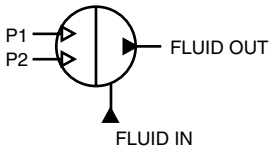
Process Pump
Air Operated Type
(External Switching Type)
Series PA3000/5000

PA3000

PA5000

JIS Symbol



Air operated type

How to Order

PA 3 1 1 3 – □ 03

Body size

3	3/8 standard
5	1/2 standard

Liquid contact body material

1	ADC12 (Aluminum)
2	SCS14 (Stainless steel)

Diaphragm material

1	PTFE

Air operated type

Port size

03	3/8(10A): PA3
04	1/2(15A): PA5
06	3/4(20A): PA5

Thread type

Nil	Rc
T*	NPTF
F*	G
N*	NPT

* T, F, N are options.

Specifications

Model		Air operated type			
		PA3113	**PA3213**	**PA5113**	**PA5213**
Port size	Main fluid suction discharge port	3/8		1/2, 3/4	
	Pilot air supply/ exhaust port	1/4			
Material	Body wetted areas	ADC12	SCS14	ADC12	SCS14
	Diaphragm	PTFE			
	Check valve	PTFE, PFA			
Discharge rate		0.1 to 12 ℓ/min		1 to 24 ℓ/min	
Average discharge pressure		0 to 0.4 MPa			
Pilot air consumption		Max. 150 ℓ/min (ANR)		Max. 250 ℓ/min (ANR)	
Suction lifting range(1)	Dry	Up to 1 m (Interior of pump dry)		Up to 0.5 m (Interior of pump dry)	
	Wet	Up to 6 m (Liquid inside pump)			
Fluid temperature		0 to 60°C (No freezing)			
Ambient temperature		0 to 60°C			
Pilot air pressure		0.1 to 0.5 MPa			
Withstand pressure		0.75 MPa			
Mounting position		Horizontal (with mounting foot at bottom)			
Weight		1.7 kg	2.2 kg	3.5 kg	6.5 kg
Recommended operating cycles		1 to 7 Hz (0.2 to 1 Hz also possible depending on conditions (2))			
Pilot air solenoid valve recommended Cv factor (3)		0.20		0.45	

* Each value of above represents at normal temperatures with fresh water.

Note 1) With cycles at 2 Hz or more

Note 2) After initial suction of liquid operating at 1 to 7 Hz, 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.

Note 3) With a low number of operating cycles, even a valve with a small Cv factor can be operated.

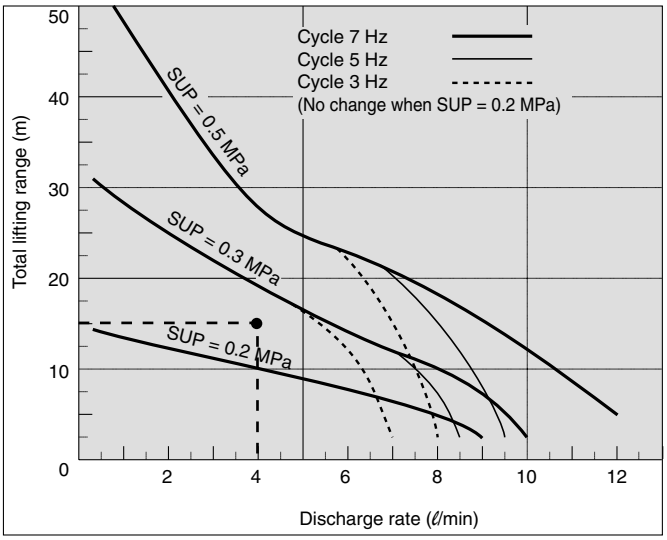
Recommended Valve

PA3000	VQZ14□0 (Exhaust center)
PA5000	VQZ24□0 (Exhaust center)

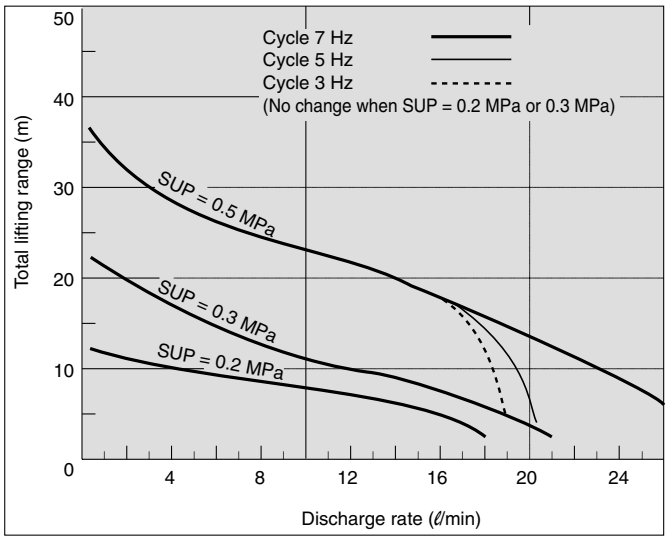
Refer to page 17-5-160 for details.

Performance Curve: Air Operated Type

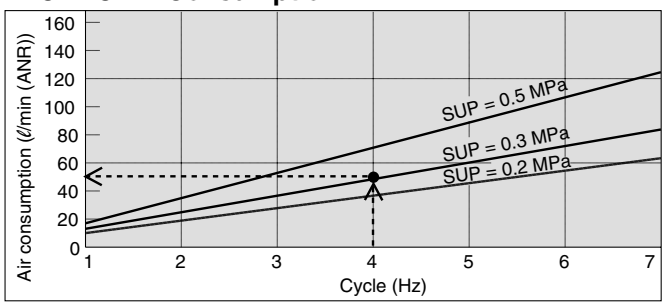
PA3□13 Flow Characteristics



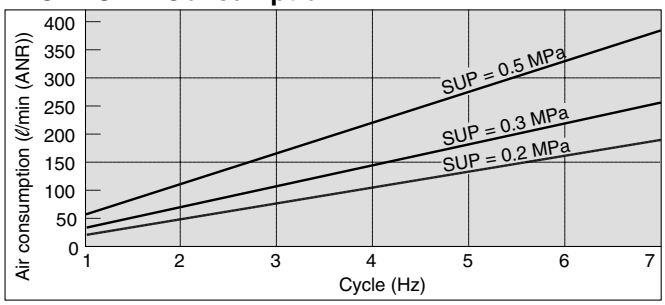
PA5□13 Flow Characteristics



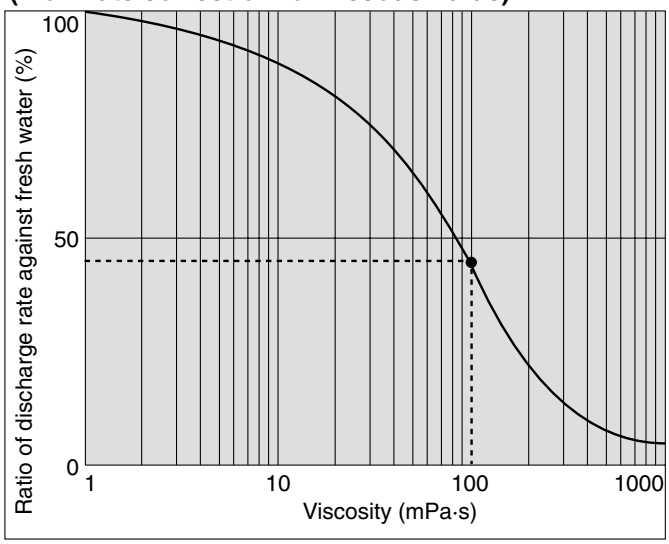
PA3□13 Air Consumption



PA5□13 Air Consumption



Viscosity Characteristics (Flow rate correction for viscous fluids)



Selection from Flow Characteristic Graph (PA3000)

Required specification example: Find the pilot air pressure and pilot air consumption for a discharge rate of 4 ℓ/min and a total lifting range of 15 m. <The transfer fluid is fresh water (viscosity 1 mPa·s, specific gravity 1.0).>

Note 1) If the discharge pressure is required instead of the total lifting height, a total lift of 10 m corresponds to discharge pressure of 0.1 MPa.

Note 2) Discharge per cycle
PA3000: Approx. 22 mℓ
PA5000: Approx. 100 mℓ

Selection procedures:

1. First mark the intersection point for a discharge rate of 4 ℓ/min and a lifting range of 15 m.

2. Find the pilot air pressure for the marked point. In this case, the point is between the discharge curves (solid lines) for SUP = 0.2 MPa and SUP = 0.3 MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.25 MPa.

Note 1) Even when switching cycles are changed for PA3000 with SUP = 0.2 MPa or PA5000 with SUP = 0.2 MPa or 0.3 MPa, there is almost no change in the lifting height.

Calculating Air Consumption (PA3000)

Find the air consumption for operation with a 4 Hz switching cycle and pilot air pressure of 0.3 MPa from the air consumption graph.

Selection procedures:

1. Look up from the 4 Hz switching cycle to find the intersection with SUP = 0.3 MPa.

2. From the point just found, draw a line to the Y-axis to find the air consumption. The result is approximately 50 ℓ/min (ANR).

⚠Caution

1. These flow characteristics are for fresh water (viscosity 1mPa·s, specific gravity 1.0).

2. The discharge rate differs greatly depending on properties (viscosity, specific gravity) of the fluid being transferred and operating conditions (density, lifting range, transfer distance).

Selection from Viscosity Characteristic Graph

Required specification example: Find the pilot air pressure and pilot air consumption for a discharge rate of 2.7 ℓ/min, a total lifting range of 25 m, and a viscosity of 100 mPa·s.

Selection procedures:

1. First find the ratio of the discharge rate for fresh water when viscosity is 100 mPa·s from the graph below. It is determined to be 45%.

2. Next, in the required specification example, the viscosity is 100mPa·s and the discharge rate is 2.7 ℓ/min. Since this is equivalent to 45% of the discharge rate for fresh water, 2.7 ℓ/min ÷ 0.45 = 6 ℓ/min, indicating that a discharge rate of 6 ℓ/min is required for fresh water.

3. Finally, find the pilot air pressure and pilot air consumption based on selection from the flow characteristic graphs.

⚠Caution

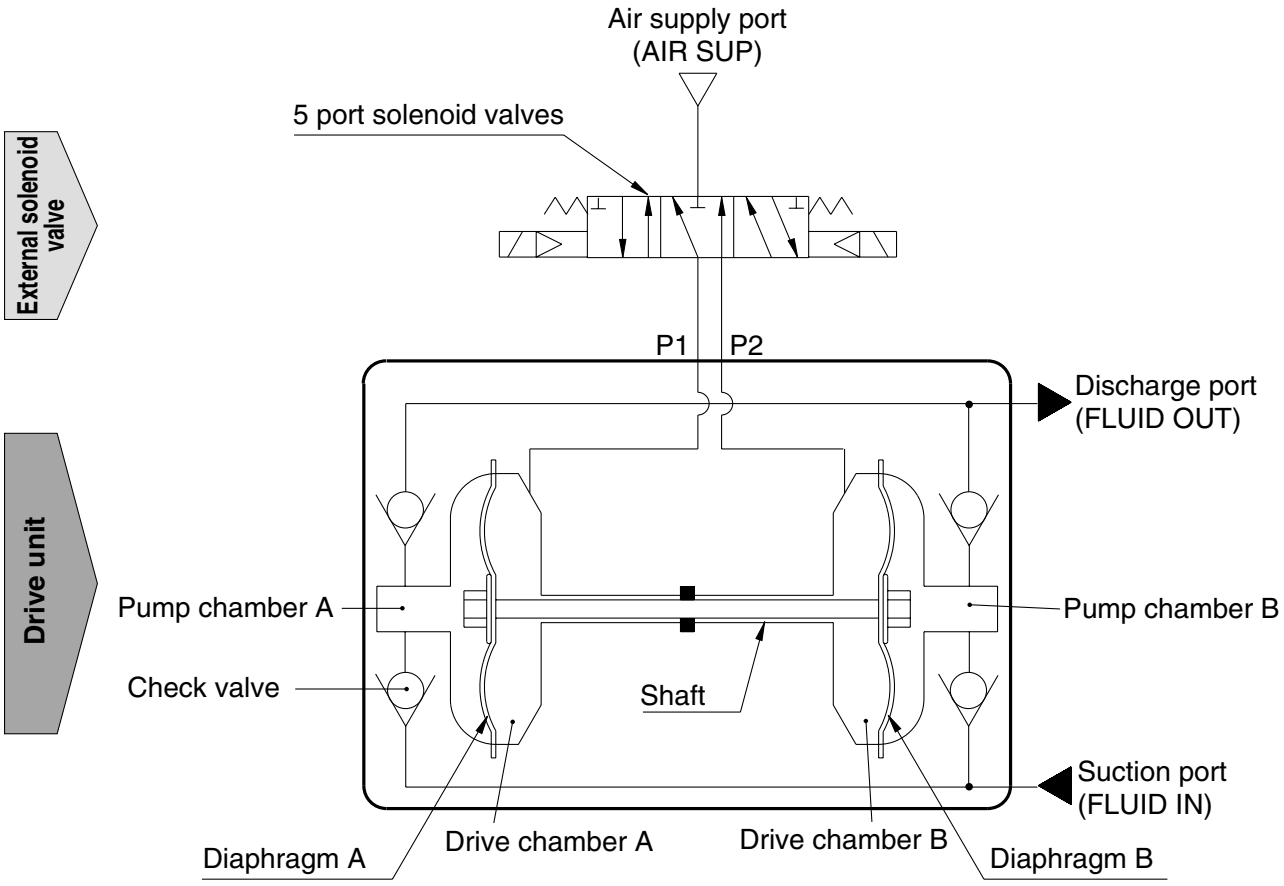
Viscosities up to 1000 mPa·s can be used.

Dynamic viscosity ν = Viscosity μ/Density ρ.

$$\nu = \frac{\mu}{\rho}$$

$\nu(10^{-3}\ m^2/s) = \mu(mPa{\cdot}s)/\rho(kg/m^3)$

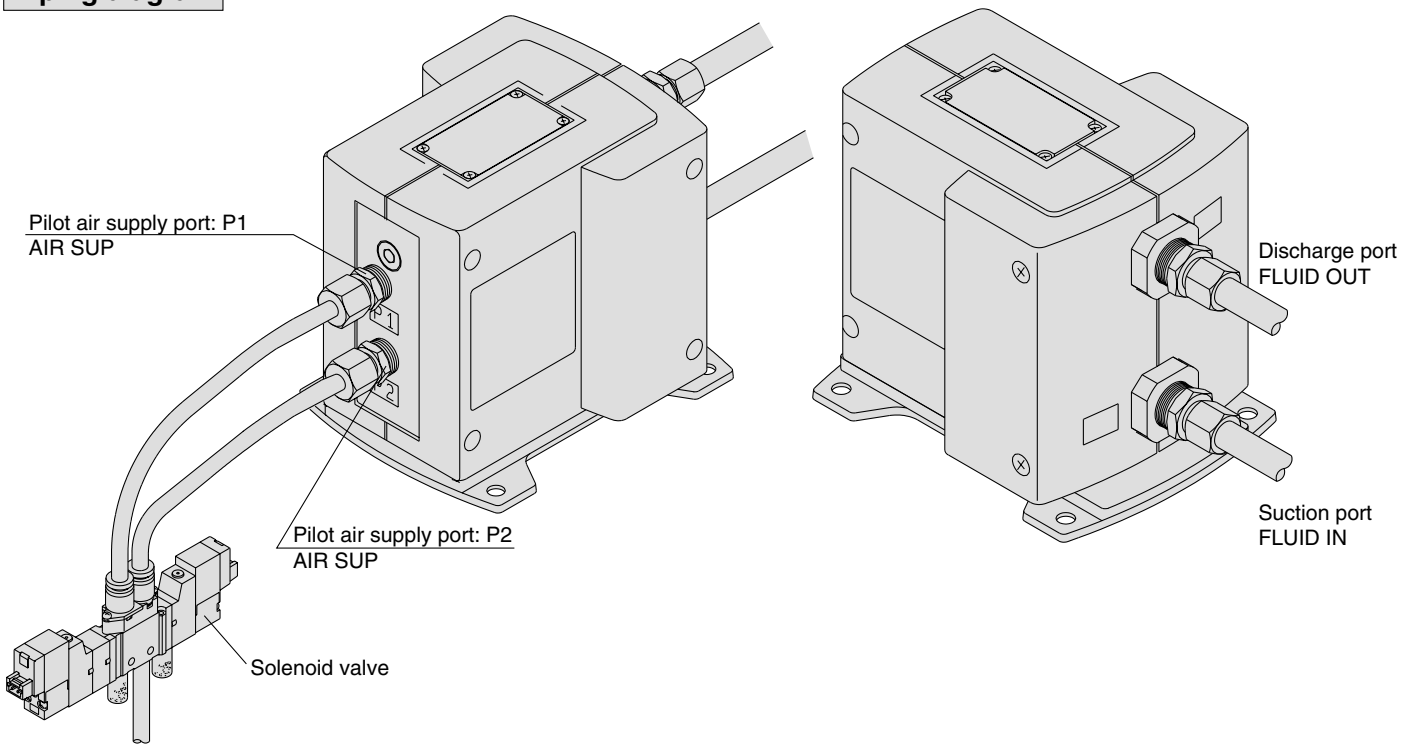
Working Principle: Air Operated Type



1.When air is supplied to P1 port, it enters drive chamber A.
2.Diaphragm A moves to the left, and at the same time diaphragm B also moves to the left.
3.The fluid in pump chamber A is forced out to the discharge port, and the fluid is sucked into pump chamber B from the suction port.
4.If air is supplied to the P2 port, the opposite will occur. Continuous suction and discharge of fluid is performed by repeating this process with the control of an external solenoid valve (5 port valve).

Piping and Operation: Air Operated Type

Piping diagram



⚠Caution

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. Connect air piping (1) to the pilot air supply port <P1>, <P2> and connect piping for the fluid to be transfered to the suction port <FLUID IN> and the discharge port <FLUID OUT>.

2. Using a regulator, set the pilot air pressure within the range of 0.1 to 0.5 MPa. Then, the pump operates when power is applied to the solenoid valve (2) 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 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: PA3 1 m, PA5 up to 0.5 m (3)) To restrict exhaust noise, attach a silencer to the solenoid valve air exhaust port.

3. 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.

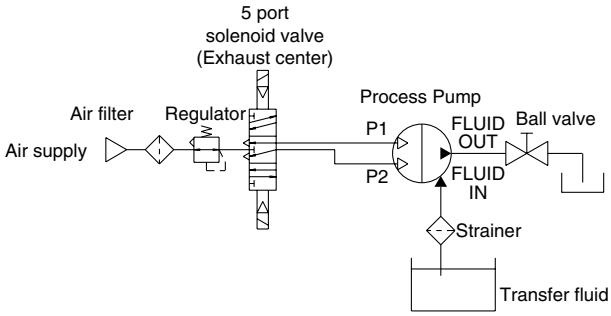
Note 2) For the solenoid valve, use an exhaust center 5 port valve, or a combination of residual exhaust 3 port valve and a pump drive 4 port valve. If air in the drive chamber is not released when the pump is stopped, the diaphragm will be subjected to pressure and its life will be shortened.

Note 3) When the pump is dry, operate the solenoid valve at a switching cycle of 1 to 7 Hz. If operated outside of this range, the suction lifting height may not reach the prescribed value.

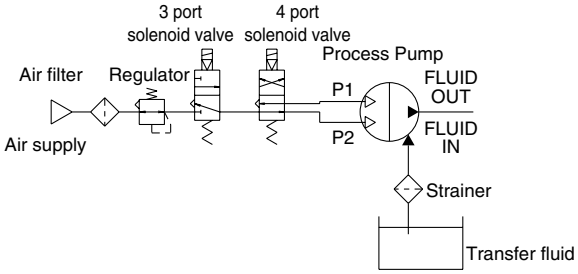
<Discharge Flow Rate Adjustment>

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.

Circuit example (1)

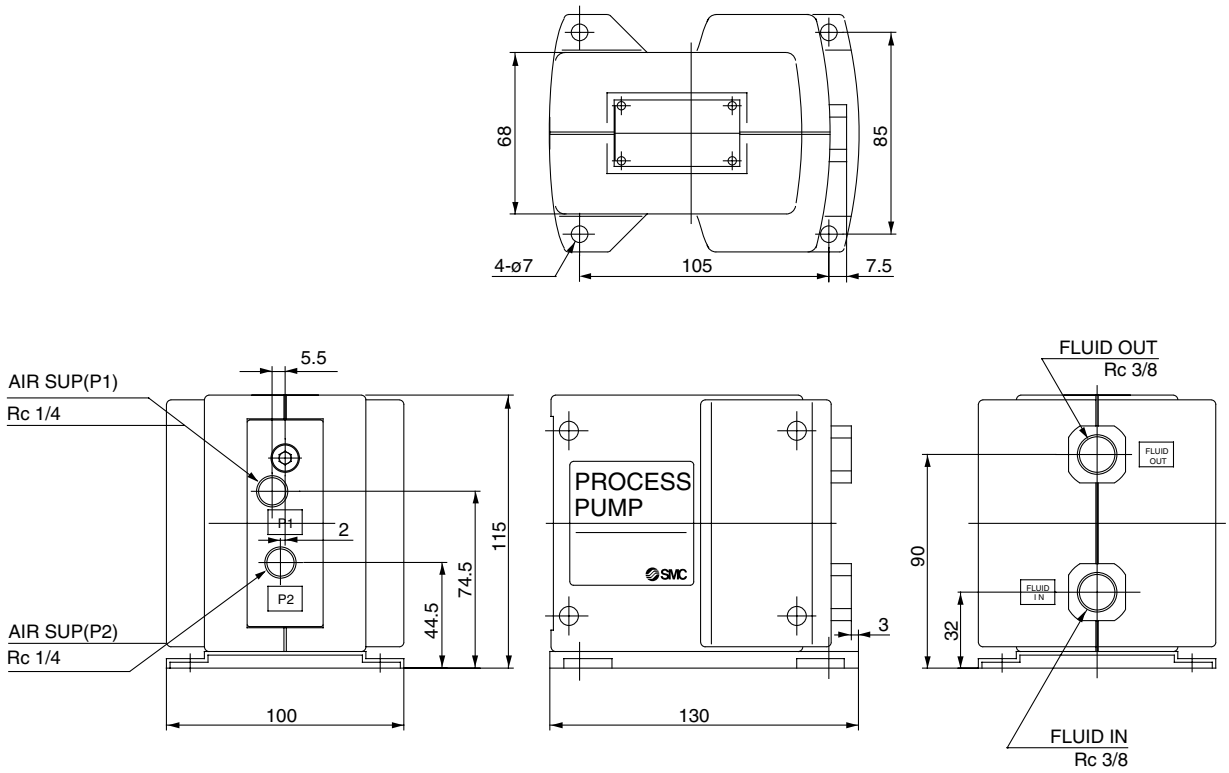


Circuit example (2)



Dimensions: Air Operated Type

PA3000



PA5000