PA□/PB Series
Specific Product Precautions 1

Be sure to read this before handling the products.
Refer to page 501 for safety instructions.

Caution on Design

⚠Warning

1. Confirm the specifications.

Give careful consideration to operating conditions such as the application, fluid and environment, and use the product within the operating ranges specified in this catalog.

2. Fluids

- For the compatibility between the materials composing the product and the fluids, check the compatibility check list. Since the compatibility of the fluid used may vary depending on its type, additives, concentration, temperature, etc., give sufficient consideration when selecting the material.
- Use within the operating fluid temperature range.
- If foreign matters are mixed in the fluid, these may cause abrasion of the inside of the pump resulting in a problem. Use an appropriate filter (strainer) to remove them. In general, 80 to 100 mesh (150 to 180 μm) filters are recommended.
- When transferring a coagulable liquid, take measures to prevent it from coagulating in the pump.
- Flammable fluid cannot be used with the process pump with built-in solenoid valve (PB1011A). Do not use in an environment where flammable fumes are present or where flammable liquid may get stuck to the product.
- Use of slurry is not recommended.
- Take countermeasures to prevent the operating fluid from getting onto the body of the process pump.
- When ignitable fluid is used, select a product with metal wetted parts (aluminum, stainless steel). Always take countermeasures against static electricity.

3. Water hammer

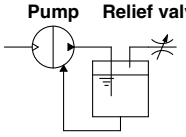
If a valve is operated abruptly etc., a high pressure may be applied due to water hammer. Take measures to prevent pressures higher than specified from being applied.

<Examples of measures>

- Use a water hammer resistant valve to reduce the valve closing speed.
- Use an elastic piping material such as rubber hose or an accumulator to absorb the impact pressure.

4. Liquid seals

To ensure that fluid does not become sealed inside the process pump, when stopping the pump, relieve the discharge pressure inside it. As shown in the figure at right, make a circuit which has a relief valve installed on the system.



Countermeasures against liquid-sealed circuit

5. Fluid pressure supplied to the process pump

Feeding the fluid from the suction side into the pump under pressure, or drawing it using a negative pressure, will reduce the life of the pump.

6. Ensure space for maintenance.

Secure the space required for maintenance and inspection. Take into consideration also leakage from the product. When transferring a flammable liquid or a liquid that may affect the human body or environment, take measures including fire ban and keeping the area off limits.

7. When the diaphragm is broken, supply air will be mixed with the fluid or fluid will enter the air switching valve. When the supply air or debris contained in it affect the product performance, or the supply air is not suitable for the chemical resistance of the components, countermeasures need to be taken by the customer.

8. Use a design which prevents reverse pressure and reverse flow.

If reverse pressure or reverse flow occurs on the discharge side of the process pump, the equipment is liable to become damaged or malfunction. Take safety measures in designing the circuit.

⚠Warning

9. Measures against static electricity

Take measures against static electricity as static electricity may occur depending on the fluid. Particularly, when circulating flammable fluid through the pump, be sure to take measures to prevent the occurrence of static electricity.

10. The pump cannot transfer gas. Do not allow it to idle for a long time.

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

11. Condensation and freezing of the pilot port

The location around the switching valve and the air exhaust port of the automatically operated type and also the air supply port of the air operated type can cool down quickly due to expansion of the supply air, and this may cause condensation on the piping and the condensation may freeze during operation in winter. Take measures to ensure that water droplets from condensation are not splashed onto any electric parts or equipment.

12. PB1011A (Built-in solenoid valve)

Refer to “Handling Precautions for SMC Products” (M-E03-3) for the usage of the solenoid valve.

⚠Caution

1. Suspension of the pump operation

●PA□ series

- For the automatically operated type, use a 3-port solenoid valve and be sure to discharge the residual pressure. If the process pump is stopped while air is still being supplied to it, a load will be applied to the internal parts of the pump, reducing the life of the pump. Also, if the pump should stop while consuming the residual pressure, the built-in pilot air switching unit may become unstable and unable to be restarted. If it cannot be restarted, press the reset button.
- For the air operated type, combine an exhaust center 5-port solenoid valve or a 3-port solenoid valve for residual pressure release and a 4-port solenoid valve for driving the pump to discharge the residual pressure inside the pump when stopping it. If the pump is pressurized during suspension, its life will become shorter.

●PB series

- For the built-in solenoid valve type, cut off the 24 VDC voltage supplied to the process pump. If the process pump is stopped without cutting off the 24 VDC, a load will be applied to the internal parts, reducing the life of the pump.
- For the air operated type, stop the 3-port solenoid valve and exhaust the air inside the process pump. If the process pump is stopped while air is still being supplied to it, a load will be applied to the internal parts, reducing the life of the pump.

2. Use the constant pilot air pressure.

In the automatically operated type, when the pressure fluctuation of the pilot air exceeds 50 kPa, a malfunction could occur and the pump may stop.

3. Reverse flow

The check valve inside the process pump does not completely stop reverse flow (the flow from the discharge side to the suction side). For this reason, fluid may sometimes flow from the discharge side to the suction side when the pump is stationary, etc). As a countermeasure, install a 2-way valve or a check valve. However, please note that when a check valve is installed, if the cracking pressure is high, defective suction may occur. (As a guide, the cracking pressure should be 0.02 MPa or less.)

PA□/PB Series
Specific Product Precautions 2

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Mounting

⚠Caution

1. **Read the operation manual carefully and understand the contents before mounting the product. The manual should also be kept where it can be referred to whenever necessary.**
2. **Open the sealed package inside a clean room.**
   Products specified for clean room are sealed and double packaged inside a clean room. We recommend that the inner package should be opened inside a clean room or clean environment.
3. **Confirm the mounting orientation of the product.**
   Since the mounting orientation varies depending on the product, check it in the operation manual or the specifications herein.
   Secure all specified mounting positions when using the product.
   If the propagation of the vibration of the pump is not acceptable, insert vibro-isolating rubber when mounting.

Piping

⚠Caution

1. **Flush the piping.**
   Flush and clean the piping before connecting the product. Any dirt or scale and the like left in the piping may cause malfunction or failure.
2. **Use fittings with resin threads when connecting piping to the product with resin threads at the ports.**
   Using fittings with metal threads may cause damage to the ports.
3. **Tighten screws with proper tightening torque.**
   When screwing fittings into the product, tighten them with proper tightening torque as shown below. If loose, liquid or air leakage may occur. If overtightened, the threaded parts may be damaged.

PA3$^{1}_{2}$□□, PA5$^{1}_{2}$□□, PAX1□12

Connection thread	Proper tightening torque (N·m)
Rc, NPT, G, NPTF 1/4	12 to 14
Rc, NPT, G, NPTF 3/8	22 to 24
Rc, NPT, G, NPTF 1/2	28 to 30
Rc, NPT, G, NPTF 3/4	28 to 30

PA501□

Connection thread	Proper tightening torque (N·m)
Rc, NPT, G 1/4	12 to 14
Rc, NPT, G 1/2	2 to 2.5
Rc, NPT, G 3/4	4 to 5

PA331□, PAP331□, PAF341□, PAF541□

Connection thread	Proper tightening torque (N·m)
Rc, NPT, G, NPTF 1/8	0.4 to 0.5
Rc, NPT, G, NPTF 1/4 (PAF3000)	0.8 to 1
Rc, NPT, G, NPTF 1/4	1.5 to 2
Rc, NPT, G, NPTF 3/8	2 to 2.5
Rc, NPT, G, NPTF 3/4	4 to 5

Piping

⚠Caution

PB1000A Series

Connection thread	Proper tightening torque (N·m)
Rc, NPT, G 1/8	0.8 to 1

PB1313A Series

Connection thread	Proper tightening torque (N·m)
Rc, NPT, G 1/8	1.5 to 2

Air Supply

⚠Warning

1. **Use clean air.**
   Do not use compressed air that includes chemicals, synthetic oils containing organic solvents, salinities or corrosive gases, etc., as it can cause damage or malfunction.
2. **Pay attention to avoid freezing when operating the product in low temperatures.**
   The equipment operates while expanding the compressed air. During this time, the temperature inside the product decreases due to adiabatic expansion. If the ambient temperature is low, using compressed air containing a lot of moisture may cause freezing because heat cannot be gained from the surroundings. In this case, take freeze prevention measures by using a membrane air dryer (such as series IDG).

⚠Caution

1. **Quality of operating air**
   - Be sure to use only air filtrated by a micro mist separator (such as series AMD). Use of a super mist separator (such as series AME) is recommended to extend maintenance intervals.
   - Use of humid air may cause condensation inside the body. Use air which has been treated by a refrigerated air dryer (such as IDF series).
   - If a pump is operated by N_2 gas, etc., the deterioration of the gaskets inside the switching valve will be accelerated and may result in substantially shortening the life span of the product.
2. **Compressed air with low dew point**
   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.
   When air with an atmospheric pressure dew point below –40°C is used for the operating environment or operating fluid, it is recommend that the customer tests the product under their own specific operating conditions.

PA□/PB Series
Specific Product Precautions 3

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Operating Environment

⚠Warning

1. Do not use in the following environments, as this can cause failure.

1) Locations with an atmosphere of corrosive gases, organic solvents or chemical solutions, and where there may be contact with the same.
2) Locations where there is contact with sea spray, water or steam.
3) Locations where ultraviolet deterioration or overheating of resin may occur due to direct sunlight.
4) Locations near heat sources with poor ventilation (heat sources should be shielded by heat insulating material).
5) Locations with impact or vibration.
6) Locations with excessive moisture and dust.

2. The product cannot be used under water.

Do not use the product immersing it in water (liquid). Otherwise, liquid will enter the openings inside the product, resulting in a malfunction.

3. Depending on the fluid used, a flammable atmosphere may occur. Take countermeasures such as ventilation.

Maintenance

⚠Warning

1. Perform maintenance after consulting the operation manual.

Obtain the operation manual for the equipment from SMC or our distributor and have sufficient knowledge of the equipment before performing maintenance. Incorrect handling may cause damage or malfunction of the equipment or system.

2. Perform maintenance work after confirming the safety of the system.

Turn off the compressed air and power supply and exhaust any remaining compressed air in the system before removing the equipment and the compressed air supply/exhaust unit. Discharge the residual liquid or sufficiently displace it as necessary. Also, when reinstalling the equipment or restarting it after replacement, confirm the safety of the product before checking that it operates normally.

3. Use appropriate protective equipment.

When touching the process pump for maintenance, wear protective equipment such as gloves which are compatible with the fluid used. There is a risk of chemical burns.

4. Do not disassemble the product, as disassembly will invalidate the product's warranty.

5. Drain discharge

Operating the system with drain accumulated in the equipment or piping may cause malfunction of the equipment, splash over into the downstream side, or unexpected accident. Periodically discharge drain from components including the air filter.

6. Caution when transferring a high-temperature fluid

The product itself will become hot due to the high-temperature fluid. Since touching the product directly may cause burns, allow sufficient time for the product to cool down when transferring a high-temperature fluid. The measurement of the product temperature is recommended to confirm the safety of the system before performing work.

Maintenance

⚠Warning

7. Caution when a temperature history cycle is applied

When a temperature history (heat cycle) is applied for the PAF series, the resin thread may extend. Additionally tighten with the specified torque (M3: 0.11 to 0.12 N·m) to prevent liquid leakage.

8. The bolts in the PA501□ series may become loose over time. Retighten the bolts before operation to prevent fluid or air leakage (refer to the maintenance manual for the required tightening torque).

Maintenance

⚠Caution

1. Caution when transferring a highly penetrating liquid

When transferring a liquid that is highly penetrating through fluoropolymer, components of the transfer liquid may enter the openings inside the equipment. Also, they may become attached to the external surface of the equipment. In this case, take the same measures as handling the transfer liquid.

2. Service life of diaphragm and maintenance of consumable items

- If the operating cycle of the process pump exceeds the service life of diaphragm, the diaphragm may be damaged due to deterioration. If it is damaged, the fluid will leak from the pilot air exhaust port and the air will blow out into the liquid circuit. Consider the pump operation (breathing, decline of discharge pressure, etc.) and the reference service life of diaphragm, and replace with new process pump or conduct necessary maintenance as early as possible.
- Items such as check valves, switching valves, pilot valves and manual caps may experience a malfunction earlier than the diaphragm depending on the operating conditions. Replacement of the whole product or maintenance should be performed as soon as possible.
- When conducting maintenance, obtain the necessary parts indicated in the maintenance parts list (refer to each series), and perform work according to the maintenance and operation manuals.

3. Please understand the following concerning the inability to repair the product.

To enable the process pump to be used with various fluids, please note that from the aspects of ensuring worker safety and also the facilities, SMC is unable to carry out repair.

PA□/PB Series
Specific Product Precautions 4

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Maintenance

⚠Caution

[Calculation of reference service life (days) of diaphragm]

<Automatically operated type>

Reference service life (days) =

$$\frac{\text{A (amount of discharge per cycle) x B (reference number of cycles in service life)}}{\text{Flow (L/min) x Operating time per day (hour) x 60 (min)}}$$

<Air operated type, PB series>

The amount of discharge per cycle for the air operated type, PB series varies depending on the piping resistance. Therefore, calculate the service life (days) using the operating frequency of a solenoid valve.

Reference service life (days) =

$$\frac{\text{B (reference number of cycles in service life)}}{\text{Operating frequency of solenoid valve (Hz) x 60 (sec) x Operating time per day (hour) x 60 (min)}}$$

Model	Operating method	Diaphragm material	Amount of discharge per cycle A	Reference number of cycles in service life B	Volume inside pump (wetted part)
PA3□10	Automatically operated type	PTFE	Approx. 0.04 L	100 million cycles	Approx. 75 mL
PA3□20		NBR		50 million cycles	
PA3□13	Air operated type	PTFE	Approx. 0.022 L*	50 million cycles	
PA5$2^1$10	Automatically operated type	PTFE	Approx. 0.10 L	50 million cycles	Approx. 315 mL
PA5$2^1$20		NBR			
PA5$2^1$13	Air operated type	PTFE	Approx.0.09 L*		
PA5010	Automatically operated type	PTFE	Approx. 0.10 L	50 million cycles	Approx. 505 mL
PA5013	Air operated type	PTFE	Approx.0.09 L*		
PA(P)3310	Automatically operated type	PTFE	Approx. 0.025 L	50 million cycles	Approx. 85 mL
PA(P)3313	Air operated type		Approx. 0.037 L		
PAX1□12	Automatically operated type	PTFE	Approx. 0.021 L	50 million cycles	Approx. 90 mL
PB1011A	Built-in solenoid valve type	PTFE	Approx. 0.004 L	30 million cycles	Approx. 9 mL
PB1013A	Air operated type				
PB1313A			Approx. 0.003 L	50 million cycles	Approx. 7 mL
PAF3410	Automatically operated type	PTFE	Approx. 0.054 L	50 million cycles	Approx. 105 mL
PAF3413	Air operated type		Approx. 0.050 L*		Approx. 100 mL
PAF5410	Automatically operated type	PTFE	Approx. 0.130 L		Approx. 600 mL
PAF5413	Air operated type		Approx. 0.190 L*		

* The amount of discharge per cycle for the air operated type is indicated assuming no piping resistance.

Lubrication

⚠Caution

1. The pump can be used without lubrication.

Do not lubricate the air operated type, the PAF series.

2. If lubricating the pump, continue lubrication.

If lubricating a pump other than the air operated type or the PAF series, use turbine oil Class 1 (with no additives) ISO VG 32, and be sure to continue lubricating the pump.

Caution on Handling

⚠Warning

1. Test before using with the actual equipment.

Test the pump before using it with the actual equipment. Even if there is no problem in a short-term test, the liquid may penetrate through the fluoropolymer diaphragm causing malfunction in the pump air circuit.

Caution on Handling

⚠Warning

2. Storage

In the case of long-term storage after use, first thoroughly remove the liquid, and clean and dry the inside to prevent deterioration of the pump materials.

3. After a long period of non-use, perform a trial run prior to operation.

4. Ensure that the bolts are not loose before operating the process pump.

5. Adjustment of the discharge amount

Connect the discharge volume adjustment valve (throttle) to the FLUID OUT port of the process pump. Adjust the volume by adjusting the opening of the valve.

6. When the discharge volume is large (flow velocity is high) depending on the fluid type and operating conditions, cavitation may lead to poor operation or failure. Increase supply air pressure or decrease the discharge volume with a throttle so that cavitation is not generated.

7. Operating environment

When dangerous fluid is used, take measures to isolate humans from the pump. External leakage of pumping fluid could cause serious injury.

8. Countermeasures against liquid leakage

There are some cases where the operating fluid will leak outside the pump, for example when the diaphragm reaches the end of the life. Measures should be taken to avoid leakage, such as installing a drain pan, so that people and equipment will not be adversely affected. In particular, if the diaphragm is damaged, fluid may enter the pilot air flow path from the damaged diaphragm part, spraying out from the AIR EXH port (for the automatically operated type) or from the exhaust port of the solenoid valve for driving (for the air operated type). When transferring flammable fluids or those that may affect human health or equipment, isolate the air exhaust part and install an enclosure, etc., to prevent splashing.

9. Caution for piping of the tube

Support the piping according to JIS B 8370 when piping the tube. Arrange the piping so that tension is not applied to the tube.

Return of Product

⚠Warning

If the product to be returned is contaminated or is possibly contaminated with substances that are harmful to humans, for safety reasons, please contact SMC beforehand and then employ a specialist cleaning company to decontaminate the product. After the decontamination prescribed above has been carried out, submit a Product Return Request Sheet or the Detoxification/Decontamination Certificate to SMC and await SMC's approval and further instructions before attempting to return the item.
Please refer to the International Chemical Safety Cards (ICSC) for a list of harmful substances.