SMC

Process Pump

Series PA3000, 5000/PAX1000
Series PB1000

A compact pump suitable for transfer and recovery of a wide variety of fluids

A compact p

for transfer and recovery

Can be used in almost any field, including machinery, metals, petroleu

Air Pilot Type
Series PA

PA3□□0:20ℓ/min

PA5□□0:45ℓ/min

Compact, large capacity diaphragm type pump

Compatible with a wide variety of fluids

PA3000:1 to 20ℓ/min, PA5000:5 to 45ℓ/min

Long life, 2 to 5 times that of conventional pumps

The diaphragm diameter has been enlarged, the stroke reduced and a new material introduced.

A simple configuration makes maintenance easy too

A new structural design allows the diaphragm and check valve to be replaced individually.

Easy adjustment of discharge pressure and flow rate

Adjustment of discharge pressure and flow rate can be easily performed with adjustment of the pilot air pressure.

Self-priming type makes priming unnecessary

Able to pump up to 1 meter in a dry state (without priming).

(At ordinary temperatures with fresh water) Able to pump up to 6 meters in a wet state (with priming).

High abrasion resistance/low dust generation

Since it is a diaphragm type there are no sliding parts in the liquid contact area.

ump suitable

of a wide variety of fluids

ım, painting, printing, chemistry, foods, semiconductors and electrical.

Built-in pulsation attenuator
Series PAX

PAX1□1□2 :10ℓ/min

Built-in pulsation attenuator (standard)

A pulsation attenuating function to suppress discharge pressure pulsation is a new built-in feature.
This controls problems such as discharge piping vibration, scattering of liquid from the discharge outlet, and foaming in tanks.
In addition, internalization of this feature makes it unnecessary to provide extra space and separate piping, etc.

Built-in solenoid valve
Series PB

Pump with built-in micro-solenoid valve

A solenoid valve drive type diaphragm pump that fits in the palm of the hand
- **Polypropylene body: 60 x 60 x 41**
- **Maximum discharge: 2ℓ/min**
- **Connection port size: Rc(PT)1/8**

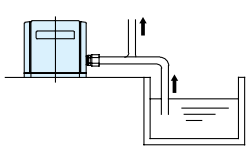
- **Space is saved due to the centralization of piping and wiring areas on the top and bottom surfaces.**

- **Simple adjustment of the discharge flow rate**

  Adjustment of the discharge flow rate can be easily performed with the number of ON/OFF cycles of the internal solenoid valve (VJ300).

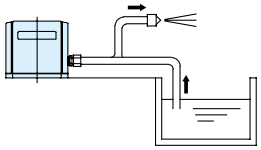
Application examples

Transfer of liquid by suction



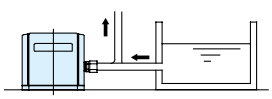
- **The suction lift is a maximum of 6m. (with priming)**

Atomizing of liquid



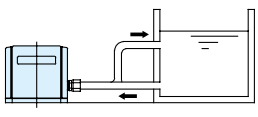
- **Increases the discharge pressure of the discharge nozzle.**

Transfer of liquid by pressure



- **Use caution regarding the suction port seal.**

Stirring of liquid



- **For stirring of liquids that may stick.**

Process Pump
Air Pilot Type
Series PA3000/PA5000

How to Order

PA3 1 1 0 — □ 03

Body material

1	ADC12 (aluminium)
2	SCS14 (stainless steel)

Diaphragm material

1	PTFE (fluororesin)
2	NBR (nitrile rubber)

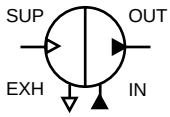
Thread type

Nil	Rc(PT)
T *	NPTF
F *	G(PF)
N *	NPT

* T, F, N are order made specifications.

Accessories/Option

AN200-02	Silencer for AIR EXH



Automatic operation type

PA5 1 1 0 — □ 04

Body material

1	ADC12 (aluminium)
2	SCS14 (stainless steel)

Diaphragm material

1	PTFE (fluororesin)
2	NBR (nitrile rubber)

Thread type

Nil	Rc(PT)
T*	NPTF
F*	G(PF)
N*	NPT

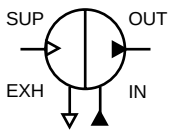
* T, F, N are order made specifications.

Connection port size

04	1/2 (15A)
06	3/4 (20A)

Accessories/Option

AN200-02	Silencer for AIR EXH



Automatic operation type

Specifications

Model		PA31□0	PA32□0
Port size	Main fluid suction/ discharge port	Rc(PT) 3/8	
	Pilot air supply/ exhaust port	Rc(PT) 1/4	
Material	Fluid contact areas	ADC12	SCS14
	Diaphragm	PTFE, NBR	
	Check valve	PTFE, PFA	
Discharge rate		1 to 20ℓ/min	
Average discharge pressure		0 to 0.6MPa (0 to 6.1kgf/cm²)	
Pilot air consumption rate		Maximum 200ℓ/min (ANR)	
Suction lifting range	Dry	Up to 1m (interior of pump dry)	
	Wet	Up to 6m (liquid inside pump)	
Fluid temperature		0 to 60°C (without freezing)	
Ambient temperature		0 to 60°C	
Noise value		Max. 92dB (79dB: With silencer AN200)	
Pilot air pressure		0.2 to 0.7MPa (2 to 7.1kgf/cm²)	
Withstanding pressure		1.05MPa (10.7kgf/cm²)	
Mounting orientation		Horizontal (with mounting foot at bottom)	
Weight		1.7kg	2.2kg

* Each of the values above indicates use at ordinary temperatures with fresh water.

Model		PA51□0	PA52□0
Port size	Main fluid suction/ discharge port	Rc(PT) 1/2, 3/4	
	Pilot air supply/ exhaust port	Rc(PT) 1/4	
Material	Fluid contact areas	ADC12	SCS14
	Diaphragm	PTFE, NBR	
	Check valve	PTFE, PFA	
Discharge rate		5 to 45ℓ/min	
Average discharge pressure		0 to 0.6MPa (0 to 6.1kgf/cm²)	
Pilot air consumption rate		Maximum 300ℓ/min (ANR)	
Suction lifting range	Dry	Up to 2m (interior of pump dry)	
	Wet	Up to 6m (liquid inside pump)	
Fluid temperature		0 to 60°C (without freezing)	
Ambient temperature		0 to 60°C	
Noise value		Max. 89dB (77dB : With silencer AN200)	
Pilot air pressure		0.2 to 0.7MPa (2 to 7.1kgf/cm²)	
Withstanding pressure		1.05MPa (10.7kgf/cm²)	
Mounting orientation		Horizontal (with mounting foot at bottom)	
Weight		3kg	6.5kg

* Each of the values above indicates use at ordinary temperatures with fresh water.

Fluid Compatibility

Fluid contact materials and models

Liquid contact area / Models	Body	Aluminum (ADC12)		Stainless steel (SCS14)	
	Diaphragm	Fluororesin	Nitrile rubber	Fluororesin	Nitrile rubber
Series PA3000		PA3110	PA3120	PA3210	PA3220
Series PA5000		PA5110	PA5120	PA5210	PA5220

1. Liquid contact area materials other than the above are: the check valve and O-ring seal which are both fluororesin.

⚠ Caution

1. Select models by choosing liquid contact materials suitable for the liquids to be used.
   - In liquid contact areas, aluminum is suitable for use with oils, and stainless steel is suitable for solvents and industrial water.
   - For the diaphragm material, nitrile rubber is suitable with inert liquids, and fluororesin is suitable with non-permeating liquids.
   - Use fluids which will not corrode the liquid contact materials.
2. Transfer examples are shown below. Since the possible applications will change depending on operating conditions, be sure to confirm by means of experimentation.
3. These products are not suitable for use in medical applications or with food products.

Examples of applicable liquids (reference)

	Body material: aluminium	Body material: stainless steel
Diaphragm material: Fluororesin	Ethyl alcohol, Toluene, Cutting oil, Brake fluid	Methyl ethyl ketone, Acetone, Flux, Isopropyl alcohol, Inert fluorine solvent
Diaphragm material: Nitrile rubber	Turbine oil	Industrial water

Examples of noncompatible liquids (classification)

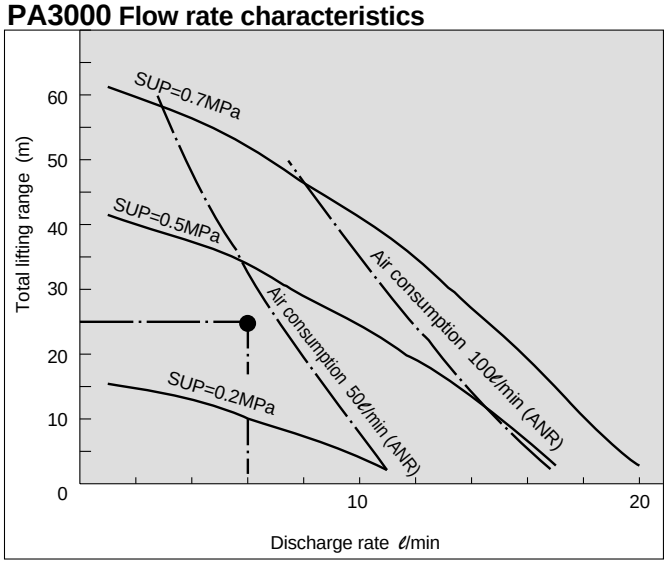
	Body material: aluminium	Body material: stainless steel
Diaphragm material: Fluororesin	Cleaning solvents, Water, Acid-alkali, High permeation liquids, High penetration liquids, Corrosive liquids	Corrosive liquids, Acid-alkali, High permeation liquids, High penetration liquids
Diaphragm material: Nitrile rubber	Cleaning solvents, Water, Solvents, Acid-alkali, Corrosive liquids	Solvents, Corrosive liquids, Acid-alkali

⚠ Caution

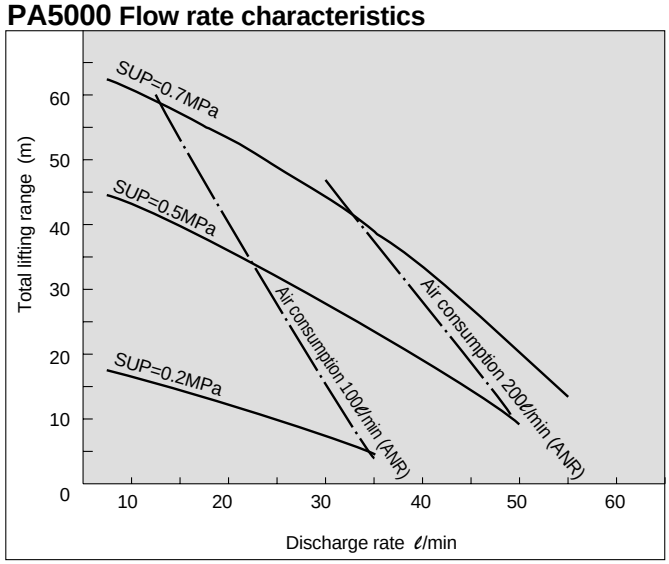
1. Possible applications will change depending on additive agents. Take note of additives.
2. Possible applications will change depending on impurities. Take note of impurities.
3. Mixing of foreign substances will shorten service life. Operate with foreign substances removed.
4. When transferring liquids subject to coagulation, take measures to prevent coagulation inside the pump.

Performance Curves

PA3000 Flow rate characteristics



PA5000 Flow rate characteristics



Selection from Flow Rate Characteristic Graphs

Required specification example:

Find the pilot air pressure and pilot air consumption rate for a discharge rate of 6ℓ/min and a total lifting range of 25m. [The transfer fluid is fresh water (viscosity 1cp, specific gravity 1.0).]

1. First mark the intersection point for a discharge rate of 6ℓ/min and a lifting range of 25m.
2. Find the pilot air pressure for the marked point. In this case, the point is between the discharge curves (solid lines) for SUP=0.2MPa and SUP=0.5MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.38MPa.
3. Next find the air consumption rate. Since the marked point is below the curve for 50ℓ/min (ANR), the maximum rate will be about 50ℓ/min (ANR).

⚠ Caution

1. These flow rate characteristics are for fresh water (viscosity 1cp, specific gravity 1.0).
2. The discharge rate differs greatly depending on properties (viscosity, specific gravity) of the fluid being transferred and operating conditions (lifting range, transfer distance), etc.
3. Use 0.75kW per 100ℓ/min of air consumption as a guide for the relationship of the air consumption rate to the compressor.

Selection from Viscosity Characteristic Graph

Required specification example:

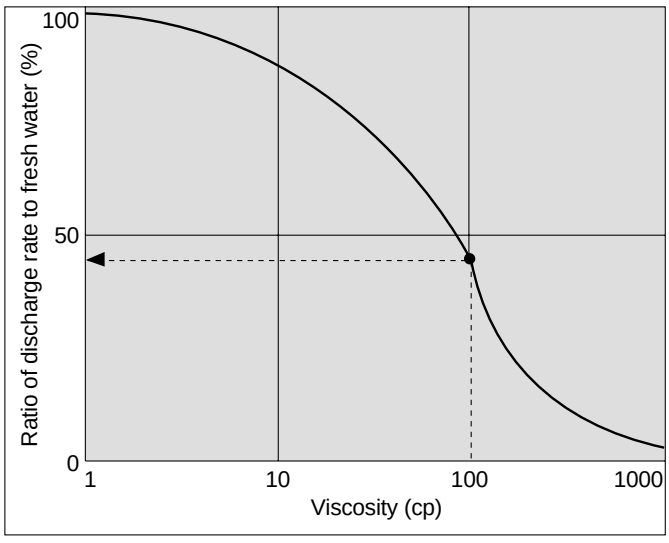
Find the pilot air pressure and pilot air consumption rate for a discharge rate of 2.7ℓ/min, a total lifting range of 25m, and a viscosity of 100cp.

1. First find the ratio of the discharge rate to fresh water when viscosity is 100cp from the graph below. It is determined to be 45%.
2. Next, in the required specification example, the viscosity is 100cp and the discharge rate is 2.7ℓ/min. Since this is equivalent to 45% of the discharge rate for fresh water, 2.7ℓ/min ÷ 0.45 = 6ℓ/min, indicating that a discharge rate of 6ℓ/min is required.
3. Finally, find the pilot air pressure and pilot air consumption rate based on selections from the flow rate characteristic graphs.

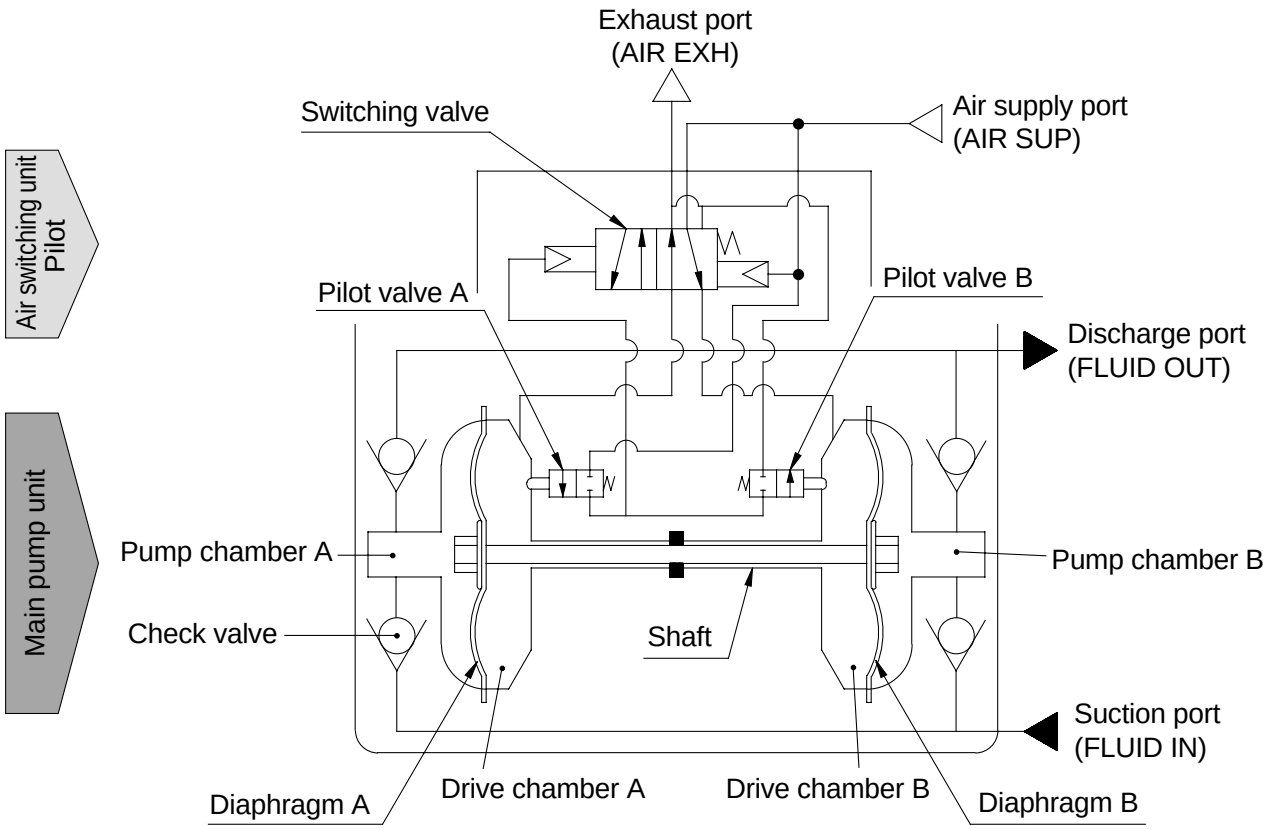
⚠ Caution

1. Viscosities up to 1000cp can be used.

Viscosity characteristics (flow rate correction for viscous fluids)



Operating Principle



Pilot air switching unit

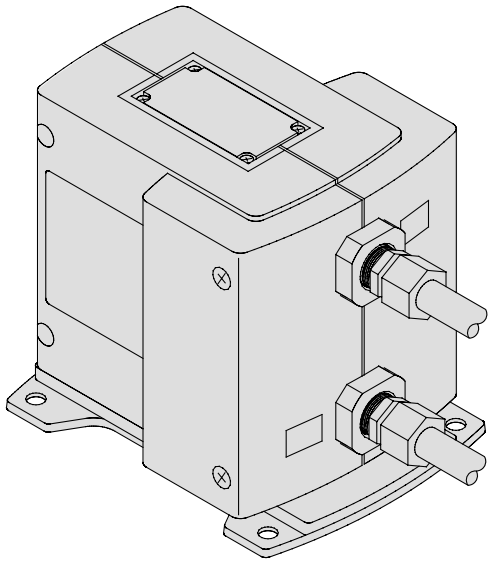
When air is supplied, it passes through the switching valve and enters drive chamber A. When air enters drive chamber A, diaphragm A moves to the left, and at the same time diaphragm B also moves to the left pushing pilot valve B. When pilot valve B is pressed, air acts upon the switching valve and this time drive chamber B is switched to a supply state. At this time, the air which was in drive chamber A goes through the exhaust passage and is exhausted to the outside. When air enters drive chamber B, diaphragm A moves to the right pressing pilot valve A. When pilot valve A is pressed, the air which was acting upon the switching valve is exhausted, and drive chamber A once again switches to a supply state. A contiuous reciprocal motion is generated by this repetition.

Main pump unit

When air enters drive chamber A, the fluid in pump chamber A is pushed out. At the same time, fluid is sucked into pump chamber B. When the diaphragm moves in the opposite direction, the fluid in pump chamber B is pushed out, and fluid is sucked into pump chamber A. Continuous suction/discharge is performed by the reciprocal motion of the diaphragm.

Piping and Operation

Piping diagram



∗ Maintain the proper tightening torque for fittings and mounting bolts, etc. Looseness can cause problems such as fluid and air leaks, while over tightening can cause damage to threads and parts, etc.

Operation

<Starting and Stopping> Refer to circuit example (1)

1. 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>.
2. Using a regulator, set the pilot pressure within the range of 0.2 to 0.7MPa (2 to 7.1kgf/cm²). 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 ball valve on the discharge side is in an open state. The pump performs suction with its own power even without priming. (Dry state suction lifting range: max. 2m) To restrict exhaust noise, attach a silencer (AN200-02: option) to the air exhaust port <AIR EXH>.
3. To stop the pump, exhaust the air pressure being supplied to the pump with the 3 port solenoid valve of the air supply port <AIR SUP>. The pump will also stop if the ball valve on the discharge side is closed.

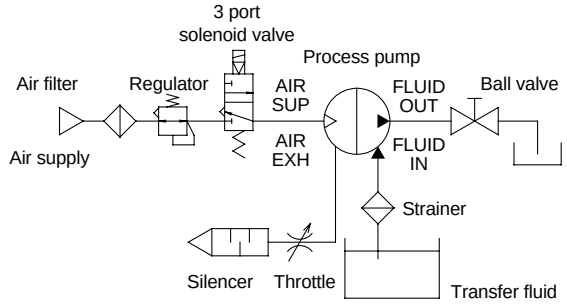
<Discharge Flow Rate Adjustment>

1. Adjustment of the flow rate from the discharge port <FLUID OUT> is performed with the ball valve connected on the discharge side or the throttle connected on the air exhaust side. For adjustment from the air side, use of the silencer with throttle ASN2 (port size 1/4) connected to the air exhaust port <AIR EXH> is effective. Refer to circuit example (1).
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). (Minimum flow rates: PA3000 1ℓ/min, PA5000 5ℓ/min)

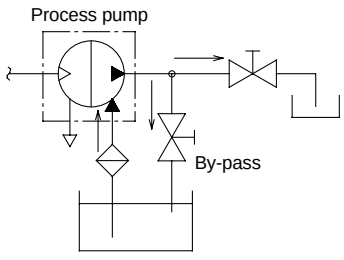
<Reset Button>

1. 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 substances in the supply air.

Circuit example (1)

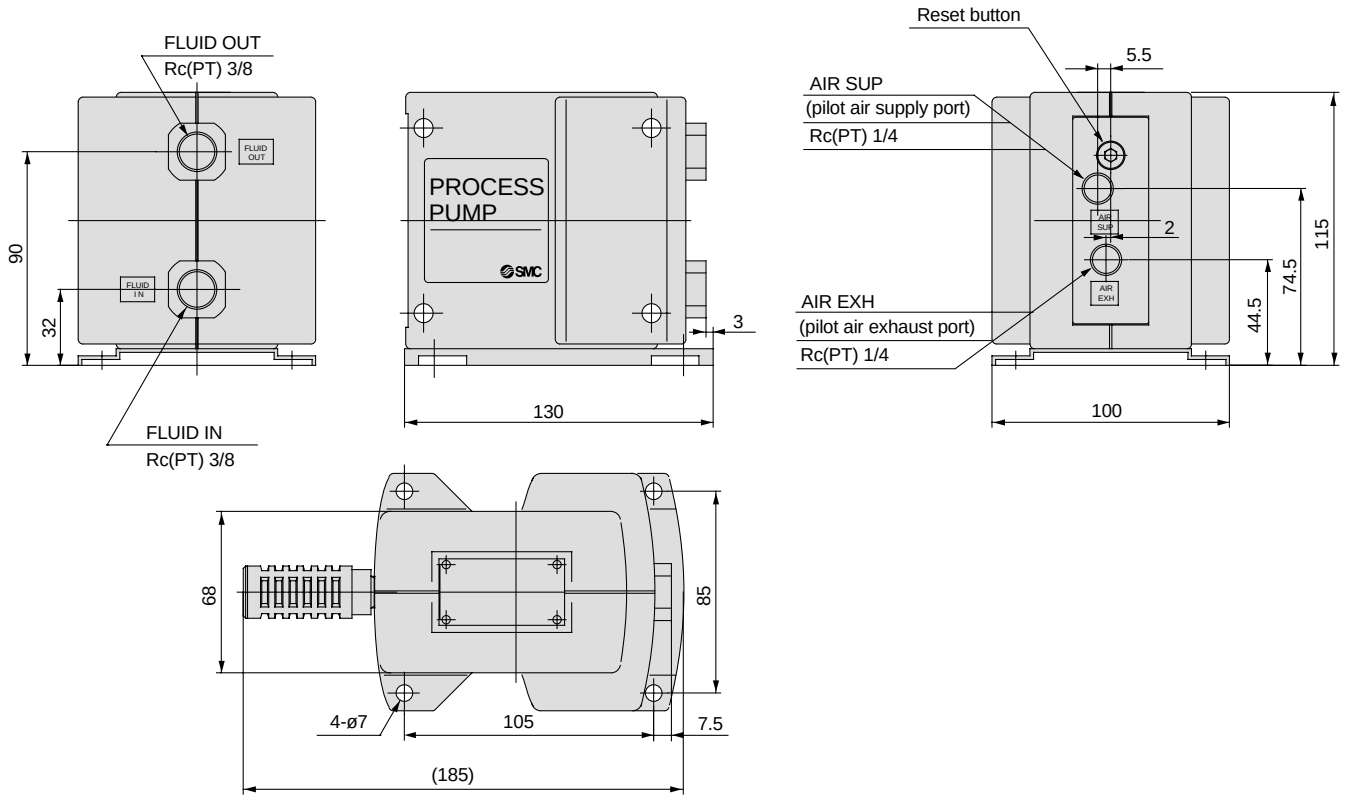


Circuit example (2)

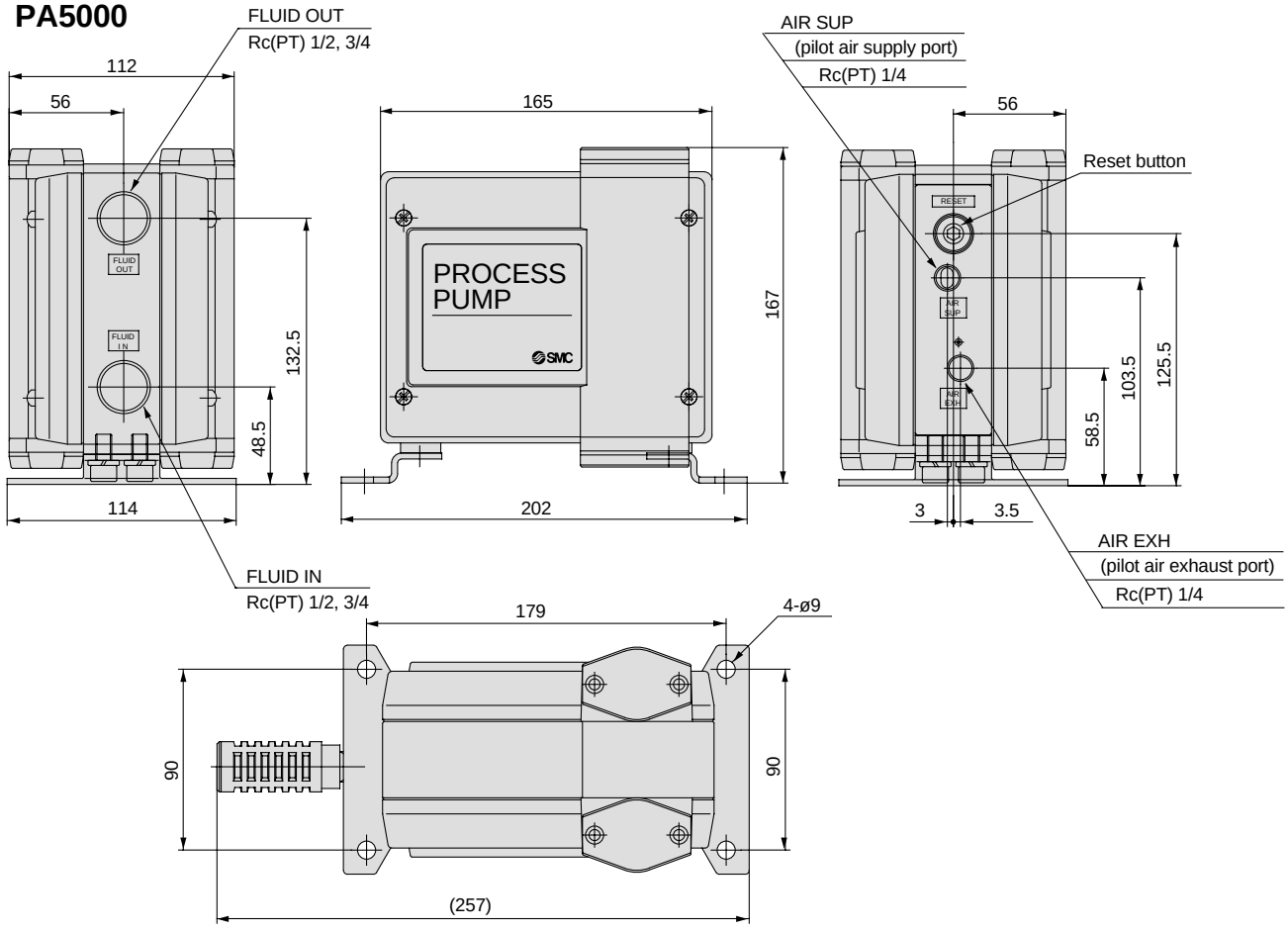


Dimensions

PA3000



PA5000



Process Pump
Built-in Pulsation Attenuator Type
Series PAX1000

How to Order

PAX1 [1] 1 2 – [ ] [02]

Body material

1	ADC12 (aluminium)
2	SCS14 (stainless steel)

Diaphragm material

1	PTFE (fluororesin)

Type of operation

2	Automatic operation type with built-in pulsation attenuator

Thread type

Nil	Rc(PT)
T *	NPTF
F *	G(PF)
N *	NPT

* T, F, N are order made specifications.

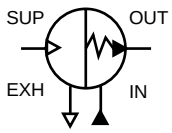
Connection port size

02	1/4 (8A)
03	3/8 (10A)

Accessories/Option

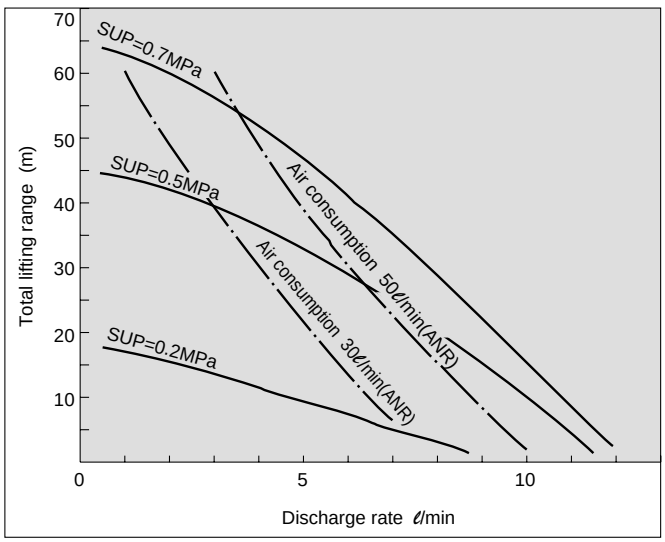
AN200-02	Silencer for AIR EXH

JIS symbol



Built-in Pulsation Attenuator
Automatic operation type

Performance Curves



Specifications

Model		PAX1112	PAX1212
Port size	**Main fluid suction/ discharge port**	Rc(PT) 1/4, 3/8	
	Pilot air supply/ exhaust port	Rc(PT) 1/4	
Material	**Fluid contact areas**	ADC12	SCS14
	Diaphragm	PTFE	
	Check valve	PTFE, SCS14	
Discharge rate		0.5 to 10ℓ/min	
Average discharge pressure		0 to 0.6MPa (0 to 6.1kgf/cm²)	
Pilot air consumption rate		Maximum 150ℓ/min (ANR)	
Suction lifting range	**Dry**	Up to 2m (interior of pump dry)	
	Wet	Up to 6m (liquid inside pump)	
Discharge pulsation attenuating capacity		30% or less of maximum discharge pressure	
Fluid temperature		0 to 60°C (without freezing)	
Ambient temperature		0 to 60°C	
Noise value		Max. 93dB (84dB : With silencer AN200)	
Pilot air pressure		0.2 to 0.7MPa (2 to 7.1kgf/cm²)	
Withstanding pressure		1.05MPa (10.7kgf/cm²)	
Mounting orientation		Horizontal (bottom facing down)	
Weight		2.0kg	3.5kg

* Each of the values above indicates use at ordinary temperatures with fresh water.

Fluid Compatibility

Fluid contact materials and models

Liquid contact area / Models	Body	Aluminium (ADC12)	Stainless steel (SCS14)
	Diaphragm	Fluororesin	Fluororesin
Series PAX1000		PAX1112	PAX1212

1. Liquid contact area materials other than the above are: check valve/stainless steel (SCS14), and O-ring seal/fluororesin (PTFE).

⚠ Caution

1. Select models by choosing liquid contact materials suitable for the liquids to be used.
   - In liquid contact areas, aluminum is suitable for use with oils, and stainless steel is suitable for solvents and industrial water.
   - Since fluororesins is used for the diaphragm, non-permeating liquids should be used.
   - Use fluids which will not corrode the liquid contact materials.
2. Transfer examples are shown below. Since the possible applications will change depending on operating conditions, be sure to confirm by means of experimentation.
3. These products are not suitable for use in medical applications or with food products.

Examples of applicable liquids (reference)

	Body material: aluminium	Body material: stainless steel
Diaphragm material: Fluororesin	Ethyl alcohol, Toluene, Cutting oil, Brake fluid	Methyl ethyl ketone, Acetone, Flux, Isopropyl alcohol, Inert fluorine solvent

Examples of noncompatible liquids (classification)

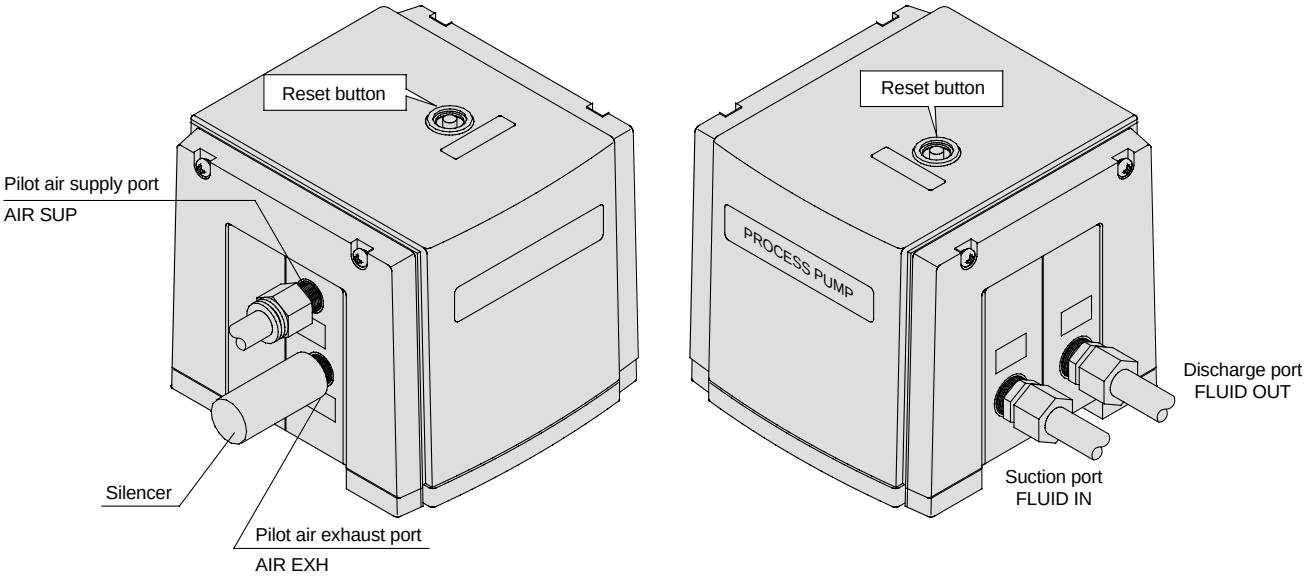
	Body material: aluminum	Body material: stainless steel
Diaphragm material: Fluororesin	Cleaning solvents, Water, Acid-alkali, High permeation liquids, High penetration liquids, Corrosive liquids	Corrosive liquids, Acid-alkali, High permeation liquids, High penetration liquids

⚠ Caution

1. Possible applications will change depending on additive agents. Take note of additives.
2. Possible applications will change depending on impurities. Take note of impurities.
3. Mixing of foreign substances will shorten service life. Operate with foreign substances removed.
4. When transferring liquids subject to coagulation, take measures to prevent coagulation inside the pump.

Piping

Piping diagram

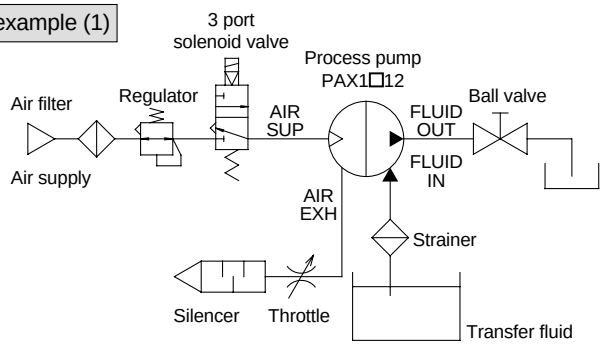


• Piping is connected to each of 4 ports as shown in the drawing above.

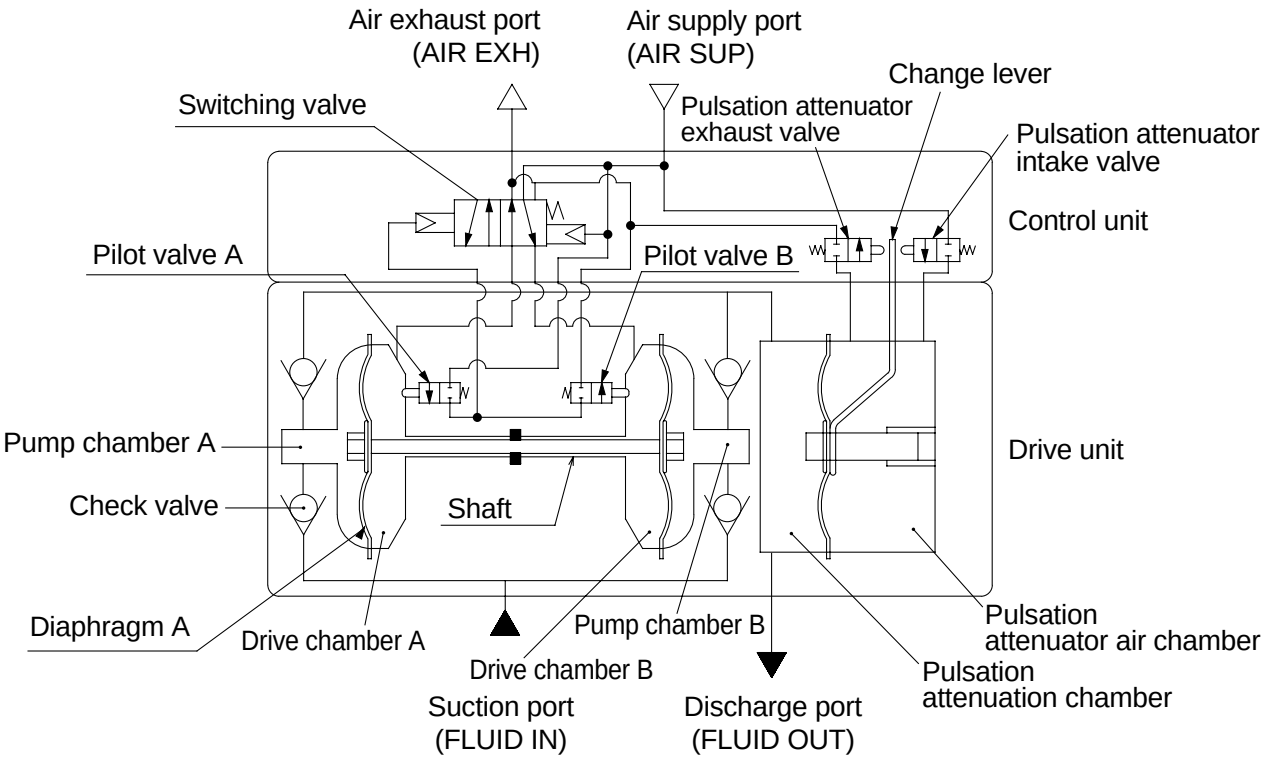
⚠ Caution

Maintain the proper tightening torque for fittings and mounting bolts, etc. Looseness can cause problems such as fluid leakage, while over tightening can cause damage to threads and parts, etc.

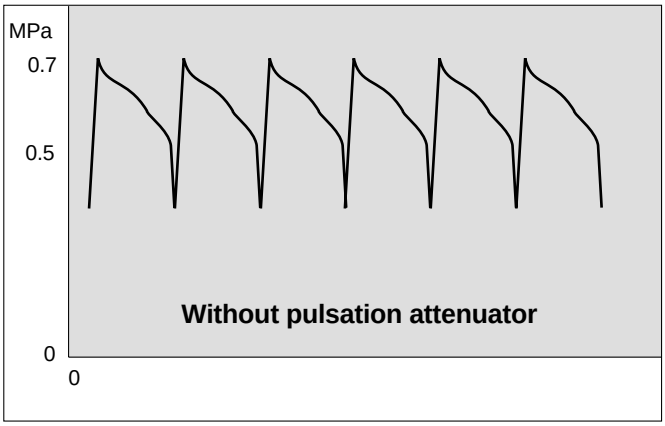
Circuit example (1)

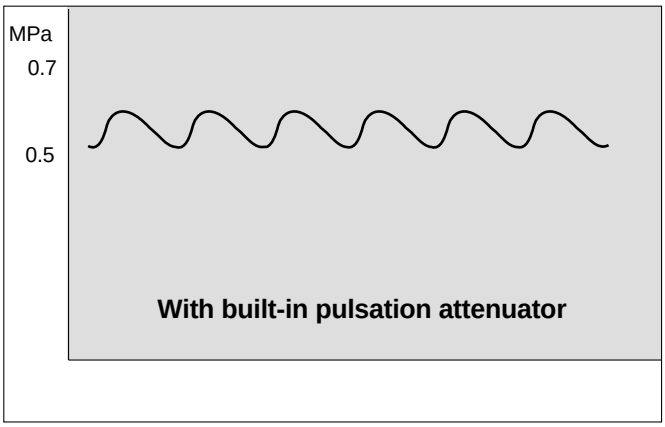


Construction and Principles



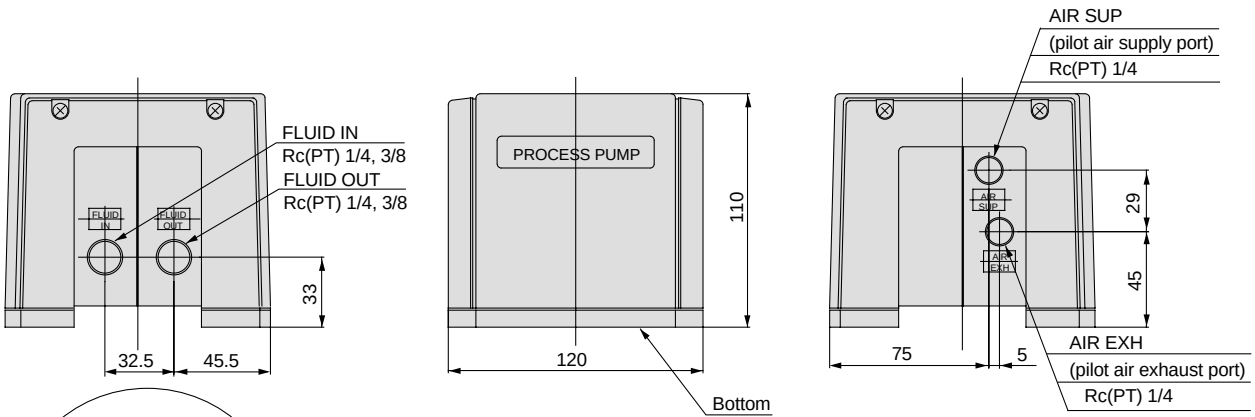
Pulsation Attenuating Capacity

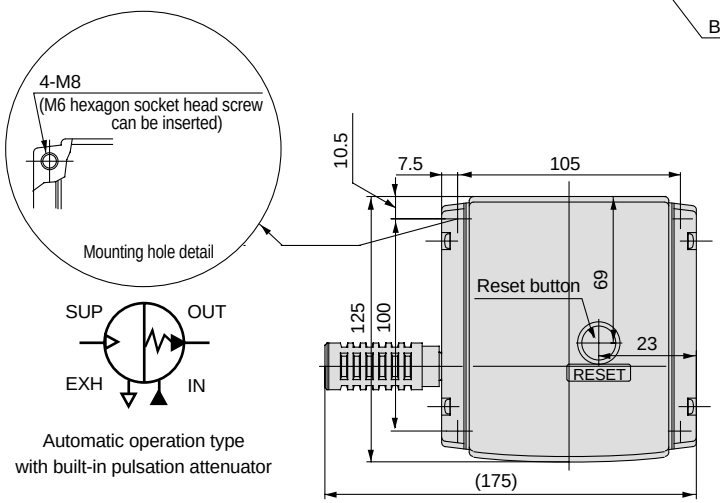




The process pump generates pulsation because it discharges a liquid using two diaphragms. The pulsation attenuator absorbs pressure when discharge pressure increases, and compensates the pressure when discharge pressure decreases. By this means pulsation is controlled.

Dimensions





Process Pump
Built-in Solenoid Valve Type
Series PB1000

How to Order

PB1 0 1 1 — □ 01

Body size

1	1/8 standard

Accessories/Option

AN120-M5	Silencer for AIR EXH *
KT-PB1-3	Foot (bolts included)

* External air operated type is not available with silencer.

Body material

0	Polypropylene

Diaphragm material

1	PTFE (fluororesin)

Connection port size

01	1/8 (6A)

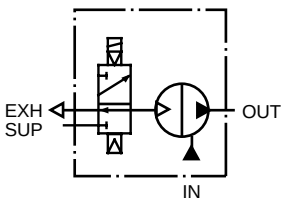
Type of operation

1	Built-in solenoid valve
3	External air operated

Thread type

Nil	Rc(PT)
T *	NPTF
F *	G(PF)
N *	NPT

* T, F, N are order made specifications.



Symbol

Specifications

Port size	**Main fluid suction/discharge port**		Rc(PT) 1/8
	Pilot air	**Supply port**	Rc(PT) 1/8
		Exhaust port	M5 x 0.8
Material	**Fluid contact areas**		Polypropylene PP, Stainless steel (SUS316)
	Diaphragm		PTFE
	Check valve		PTFE
	Liquid contact seals		FKM
Discharge rate		**PB1011**	8 to 2000mℓ/min
		PB1013	8 to 500mℓ/min
Average discharge pressure			0 to 0.6MPa {0 to 6.1kgf/cm²}
Suction lifting range (Dry: interior of the pump is dry)			Up to 2.5m
Fluid temperature			0 to 50°C (without freezing)
Ambient temperature			0 to 50°C
Pilot air pressure			0.2 to 0.7MPa {2 to 7.1kgf/cm²}
Withstanding pressure			1.05MPa (10.7kgf/cm²)
Maximum operating frequency			10c/s
Lubrication			Not required
Voltage (PB1011)			24VDC
Weight			0.17kg
Mounting orientation			OUT port at top (indication on name plate)

* Each of the values above indicates use at ordinary temperatures with fresh water.
Note on the transfer of slurry:
Slurry transfer is not possible with Series PB1000 because of deterioration and wear of the check valve seat and the accumulation of particles, which will render the pump inoperable.

Fluid Compatibility

Liquid contact parts table

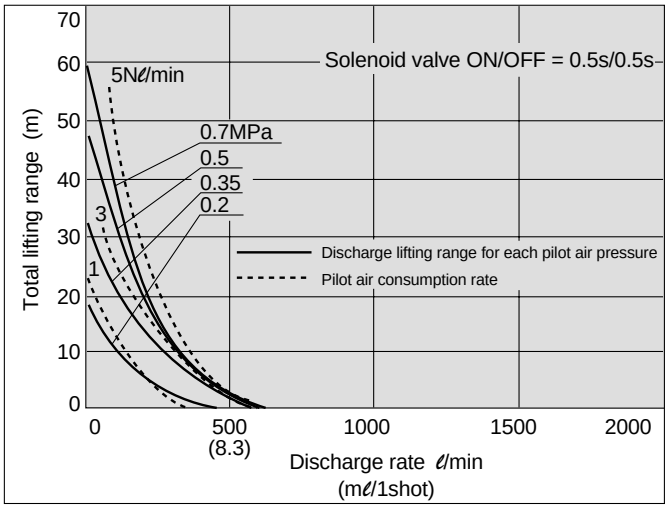
Liquid contact part description	Liquid contact part material
Diaphragm	Fluororesin
Body	Polypropylene, SUS316
Seals	Fluororubber

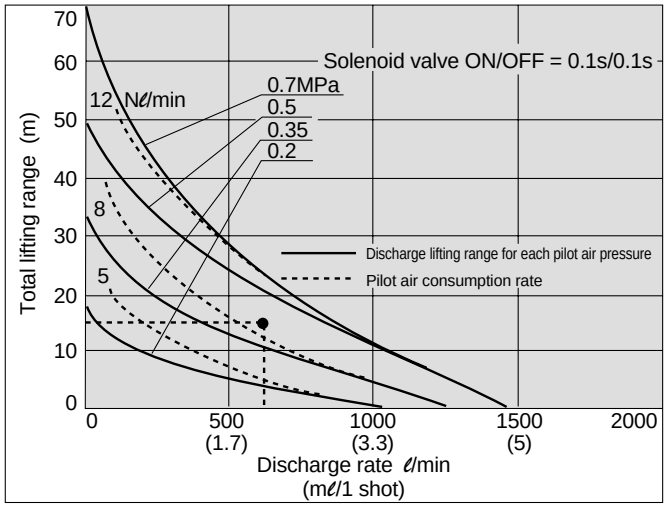
Note) Liquid contact area material other than the above is: check valve/fluororesin.

⚠ Caution

1. Give careful consideration to the transfer fluid to be used and the fluid contact materials.
   - Since fluororesin is used for the diaphragm material, use liquids which will not permeate or penetrate it.
   - Since there is a built-in solenoid valve, this product cannot be used for the transfer of flammable fluids. (PB1011)
   - Use fluids which will not corrode the liquid contact materials.
2. These products are not suitable for use in medical applications or with food products.

Flow rate characteristics





Required specification example:

Find the pilot air pressure and pilot air consumption rate for a discharge rate of 600mℓ/min and a total lifting range of 15m.
[The transfer fluid is fresh water (viscosity 1cp, specific gravity 1.0), and the solenoid valve ON/OFF= 0.1s/0.1s]

1. First mark the intersection point for a discharge rate of 600mℓ/min and a lifting range of 15m.
2. Find the pilot air pressure for the marked point. In this case, the point is between the discharge curves (solid lines) for SUP=0.35MPa and SUP=0.5MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.4MPa.
3. Next find the air consumption rate. The marked point is between the curves for 8Nℓ/min and 12Nℓ/min, and based on the proportional relationship to these lines, it is determined that the pilot air consumption rate for this point is 9Nℓ/min.

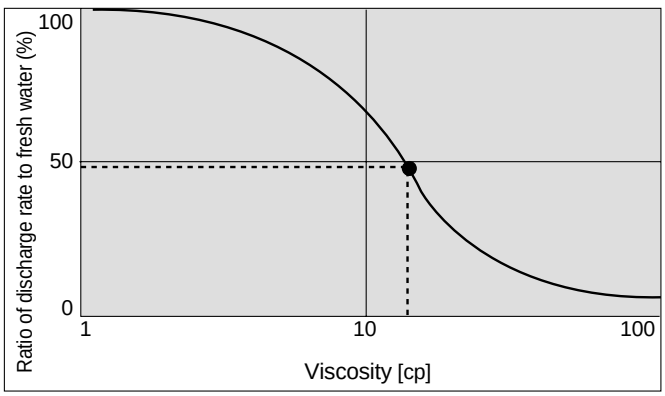
Solenoid valve ON/OFF time

The discharge rate also depends on the ON/OFF time of the solenoid valve. Set an appropriate time using the flow rate characteristics as criteria. Furthermore, set the ON/OFF time to no less than 0.02s/0.06s for the maximum discharge rate of 2000mℓ/min.

⚠ Caution

1. These flow rate characteristics are for fresh water (viscosity 1cp, specific gravity 1.0).
2. The discharge rate differs greatly depending on properties (viscosity, specific gravity) of the fluid being transferred and operating conditions (lifting range, transfer distance), etc.
3. When compressor output is selected based on the air consumption rate, use 0.75kW for 100ℓ/min of air consumption as a criteria.

Viscosity characteristics (flow rate correction for viscous fluids)



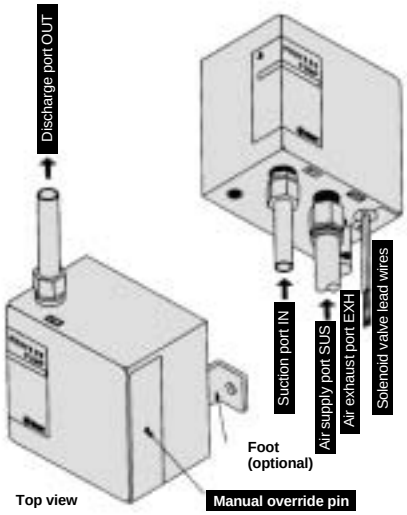
Required specification example:

Find the pilot air pressure and pilot air consumption rate for a discharge rate of 200mℓ/min, a total lifting range of 10m, and a viscosity of 15cp.

1. First find the ratio of the discharge rate to fresh water when viscosity is 15cp from the graph to the left. It is determined to be 48%.
2. Next, the viscosity of 15cp and the discharge rate of 200ℓ/min in the required specification example, are converted to the discharge rate for fresh water. Since 48% of the fresh water discharge rate is equivalent to 200mℓ/min in the required specifications, 200mℓ/min ÷ 0.48 = approximately 420mℓ/min, indicating that a discharge rate of 420mℓ/min is required for fresh water.
3. Finally, find the pilot air pressure and pilot air consumption rate based on viewing of the flow rate characteristics.

Viscosity: Transfer is possible up to about 100cp.

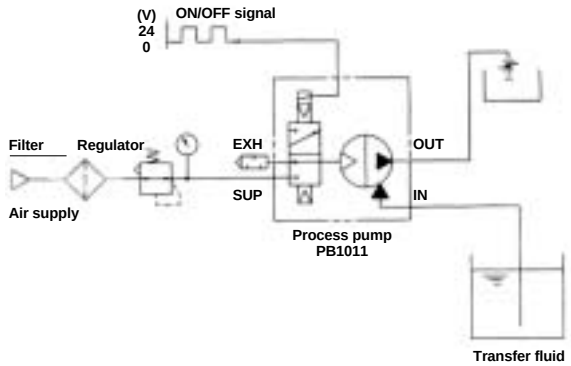
Piping and Operation



Piping

Piping is connected to each of 4 ports as shown in the drawing to the left.
The solenoid valve lead wires are connected to a 24VDC power supply.

Circuit example



Names and Functions of Ports

IN **Suction Port**

Connects to piping for the transfer fluid.

OUT **Discharge Port**

Discharges the fluid which has been sucked into the pump.

SUP **Pilot Air Supply Port**

Supplies the pressure which is set by a regulator, etc. Use clean air.

EXH **Pilot Air Exhaust Port**

Discharges the pilot air.

Solenoid Valve Lead Wires

Connect to 24VDC power supply.
Red (+), Black (–)

Manual Override Pin

Presses the manual override button for the solenoid valve. Pushing once operates the valve one time without turning on the power.

Operation

1 Connect air piping to the air supply port SUP, and connect piping for the transfer fluid to the suction port IN and the discharge port OUT.

2 Connect the solenoid valve lead wires to a 24VDC power supply. Red is (+) and Black is (–).

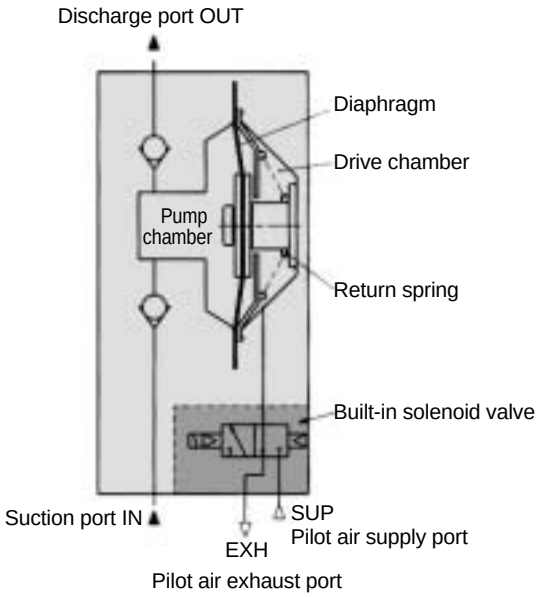
3 Using a regulator, set the pilot air pressure within the range of 0.2 to 0.7MPa (2 to 7kgf/cm²). By continuously turning the 24VDC power ON/OFF the fluid flows from the suction port IN to the discharge port OUT. The pump performs suction with its own power even without priming.

4 To stop the pump turn OFF the 24VDC power. Also be sure to turn OFF the power when the discharge side is closed.

⚠ Caution

Be sure that the discharge side OUT is on top when the pump is mounted.
Supply clean air that has passed through an AF filter, etc. to the air supply port SUP.
Air that contains debris or drainage, etc. will have an adverse effect on the built-in solenoid valve, and will cause malfunction of the pump. In cases that particularly require air cleaning, use a filter (Series AF) together with a mist separator (Series AM).

Construction and Operation



Operating Principle

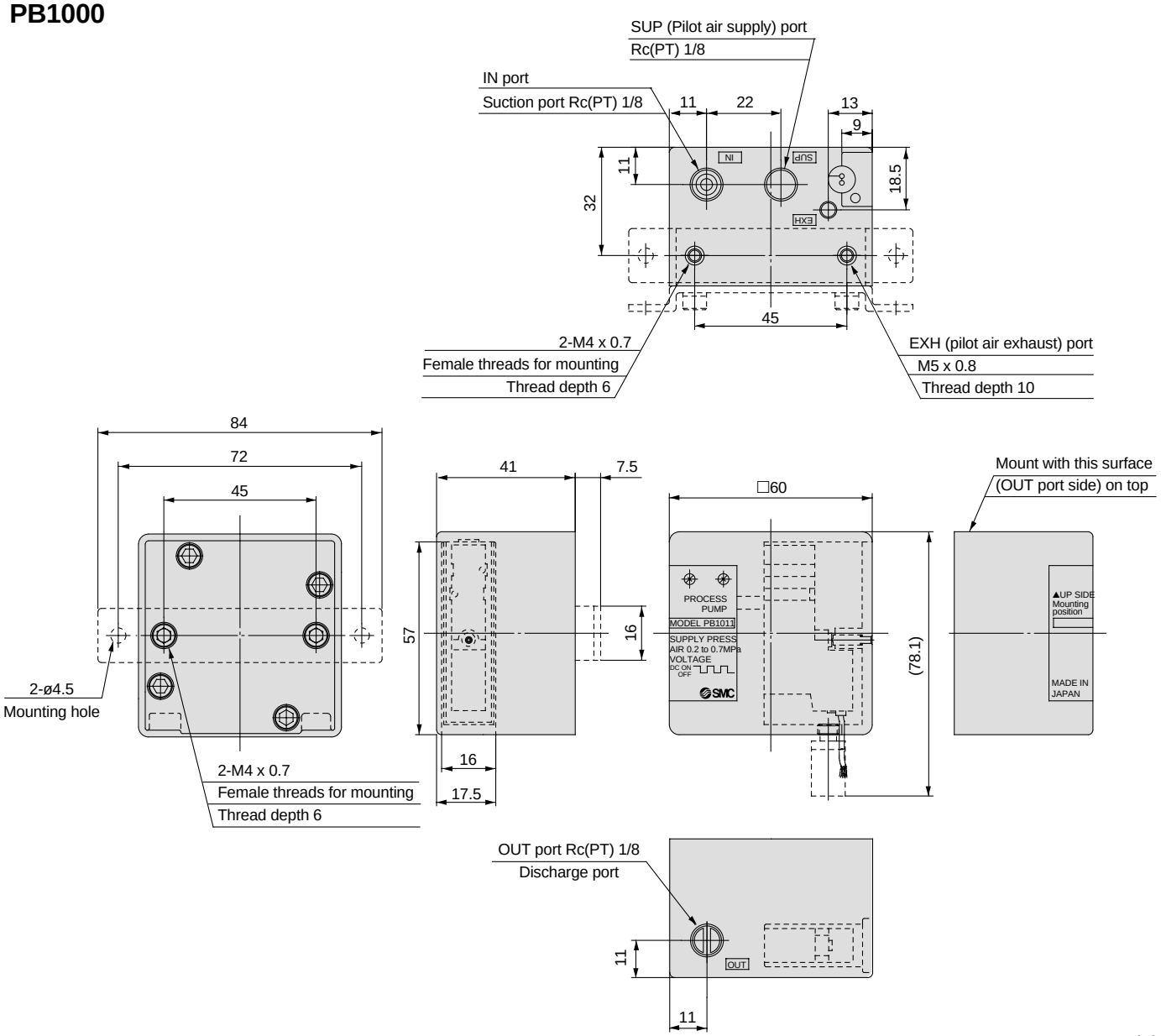
When air is supplied and the built-in solenoid valve is turned ON, air enters the drive chamber and the diaphragm moves to the left. Due to this movement, the fluid in the pump chamber passes through the upper check valve and is discharged to the OUT side.

When the solenoid valve is turned OFF, the air inside the drive chamber is evacuated to EXH, and the diaphragm is moved to the right by the return force of the return spring. Due to this movement, the fluid on the IN side passes through the lower check valve and is sucked into the pump chamber.

The pump repeats this suction and discharge with the repetition of the solenoid valve's ON/OFF operation.

Dimensions

PB1000



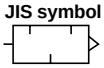
Related Products (Refer to the individual product catalogs for further details.)

(BC Sintered Body)

Series AN120

Ideal for compact valves and pilot air exhaust, etc.

JIS symbol



Specifications

Fluid	Compressed air
Maximum operating pressure	1.0MPa {10.2kgf/cm²}
Noise reduction	18dB (A)
Ambient and fluid temperature	5 to 150°C *

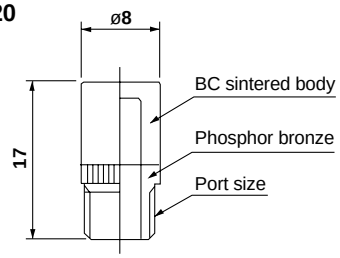
* Can be used at -10 to 150°C when there is no danger of water droplets being generated from the fluid.

Models

Model	Port size R(PT)	Effective sectional area mm²	Weight g
AN120-M5	M5	5	3.3

Construction/Parts, Dimensions

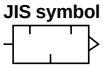
AN120



Series AN200

Noise reduction of 30dB (A) or more
Low air flow resistance
Compact and easy to mount

JIS symbol



Specifications

Fluid	Compressed air
Maximum operating pressure	1.0MPa {10.2kgf/cm²}
Noise reduction	30dB (A) or more
Ambient and fluid temperature	5 to 60°C *

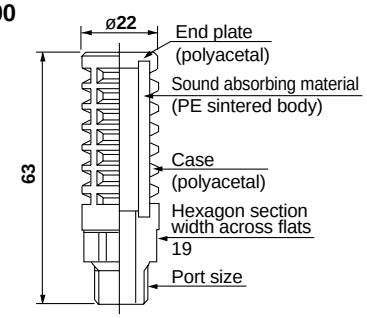
* Can be used at -10 to 60°C when there is no danger of water droplets being generated from the fluid and freezing.

Models

Model	Port size R(PT)	Effective sectional area mm²	Weight g
AN200-02	1/4	35	17

Construction/Parts, Dimensions

AN200



Mist Separator

Series AM

Series AM separates and removes the oil mist in compressed air which is troublesome for ordinary filters, and removes fine particles of rust and carbon, etc. of 0.3μm or larger. Should be used with an air supply for driving pilot type and metal type solenoid valves.

Specifications

Fluid	Compressed air
Maximum operating pressure	1.0MPa {10.2kgf/cm²}
Min. operating pressure*	0.05MPa {0.51kgf/cm²}
Proof pressure	1.5MPa {15.3kgf/cm²}
Ambient and fluid temperature	5 to 60°C
Filtration degree	0.3μm (95% filtered particle diameter)
Downstream oil mist concentration	Max.1.0mg/m³ (ANR) * (Approx. 0.8ppm)
Element life	2 years, or when pressure drop reaches 0.1MPa {1.0kgf/cm²}

* N.O. with auto drain is 0.15MPa (1.5kgf/cm²)
* When compressor discharge oil mist concentration is 30mg/m³ (ANR)

Models

Model	AM150	AM250
Rated flow rate ℓ/min (ANR)	300	750
Port size (nominal size B)	1/8, 1/4, 3/8	1/4, 3/8, 1/2
Weight (kg)	0.38	0.55

How to Order

AM 250 ☐ 03 B J

Body size
150 – 1/8 standard
250 – 1/4 standard
350 – 3/8 standard
450 – 1/2 standard
550 – 3/4 standard
650 – 1 standard
850 – 1 1/2 standard

Thread type
Nil ——— Rc(PT)
F ——— G(PF)
N ——— NPT

Port size
01 – 1/8B
02 – 1/4B
03 – 3/8B
04 – 1/2B
06 – 3/4B
10 – 1
14 – 1 1/2B
20 – 2B

Order made specification *
J – Drain guide 1/4B female threads
R – IN, OUT in opposite directions
T – Clogging checker

Accessories (optional) *

Symbol	Description
Nil	–
B	Bracket
C	N.C. auto drain
D	N.O. auto drain

* Refer to the table below regarding the combination of accessories with order made specifications.

Filter Regulator + Mist Separator Air Combination

Series AC2040, 3040

Standard specifications

Model		AC2040	AC3040
Component devices	Filter regulator	AW2000	AW3000
	Mist separator	AFM2000	AFM3000
Port size Rc(PT)		1/8 1/4	1/4 3/8
Pressure gauge port size Rc(PT)		1/8	1/8

Maintenance Parts Lists

PAX1000

Diaphragm kit (PTFE)	KT-PAX1-31
Check valve kit	KT-PAX1-36
Switching valve parts kit	KT-PAX1-37
Pilot valve kit	KT-PA5-38
Pulsation attenuator control valve kit	KT-PAX1-39

PB1000

Diaphragm kit	KT-PB1-2
Check valve kit	KT-PB1-1
Built-in solenoid valve kit	VJ314MY-5H

PA3000

Diaphragm kit (PTFE)	KT-PA3-31
Diaphragm kit (NBR)	KT-PA3-32
Check valve kit	KT-PA3-36
Switching valve assembly kit	KT-PA3-37
Pilot valve kit	KT-PA5-38

PA5000

Diaphragm kit (PTFE)	KT-PA5-31
Diaphragm kit (NBR)	KT-PA5-32
Check valve kit	KT-PA5-36
Switching valve parts kit	KT-PA5-37
Pilot valve kit	KT-PA5-38

Process Pump
Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of **"Caution", "Warning" or "Danger"**. To ensure safety, be sure to observe ISO4413 Note 1), ISO4414 Note 2), JISB8361 Note 3), JISB8370 Note 4), JISZ9102 Note 5) and other safety practices.

⚠ Caution : Operator error could result in injury or equipment damage.

⚠ Warning : Operator error could result in serious injury or loss of life.

⚠ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO4413: Hydraulic fluid power-General rules for the application of equipment to transmission and control systems.
Note 2) ISO4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems.
Note 3) JISB8361: Hydraulic system axiom
Note 4) JISB8370: Pneumatic system axiom.
Note 5) JISZ9102: Piping identification marking

⚠ Warning

1. 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 are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. Give particularly careful consideration to the determination of compatible fluids.

2. 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 operators.

3. 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. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back-pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions or environments beyond the specifications given in the catalog and instruction manual.
2. With fluids whose application causes concern due to type or additives, etc.
3. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
4. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Process Pump Common Precautions 1

Be sure to read before handling.
Refer to the main catalog sections for detailed precautions on each series.

Precautions on Design

⚠ Warning

1. Confirm the fluid to be used.

Be sure to confirm the specifications, as the fluids to be used differ depending on the product. When different fluids are used, characteristics change and this can cause faulty operation.

2. Fluid temperature.

Use each model within its respective fluid temperature range.

3. Fluid quality.

If fluid is used which contains foreign matter, troubles such as malfunction and seal failure may occur due to wearing of valve seats and sticking, etc. Install a suitable filter (strainer) immediately before the pump. As a general rule, mesh of about 80 to 100 can be used.

4. Be sure to observe the maximum operating pressure.

Operation above the maximum operating pressure can cause damage. In particular, avoid application of pressure above the specifications caused by a water hammer.

<Example Pressure Reduction Measures>

a) Use a water hammer relief valve and slow the valve's closing speed.

b) Absorb impact pressure by using elastic piping material such as rubber, or an accumulator, etc.

5. Liquid seals.

In cases with a flowing liquid, provide a by-pass valve in the system to prevent the liquid from entering the liquid seal circuit.

6. Quality of operating air.

1. Use clean air.

   Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as these can cause damage or malfunction.

2. Install an air filter.

   Install an air filter near valves on their upstream side. Choose a filtration degree of 5µm or finer.

3. Compressed air which includes a large amount of drainage can cause malfunction of valves and other pneumatic equipment. As a countermeasure, install and air dryer or after cooler, etc.

4. In situations where a large amount of carbon dust is generated, install a mist separator at the upstream side of valves to remove it. When a lot of carbon dust is generated from a compressor, it can adhere to the interior of valves and cause malfunction.

Refer to the SMC "Air Cleaning Equipment" catalog for details on the above mentioned air quality.

7. Ensure space for maintenance.

Be sure to allow the space required for maintenance activities.

8. Fluid properties.

1. Do not use strong acids, strong alkali or chemicals which can effect humans.
2. When inflammable fluids are transferred, give consideration to leakage during operation, and strictly prohibit flames. There is a danger of fire or explosion due to accidental leakage of the fluid.

9. Stopping the pump.

Use a 3 port solenoid valve when starting or stopping the pump by means of pilot air. Do not use a 2 port solenoid valve. (In the case of a 2 port solenoid valve, the air pressure which remains after the solenoid valve closes is gradually consumed inside the process pump. This causes instability in the operating position of the pilot air switching unit, and it may become inoperable. Since the same kind of problem also occurs when the air supply pressure is gradually lost after operation is stopped, a 3 port solenoid valve should be used for stopping. When the unit will not be restarted, press the reset button.)

10. Other.

1. Test the unit before using it in an actual equipment application. Furthermore, even if there is no problem in a short term test, there are cases in which trouble is caused by permeation through the fluororesin diaphragm to the air side.
2. Since the compatibility of fluids differs depending on type, additives, concentration and temperature, etc., give careful attention to the selection of materials.
3. The product cannot be used with gases.

⚠ Caution

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

If reverse pressure or flow occur, this can cause equipment damage or malfunction, etc. Give attention to safety measures, including the method of operation.

Selection

⚠ Warning

1. Confirm the specifications.

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

2. Type of fluid.

Operate only after confirming the materials and applicable fluids for each model to determine which fluids can be used.

3. Equipment selection.

When selecting equipment, make a selection from the latest catalog, staying within specified operating ranges, and carefully confirming the purpose of use, the required specifications and the operating conditions (pressure, flow rate, temperature, environment). In case of any unclear points, contact SMC in advance.

Process Pump Common Precautions 2

Be sure to read before handling.
Refer to the main catalog sections for detailed precautions on each series.

Mounting

⚠ Warning

1. Instruction manual.

The product should be mounted and operated after reading the manual carefully and having a good understanding of its contents. The manual should also be kept where it can be referred to whenever necessary.

2. Confirm the mounting position.

- Since the mounting position is different for each piece of equipment, this point should be confirmed either in this catalog or in the instruction manual.
- The mounting orientation is limited. (Refer to the cover photo.) Mount with the bottom (foot hole or mounting hole side) facing down.
- Since the reciprocal motion of the diaphragm propagates, the mounting bolts should be tightened securely. Furthermore, in cases where the propagation of vibration is not acceptable, insert vibro-isolating rubber when mounting.

3. Ensure sufficient maintenance space.

When installing and mounting, be sure to allow the space required for maintenance and inspections. Confirm the necessary maintenance space in the instruction manual for each piece of equipment.

4. Do not drop or bump.

Do not drop, bump or apply excessive impact (1000m/s²) when handling.

5. Never mount in a place which will be used as a scaffold during piping work.

Damage can be caused if subjected to an excessive load.

Piping

⚠ Caution

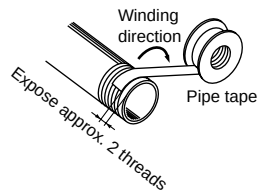
1. Preparation before piping.

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove cutting chips, cutting oil and other debris from inside the pipe.

2. Wrapping of pipe tape.

When connecting pipes and fittings, etc., be sure that cutting chips from the pipe threads and sealing material do not get inside the valve.

Further, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe/fitting.



3. Connection of piping to products.

When connecting piping to a product, refer to its instruction manual to avoid mistakes regarding the supply port, etc.

4. Always fasten threads with the proper tightening torque.

When screwing fittings into valves, fasten with the proper tightening torques as shown below.

PAX1000, PA3000, PA5000

Connection threads	Proper tightening torque N·m (kgf·cm)
Rc(PT) 1/4	12 to 14 (122.4 to 142.8)
Rc(PT) 3/8	22 to 24 (224.4 to 244.8)
Rc(PT) 1/2	28 to 30 (285.6 to 306)
Rc(PT) 3/4	28 to 30 (285.6 to 306)

PB1000

Connection threads	Proper tightening torque N·m (kgf·cm)
M5	1/6 turn after tightening by hand
Rc(PT) 1/8	2 to 3 (20.4 to 30.6)

Since the threaded sections of the PB1000 are resin, take particular care not to tighten any more than necessary.

Air Supply

⚠ Warning

1. Do not use compressed air which contains chemicals, organic solvents or corrosive gases.

Do not use compressed air containing chemicals, organic solvents, salt or corrosive gases, as this can cause damage and malfunction, etc.

2. Use within the operating pressure range.

The operating pressure range is determined by the equipment being used. Operation beyond this range can cause damage, failure or malfunction, etc.

Process Pump Common Precautions 3

Be sure to read before handling.
Refer to the main catalog sections for detailed precautions on each series.

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 locations where there may be contact with the same.
2. Locations where there is contact with sea spray, water or steam.
3. Locations which receive direct sunlight. (Sunlight should be blocked to prevent deterioration of resin from ultra violet rays and over heating, etc.)
4. Locations near heat sources with poor ventilation. (Heat sources should be blocked off, because radiated heat may cause damage due to softening of materials.)
5. Locations with impacts or vibration. (Confirm specifications.)
6. Locations with high moisture and dust. (Contact SMC in advance.)

2. Adhere to the fluid and ambient temperature ranges.

The fluid and ambient temperatures are determined by the equipment being used. Operation beyond this range can cause damage, failure or malfunction, etc.

3. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

⚠ Caution

1. Operating environment.

- Do not allow corrosive fluids or solvents, etc. come into contact with the outer surfaces of the pump.
- Do not use in water (or other liquid). Fluid may leak into the pilot switching valve and there may be corrosion of external parts, etc.

2. Low temperature operation.

Do not allow freezing. Operation is possible down to an ambient temperature of 0°C, but do not allow solidification or freezing of drainage and moisture, etc.

3. Fluid leakage.

- Take measures to deal with leakage. Fluid may leak when the pump is in operation due to aging of the diaphragm, etc. Take measures so that leakage in this type of situation will not have an adverse effect on equipment or personnel.
- Be careful not to touch fluid which has leaked. There is a danger of burns or other injury to the skin if hot fluids or chemicals, etc. are touched.

4. Perform periodic inspections to confirm normal operation.

- It may otherwise become impossible to assure safety in the event of unexpected malfunction or misoperation.

Maintenance

⚠ Warning

1. Shut off the compressed air if an abnormality occurs.

Stop the inflow of compressed air if there are abnormalities such as an unusual odor or sound.

2. Set the compressed air pressure to zero when performing maintenance.

In case of disassembly, first confirm that the pressure inside the pump is zero.

⚠ Caution

1. Do not step on or place heavy objects on the unit.

The equipment may be deformed or damaged, and if balance is lost, a fall may cause injury.

2. Discharge drainage regularly.

If drainage accumulates in equipment, in piping or other areas, this can cause malfunction of the equipment or unexpected trouble due to splash over into the downstream side, etc. Therefore, the amount of drainage and operation of auto drains should be checked every day.

3. Maintenance should be performed in accordance with the procedures in the instruction manual.

If handled improperly, this can cause damage or malfunction in equipment and devices, etc.

4. Demounting of the product.

1. Shut off the fluid supply and release the fluid pressure in the system.
2. In the case of the air pilot type, shut off the air supply and exhaust the compressed air in the pilot piping.
3. Demount the product.

5. Transfer of dangerous fluids.

In case a dangerous fluid such as strong acid or strong alkali 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.

Process Pump Common Precautions 4

Be sure to read before handling.
Refer to the main catalog sections for detailed precautions on each series.

Maintenance

⚠ Caution

6. Service life and replacement of consumable parts.

- When the pump exceeds the number of service life cycles (∗), the diaphragm deteriorates and malfunction may occur. Furthermore, when the diaphragm is damaged by aging, the fluid escapes to the pilot air side, and it may become impossible to start the pump again. Using the number of service life cycles for reference, replace parts as soon as possible. Request maintenance parts (page 15) and replace them in accordance with the instruction manual.

∗ Service life cycles (reference)

PA3000	100,000,000
PA5000, PAX1000	50,000,000

These values are for pilot air pressure of 0.5MPa, ordinary temperatures, and fresh water, where 1 cycle is one reciprocal motion. This may be shorter depending on the type of fluid and operating conditions, etc.

Discharge per cycle

PAX1000	21mℓ
PA3000	40mℓ
PA5000	80mℓ

• Calculation of diaphragm life

Example 1)
Discharge rate 5ℓ/min, when operating 8h/D (for PAX1000)

$$\frac{\text{Discharge rate}}{\text{Discharge per cycle}} = \frac{5}{0.021} = 238 \text{ (cycles/min) Cycles per minute}$$

$$\text{Service life} = \frac{\text{Reference life cycles}}{\text{Cycles per minute}} \times \frac{1}{60} \times \frac{1}{8 \text{ (daily operating time)}}$$

$$= \frac{50{,}000{,}000}{238} \times \frac{1}{60} \times \frac{1}{8}$$

$$= 437 \text{ days}$$

Example 2)
Discharge rate 5ℓ/min, when operating 8h/D (for PA3000)

$$\frac{\text{Discharge rate}}{\text{Discharge per cycle}} = \frac{5}{0.040} = 125 \text{ (cycles/min) Cycles per minute}$$

$$\text{Service life} = \frac{\text{Reference life cycles}}{\text{Cycles per minute}} \times \frac{1}{60} \times \frac{1}{8 \text{ (daily operating time)}}$$

$$= \frac{100{,}000{,}000}{125} \times \frac{1}{60} \times \frac{1}{8}$$

$$= 1600 \text{ days}$$

Example 3)
Discharge rate 5ℓ/min, when operating 8h/D (for PA5000)

$$\frac{\text{Discharge rate}}{\text{Discharge per cycle}} = \frac{5}{0.080} = 62.5 \text{ (cycles/min) Cycles per minute}$$

$$\text{Service life} = \frac{\text{Reference life cycles}}{\text{Cycles per minute}} \times \frac{1}{60} \times \frac{1}{8 \text{ (daily operating time)}}$$

$$= \frac{50{,}000{,}000}{62.5} \times \frac{1}{60} \times \frac{1}{8}$$

$$= 1600 \text{ days}$$

Lubrication

⚠ Caution

1. The pump does not require lubrication.

In the event that it is lubricated, use Class 1 turbine oil (without additives), ISO VG32.

2. Filters and strainers.

- Be careful regarding clogging of filters and strainers.
- Replace filters after one year of use, or earlier if the amount of pressure drop reaches 0.1MPa.
- Replace strainers when the amount of pressure drop reaches 0.1MPa.
- Flush drainage from filters regularly.

3. Lubrication.

If operated with lubrication, be sure to continue the lubrication.

4. Storage.

In case of long term storage after use with water, etc., first thoroughly remove all moisture to prevent rust and deterioration of rubber materials, etc.