure  | 1.05 MPa  |                                    |  |                                      | 0.75 MPa   |                                      |                       |  |               |       |
| Diaphragm life <sup>4</sup>                                 | 50 million times  |                                    |  |                                      |  |                                      |                       |  |               |       |
| Fluid temperature   | 0 to 60°C (no freezing)                                 |                                    |  |                                      |  |                                      |                       |  |               |       |
| Ambient temperature   | 0 to 60°C (no freezing)                                 |                                    |  |                                      |  |                                      |                       |  |               |       |
| Maximum viscosity   | 1000 mPa·s  |                                    | 5000 mPa·s                                     |                                      | 1000 mPa·s   |                                      | 5000 mPa·s            |  |               |       |
| Mounting position   | Horizontal (with mounting foot at bottom)               |                                    |  |                                      |  |                                      |                       |  |               |       |
| Weight  | 1.7kg   | 2.2kg                              | 3.5kg  | 6.5kg                                | 3.0kg  | 1.7kg                                | 2.2kg                 | 3.5kg                                    | 6.5kg         | 3.0kg |
| Recommended operating frequency                             | --  |                                    |  |                                      | (0.2 to 1Hz also possible depending on conditions) <sup>2</sup>                  |                                      |                       |  |               |       |
| Pilot air solenoid valve recommended Cv factor <sup>3</sup> | --  |                                    |  |                                      | 0.20   |                                      | 0.45                  |  |               |       |
| Packaging   | General Environment                                     |                                    |  |                                      |  |                                      |                       |  |               |       |

Note 1: With cycles at 2Hz or more  
Note 2: After initial suction of liquid operation at 1 to 7Hz, it can be used with operation at lower cycles. Since a large quantity of liquid will be pumped out, use a suitable throttle in the discharge port if problems occur to control the flow.  
Note 3: With low number of operating cycles, even a valve with a small Cv factor can be operated.  
Note 4: These are reference values for room temperature and fresh water. These are not guaranteed. For details, refer to operation manual.

2 Specifications (continued)

56-PA-X10 Process Pump Specifications

Each of the values below are for normal temperatures and for transferred fluid fresh water.

| Model                      |                                     | Automatically operated type               |                                 |  |                                 |
|----------------------------|-------------------------------------|---|---------------------------------|--|---------------------------------|
|                            |                                     | 56-PA31#0-X10                             | 56-PA32#0-X10                   | 56-PA51#0-X10                              | 56-PA52#0-X10                   |
| Port sizes                 | Main fluid suction / discharge port | Rc, NPT, G, NPTF<br>3/8"                  |                                 | Rc, NPT, G, NPTF<br>-04: 1/2"<br>-06: 3/4" |                                 |
|                            | Pilot air supply / exhaust port     | Rc, NPT, G, NPTF<br>1/4"                  |                                 |  |                                 |
| Material                   | Liquid contact areas                | ADC12                                     | SCS14                           | ADC12                                      | SCS14                           |
|                            | Diaphragm                           | PTFE, NBR                                 |                                 |  |                                 |
|                            | Check valve                         | Stainless steel, Ceramic                  |                                 |  |                                 |
| Discharge rate             |                                     | 1 to 10L/min                              |                                 | 5 to 28L/min                               |                                 |
| Average discharge pressure |                                     | 0 to 0.3MPa                               |                                 | 0 to 0.6MPa                                |                                 |
| Pilot air consumption      |                                     | Maximum 200 L/min (ANR)                   |                                 | Maximum 280 L/min (ANR)                    |                                 |
| Suction lifting range      |                                     | Dry                                       | Up to 1m (interior of pump dry) |  | Up to 1m (interior of pump dry) |
|                            |                                     | Wet                                       | Up to 6m (liquid inside pump)   |  |                                 |
| Fluid temperature          |                                     | 0 to 60°C (no freezing)                   |                                 |  |                                 |
| Ambient temperature        |                                     | 0 to 60°C (no freezing)                   |                                 |  |                                 |
| Maximum viscosity          |                                     | 1000 mPa·s                                |                                 |  |                                 |
| Pilot air pressure         |                                     | 0.2 to 0.7 MPa                            |                                 |  |                                 |
| Withstand pressure         |                                     | 1.05 MPa                                  |                                 |  |                                 |
| Mounting position          |                                     | Horizontal (with mounting foot at bottom) |                                 |  |                                 |
| Weight                     |                                     | 1.7kg                                     | 2.2kg                           | 3.6kg                                      | 6.6kg                           |

2.2 Performance Curves

Refer to the information in the standard PA3000-5000 web catalogue.

2.3 Production Batch Code

The production batch code printed on the label indicates the month and year of production as per the following table.

| Construction | Production batch codes |     |     |     |     |     |     |     |     |     |     |     |
|--------------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year / Month | Jan                    | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 2019         | Xo                     | XP  | XQ  | XR  | XS  | XT  | XU  | XV  | XW  | XX  | Xy  | XZ  |
| 2020         | yo                     | yP  | yQ  | yR  | yS  | yT  | yU  | yV  | yW  | yX  | yy  | yZ  |
| ...          | ...                    | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 2024         | Co                     | CP  | CQ  | CR  | CS  | CT  | CU  | CV  | CW  | CX  | Cy  | CZ  |

2.4 Construction

Refer to the information in the standard PA3000-5000 web catalogue for construction details.

3 Installation

**Warning**

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

3.1 Operating Environment

**Warning**

- Do not use in the following environments, as this can cause failure.**
  - Locations with an atmosphere of corrosive gases, organic solvents or chemical solutions, and where there may be contact with the same.
  - Locations where there is contact with sea spray, water or steam.
  - Locations where ultraviolet deterioration or overheating of resin may occur due to direct sunlight.
  - Locations near heat sources with poor ventilation (heat sources should be shielded by heat insulating material).
  - Locations with impact or vibration.
  - Locations with excessive moisture and dust.
- Do not use the product immersing it in water (liquid). Otherwise, liquid will enter the openings inside the product resulting in a malfunction.
- If compressed air with an atmospheric pressure dew point below -40°C is used, the lubrication properties inside the product can deteriorate prematurely, affecting the life of the product. In these cases, it is recommended that customers test the product under their own specific operating conditions.

**Caution**

- Fluid leakage**
  - There are some cases where the operating fluid will leak outside the pump, for example when the diaphragm reaches the end of its life. Measures should be taken to avoid leakage, such as installing a drain pan, so that people and equipment will not be adversely affected.
  - When dangerous fluid is used, take measures to isolate humans from the pump. External leakage of pumping fluid could cause serious injury.
- Perform periodic inspections to confirm normal operation.**

It may otherwise become impossible to assure safety in the event of unexpected malfunction or miss operation.
- Earth connection**

Ensure that the pump is electrically connected to an earthing (ground) point. The ground cable must be prepared by the customer (see Fig.1).

3 Installation (continued)

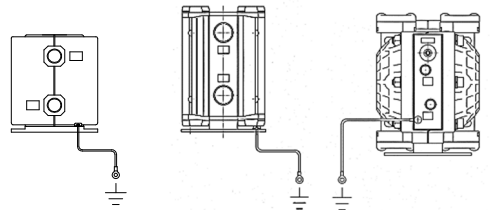


Fig.1 Method of Connecting Ground Cable<sup>\*4</sup>

Note 1: Use the dedicated hole on the foot on the fluid ports side to connect the ground cable.  
Note 2: Use any of the four fixing holes on the feet to connect the ground cable using the fixing screw.  
Note 3: Due to case material being PP, the earthing point on PA501# is located directly on the center plate. Use the dedicated M4x0.7 hole below the air supply and exhaust ports.  
Note 4: 56-PA-X43 has no mounting bracket, the customer must prepare the earthing method.

3.2 Mounting

**Warning**

- Only horizontal mounting is possible. Mount the pump horizontally with the feet facing down.
  - Secure all specified mounting positions when using the product.
  - If the propagation of the vibration of the pump is not acceptable, insert vibrating-isolating rubber when mounting.
- Ensure sufficient maintenance space.**
    - When installing and mounting, be sure to secure the space required for maintenance and inspections.
    - Consider possible leakage from the product. When transferring flammable or hazardous liquids, take measures including fire ban and keeping the area off-limits.

3.3 Piping

Refer to [Fig. 2] for circuit examples.

**Automatically operated type**

<Starting and Stopping> Refer to circuit example (1) [Fig. 2].

- Connect air piping to the air supply port <AIR SUP> and connect piping for the fluid to be transferred to the suction port <FLUID IN> and the discharge port <FLUID OUT>.

3 Installation (continued)

- Using a regulator set the pilot air pressure within the range of 0.2 to 0.7MPa. Then, the pump operates when power is applied to the 3-port solenoid valve of the air supply port <AIR SUP>, the sound of exhaust begins from the air exhaust port <AIR EXH> and fluid flows from the suction port <FLUID IN> to the discharge port <FLUID OUT>. At this time, the throttle on the discharge side should be open. The pump performs suction with its own power. To restrict exhaust noise, attach a silencer (AN20-\*02: option) to the air exhaust port <AIR EXH>.
- To stop the pump, exhaust the air pressure being supplied to the pump by the 3-port solenoid valve of the air supply port <AIR SUP>.

<Discharge flow rate adjustment>

- To adjust the flow rate from the discharge port <FLUID OUT>, use the throttle connected to the discharge side. Refer to circuit example (1) [Fig. 2].
- When operating with a discharge flow rate below the specification range, provide a by-pass circuit from the discharge side to the suction side to ensure the minimum flow rate inside the process pump. With a discharge flow rate below the minimum flow rate, the process pump may stop due to unstable operation. Refer to circuit example (2) [Fig. 2] (Minimum flow rates: 56-PA3##0 1L/min, 56-PA5##0 5L/min).

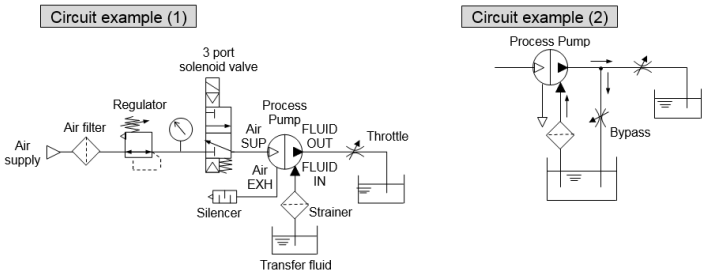


Fig 2. Automatically Operated Circuit Examples

3 Installation (continued)

<Reset button> Excluding 56-PA3##0-X8 & 56-PA5##0-X8

- When the pump stops during operation, press the reset button. This makes it possible to restore operation in case the switching valve becomes clogged due to foreign matter in the supply air.

<How to count the number of cycles with 56-PA-X8>

The number of cycles of the pump can be counted by mounting detecting equipment such as a pressure switch on the pressure signal output port. When mounting the detecting equipment, the distance from the equipment to the pump should be as short as possible (50mm or shorter). If it is not necessary to count the number of cycles, plug the M5 port.

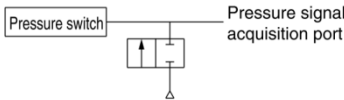


Fig.3 Cycle Counting Circuit Example

**Air operated type**

< Starting and Stopping > Refer to circuit examples [Fig.4].

- Connect air piping<sup>\*1</sup> to the pilot air supply ports <P1>, <P2> and connect piping for the fluid to be transferred to the suction port <FLUID IN> and the discharge port <FLUID OUT>.
- Using a regulator set the pilot air pressure within the range of 0.1 to 0.5MPa. Then, the pump operates when power is applied to the solenoid valve<sup>\*2</sup> of the pilot air supply port and fluid flows from the suction port <FLUID IN> to the discharge port <FLUID OUT>. At this time, the throttle on the discharge side should be open. The pump performs suction with its own power. To restrict exhaust noise, attach a silencer to the solenoid valve air exhaust port.
- To stop the pump, exhaust the air pressure being supplied to the pump with the solenoid valve of the air supply port.

Note 1: When used for highly permeable fluids, the solenoid valve may malfunction due to the gas contained in the exhaust. Implement measures to keep the exhaust from going to the solenoid valve side.

Note 2: For the solenoid valve, use an exhaust centre 5 port valve, or a combination of residual exhaust 3 port valve and a pump drive 4 port valve. If air in the drive chamber is not released when the pump is stopped, the diaphragm will be subjected to pressure and its life will be shortened. Refer to circuit examples (1) and (2) [Fig.4].



3 Installation (continued)

<Discharge flow rate adjustment>

- 1. The flow rate from the discharge port <FLUID OUT> can be adjusted easily by changing the switching cycle of the solenoid valve on the air supply port.

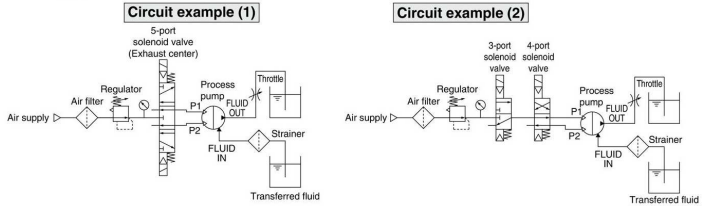


Fig 4. Air Operated Circuit Examples

Caution

- Flush and clean the piping before connecting the product.
- Any dirt or scale left in the piping may cause a malfunction or failure. When installing piping or fittings, ensure sealant material does not enter the ports.
- Only use fittings with resin threads when using a product with resin threads at the ports. Using metal fittings may damage the product.
- **Always fasten threads with the correct tightening torque**  
When screwing fittings into the product, tighten them with the appropriate torque as shown in the tables below.  
If loose, liquid or air leakage may occur. If overtightened, the threaded parts may be damaged.

| Connection thread | Proper tightening torque [N.m]                  |           |
|-------------------|---|-----------|
|                   | 56-PA <sub>5</sub> <sup>3</sup> <sub>2</sub> ## | 56-PA501# |
| 1/4"              | 12 to 14  | 12 to 14  |
| 3/8"              | 22 to 24  | -         |
| 1/2"              | 28 to 30  | 2 to 2.5  |
| 3/4"              | 28 to 30  | 4 to 5    |

3 Installation (continued)

3.4 Air Supply

Warning

- **Use clean air.** Do not use compressed air that includes chemicals, synthetic oils containing organic solvents, salinities or corrosive gases, etc., as these can cause damage or malfunction.
- **Avoid freezing in low temperatures.** The equipment operates while expanding compressed air. Temperature inside decreases due to adiabatic expansion. If ambient temperature is low, use of humid compressed air can cause freezing. Take prevention measures such as the use of a membrane dryer (such as IDG series).

Caution

Quality of operating air.

- Only use air filtrated by a micro mist separator (such as AMD series). Use of a super mist separator (such as AME series) is recommended to extend maintenance intervals.
- Use of humid air may cause condensation inside the pump. Use air which has been treated by a refrigerated air dryer (such as IDF series).
- If the pump is operated with N<sub>2</sub> gas, the deterioration of the gaskets in the switching valve will be accelerated and may shorten the life of the product.

3.5 Storage

Warning

- In case of long-term storage after use, first thoroughly remove all the liquid and clean and dry the inside to prevent deterioration to the pump materials.
- After a long period of non-use, perform a trial run prior to operation.
- Ensure that the bolts are not loose before operating the process pump.

3.6 Lubrication

Caution

- **The pump can be used without lubrication.**  
Do not lubricate the air operated type.

3 Installation (continued)

- **If lubricating the pump, continue lubrication.**

If lubricating a pump other than the air operated type, use turbine oil Class 1 (with no additives) ISO VG32, and continue lubricating the pump.

3.7 Fluid

Warning

- When ignitable fluid is used, select a product with metal wetted parts (56-PA<sub>5</sub><sup>3</sup><sub>2</sub> ##). Always take countermeasures against static electricity.
- Check the fluid compatibility check list in Section 7. Consider that the compatibility may change with type, additives, concentration, temperature, etc.
- Contact your SMC representative for fluids outside the compatibility list.
- Foreign matter in the fluid may cause abrasion. The use of a strainer with 80 to 100 mesh (150 to 180 μm) is recommended.
- When transferring coagulable liquids, take measures to prevent coagulation inside the pump.
- Contact your SMC representative for the use with slurry.
- **Take measures to prevent fluid getting on the body of the pump.**
- **The pump cannot transfer gas.**
- **Do not allow pump to idle for a long time.**

If the pump is operated for a long time without any fluid inside or in a gas-liquid mixed state, the diaphragm may be damaged, or the life may be shortened. Dry operation is only allowed during self-priming.

When flammable fluids are transferred and the diaphragm is damaged due to ageing, the fluid can enter the air circuit and be exhausted by the pump. In this case the exhaust gas can contain flammable vapour, ensure that the exhaust is piped to a safe area.

- **Liquid seal.** To ensure that fluid does not become sealed in the pump, relieve the discharge pressure when stopping the pump. Include a pressure relief valve on your system.
- **Be sure to observe the maximum operating pressure.**  
Operation above the maximum operating pressure can cause damage. Avoid application of pressure above the specifications caused by water hammer, for example when a valve is operated abruptly. Take measures to prevent pressures higher than specified, such as:
  1. Use a water hammer relief valve or reduce the valve's closing speed.
  2. Absorb impact pressure by using elastic piping material such as rubber, or an accumulator, etc.

4 How to Order

Refer to the information in the standard PA3000-5000 web catalogue for 'How to Order'.

5 Outline Dimensions

Refer to the information in the standard PA3000-5000 web catalogue for general dimensions.

6 Maintenance

6.1 General Maintenance

Warning

- If handled improperly, compressed air can be dangerous. Only qualified personnel should perform maintenance of pneumatic systems.
- Before performing maintenance, ensure the supply pressure is shut off and all residual air pressure is released from the system.

Caution

- **Perform maintenance in accordance with the procedures in the maintenance manual specific to each 'Process Pump' model. If handled improperly, this can cause damage or malfunction in machines and equipment, etc. (Contact SMC for the specific maintenance manual.).**
- After maintenance apply operating pressure and power to the equipment and check for proper operation and possible air leaks. If operation is abnormal, verify product set-up parameters.
- Do not make any modification to the product.
- Do not disassemble the product, as disassembly will invalidate the product's warranty. When disassembly is necessary, please consult with SMC or our distributor.
- **Do not step on or place heavy objects on the unit.**  
The equipment may be deformed or damaged.
- **Discharge drainage regularly from components and filters.**  
Operating the system with accumulated drain in equipment or piping may cause malfunctions, downstream splashes or unexpected accidents.
- **The bolts in 56-PA501# may become loose over time due to creep of the PP housing.** Retighten the bolts before operation to prevent fluid or air leakage. Refer to the maintenance manual for the required tightening torque.

6 Maintenance (continued)

- **Only perform maintenance work after confirming system safety.**
  1. Turn off the compressed air and power supply. Exhaust any residual air pressure.
  2. Discharge any residual liquid or displace it as necessary.
- **Confirm system safety after reinstallation, prior to operation.**
- **Use appropriate protective equipment.**

When handling the product for maintenance, wear equipment such as gloves and goggles compatible with the fluid being used.

- **Transfer of dangerous fluids.**

In case a dangerous fluid such as a strong acid or base is transferred by mistake, do not disassemble the product. There is a danger of serious injury if personnel come into contact with the remaining fluid.

6.2 Service life and replacement of consumable parts

- When the pump exceeds the number of service life cycles, the diaphragm deteriorates, and malfunction may occur. When this occurs, fluid will leak into the air pilot exhaust port and air will enter the liquid circuit. Consider the pump operating conditions and reference service life to replace the pump or conduct maintenance as necessary.
- Items such as check valves, switching valves and other components may experience malfunction earlier than the diaphragm depending on operation conditions. Replace damaged parts as soon as possible.
- Obtain the necessary parts as indicated in the maintenance parts list and only perform work according to maintenance and operation manuals.

6.3 Inability to repair the product

In order to enable the process pump to be used with various fluids, and regarding workers and facilities safety, please understand that SMC is unable to carry out repair on customer units.

6.4 Calculation of reference service life (days) of diaphragm

<Automatically operated type>

$$\text{Reference service life (days)} = \frac{\text{A (Amount of discharge per cycle)} \times \text{B (Reference number of cycles in service life)}}{\text{Flow rate (L/min)} \times \text{Operating time per day (hours)} \times 60}$$

6 Maintenance (continued)

<Air operated type>

The amount of discharge per cycle for the air operated type depends on the piping resistance. Therefore, service life (days) is calculated using the operating frequency of the solenoid valve.

$$\text{Reference service life (days)} = \frac{\text{B (Reference number of cycles in service life)}}{\text{Operating frequency of solenoid valve (Hz)} \times \text{Operating time per day (hours)} \times 3600}$$

| Model     | Operating method       | Diaphragm material | Amount of discharge per cycle A | Reference <sup>2</sup><br>number of cycles in service life B | Volume inside pump (wetted part) |
|-----------|------------------------|--------------------|---------------------------------|--|----------------------------------|
| 56-PA3110 | Automatically operated | PTFE               | Approx. 0.04 L                  | 100 million cycles   | Approx. 0.075 L                  |
| 56-PA3120 | Air operated           | NBR                | Approx. 0.022 L <sup>1</sup>    | 50 million cycles  |                                  |
| 56-PA3113 | Air operated           | PTFE               |                                 |  |                                  |
| 56-PA5110 | Automatically operated | PTFE               | Approx. 0.10 L                  | 50 million cycles  | Approx. 0.315 L                  |
| 56-PA5120 | Air operated           | NBR                | Approx. 0.09 L <sup>1</sup>     |  |                                  |
| 56-PA5113 | Air operated           | PTFE               | Approx. 0.09 L <sup>1</sup>     |  |                                  |
| 56-PA5010 | Automatically operated | PTFE               | Approx. 0.10 L                  | 50 million cycles  | Approx. 0.505 L                  |
| 56-PA5013 | Air operated           | PTFE               | Approx. 0.09 L <sup>1</sup>     |  |                                  |

Note 1: The amount of discharge for the air operated type is indicated assuming no piping resistance.  
Note 2: These are reference values given for rated temperature and tap water and are not guaranteed.

7 Applicable Fluids

Caution

- Select the wetted parts materials according to the transfer liquid you will use:
  - a) Liquid contact materials: aluminium is suitable for oils, stainless steel is suitable for solvents and industrial water, and PP is suitable for water, acids and alkali fluids.
  - b) Diaphragm material: NBR is suitable for inert liquids, and PTFE is suitable for non-permeating liquids.
  - c) Use fluids that will not corrode the wetted parts materials.
- These products are not suitable for use with medical or food products.
- Applicability will change depending on additives and impurities. Take note of additives and impurities.
- Applicability may vary with operating conditions, be sure to check with testing.
- Compatibility shown in the table is for a fluid temperature within specification.
- **Depending on the fluid used, a flammable atmosphere may occur. Take countermeasures such as ventilation.**

7 Applicable Fluids (continued)

| Material and fluid compatibility |                           | Table symbols O: Can be used. X: Cannot be used. --: Contact SMC. |                |        |        |                |        |        |        |                |  |
|----------------------------------|---------------------------|---|----------------|--------|--------|----------------|--------|--------|--------|----------------|--|
| Model                            | 56-                       | PA3110  | PA3113         | PA3120 | PA3210 | PA3213         | PA3220 | PA5010 | PA5013 |                |  |
| Diaphragm material               |                           | PA5110  | PA5113         | PA5120 | PA5210 | PA5213         | PA5220 |        |        |                |  |
| Body material                    |                           | ADC12   |                | SCS14  |        |                |        | PP     |        |                |  |
| Water                            |                           | PTFE  |                | NBR    |        | PTFE           |        | NBR    |        | PTFE           |  |
| Examples of applicable liquids   | Tap water                 | X   |                | O      |        | O              |        | O      |        | O              |  |
|                                  | Pure water                | X   |                | -      |        | -              |        | -      |        | -              |  |
|                                  | Turbine oil               | O   |                | X      |        | O              |        | X      |        | O              |  |
|                                  | Cutting oil               | O   |                | X      |        | O              |        | X      |        | O              |  |
|                                  | Brake oil                 | O   |                | X      |        | O              |        | X      |        | O              |  |
|                                  | Flux                      | X   |                | O      |        | O              |        | X      |        | -              |  |
| Solvent                          | Toluene                   | O <sup>2</sup>  |                | X      |        | O <sup>2</sup> |        | X      |        | -              |  |
|                                  | Methyl ethyl ketone       | X   |                | X      |        | O <sup>2</sup> |        | X      |        | -              |  |
|                                  | Acetone                   | X   |                | X      |        | O <sup>2</sup> |        | X      |        | -              |  |
|                                  | Inert solvent             | X   |                | O      |        | O              |        | X      |        | O <sup>2</sup> |  |
|                                  | Ethyl alcohol             | O <sup>2</sup>  |                | X      |        | O <sup>2</sup> |        | X      |        | -              |  |
|                                  | Isopropyl alcohol         | O <sup>2</sup>  |                | X      |        | O <sup>2</sup> |        | X      |        | -              |  |
| Acids                            | Sodium hypochlorite       | X   |                | X      |        | X              |        | X      |        | -              |  |
|                                  | Alkalis                   | X   |                | X      |        | X              |        | X      |        | O <sup>3</sup> |  |
|                                  | Metal corrosive liquid    | X   |                | X      |        | X              |        | X      |        | X              |  |
|                                  | Highly permeating liquid  | X   |                | X      |        | X              |        | X      |        | X              |  |
|                                  | Highly penetrating liquid | X   | O <sup>1</sup> | X      | X      | O <sup>1</sup> | X      | X      | X      | O <sup>1</sup> |  |
|                                  |                           |   |                |        |        |                |        |        |        |                |  |

Note 1: The air operated type can also be used for highly permeable liquids. However, they cannot be used if the penetrating components damage parts such as seals in the air circuit. In addition, since the exhaust air contains the gas components penetrating through the diagram, take measures to prevent the exhaust air from going to the solenoid valve.  
Note 2: Static electricity may be generated. Take measures to prevent static electricity.  
Note 3: Strong acidic chemicals, strong basic chemicals and hydrofluoric acid are not allowed.  
Note: These pumps could be penetrated by fluids, and penetrating fluids may affect internal parts of other materials.

8 Limitations of Use

8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

Caution

8.2 Obligations of the end-user

- Ensure the product is used within the specification outlined.
- Ensure that the maintenance periods are suitable for the application.
- Ensure any cleaning processes to remove dust layers are made with the atmosphere in mind (e.g. using a damp cloth to avoid static build up).
- Ensure that the application does not introduce additional hazards by mounting, loading, impacts or other methods.
- Ensure that there is sufficient ventilation & air circulation around the product.
- If the product is subject to direct heat sources in the application, it should be shielded so that the temperature stays within the stated operating range.
- **SMC products are not intended for use as instruments for legal metrology.**  
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

8 Limitations of Use (continued)

Danger

- Do not exceed any of the specifications listed in Section 2 of this document as this will be deemed improper use.
- Air equipment has an air leakage during operation within certain limits. Do not use this equipment when the air itself introduces additional hazards and could lead to an explosion.
- Refer to the Ex classification for the product.
- Use only Ex certified auto switches. These should be ordered separately. Do not use this product in the presence of strong magnetic fields that could generate a surface temperature higher than the product specification.
- In the event of damage or failure of any parts located in the vicinity where this product has been installed, it is the responsibility of the user to determine whether or not this has compromised the safety and condition of this product and/or the application.
- External impact on the body could result in a spark and/or damage. Avoid any application where foreign objects can hit or impact the body. In such situations the application should install a suitable guard to prevent this occurrence.
- Do not use this equipment where vibration could lead to failure.

9 Product Disposal

This product shall 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.

10 Contacts

Refer to [www.smworld.com](http://www.smworld.com) or [www.smc.eu](http://www.smc.eu) for your local distributor/importer.

SMC Corporation

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