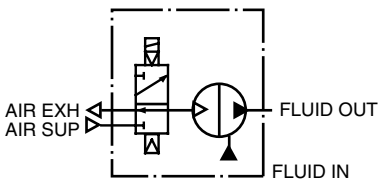
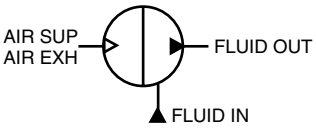
# Process Pump
# Built-in Solenoid Valve Type/
# Air Operated Type (External Switching Type)
# Series PB1000

**JIS Symbol**




Built-in solenoid valve




Air operated type

## How to Order

**PB1 0 1 1 — □ 01 — □**

**Body size**

| | |
|---|---|
| 1 | 1/8 standard |

**Body material**

| | |
|---|---|
| 0 | Polypropylene |

**Diaphragm material**

| | |
|---|---|
| 1 | PTFE (Fluoro resin) |

**Style**

| | |
|---|---|
| 1 | Built-in solenoid valve |
| 3 | Air operated |

**Thread type**

| | |
|---|---|
| Nil | Rc |
| T * | NPTF |
| F * | G |
| N * | NPT |

* T, F, N are options.

**Port size**

| | |
|---|---|
| 01 | 1/8 (6A) |

**Option/Part no.**

| | |
|---|---|
| Nil | Pump only |
| B | With foot (bolts included) KT-PB1-3 |
| N * | With silencer AN120-M5 |

* For AIR EXH
Air operated type is not available with silencer (symbol N).

## Specifications

| Model | | | PB1011 | PB1013 |
|---|---|---|---|---|
| Port size | Main fluid suction/discharge port | | 1/8 | |
| | Pilot air | Supply port | 1/8 | |
| | | Exhaust port | M5 x 0.8 | |
| Material | Body wetted areas | | Polypropylene PP, Stainless steel (SUS316) | |
| | Diaphragm | | PTFE | |
| | Check valve | | PTFE | |
| | Liquid contact seals | | FKM | |
| Discharge rate | | | 8 to 2000 mℓ/min | 8 to 500 mℓ/min |
| Average discharge pressure | | | 0 to 0.6 MPa | |
| Suction head | | | Up to 2.5 m (Dry: Interior of pump dry) | |
| Fluid temperature | | | 0 to 50°C (No freezing) | |
| Ambient temperature | | | 0 to 50°C | |
| Pilot air pressure | | | 0.2 to 0.7 MPa | |
| Withstand pressure | | | 1.05 MPa | |
| Recommended operating cycle | | | 1 to 10 Hz (0.03 to 1 Hz also possible depending on conditions (2)) | |
| Lubrication | | | Not required | |
| Voltage | | | 24 VDC | — |
| Weight | | | 0.17 kg | 0.15 kg |
| Mounting position | | | OUT port at top (Indication on name plate) | |
| Pilot air solenoid valve recommended Cv factor (1) | | | — | 0.2 |

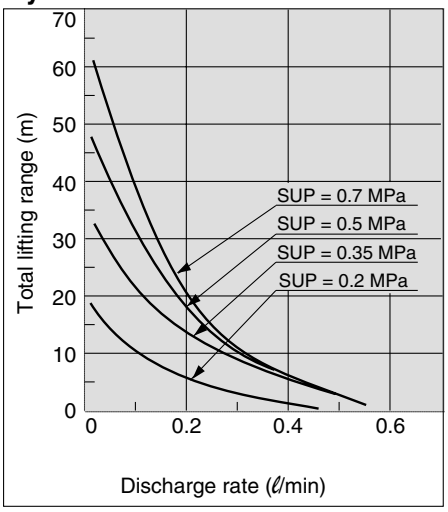
* Each value of above represents at normal temperatures with fresh water.
Note on the transfer of slurry:
Slurry transfer is not possible with Series PB1000 because of deterioration and wear of the check valve seat and the accumulation of particles, which will render the pump inoperable.

Note 1) With low operating cycles, even a valve with a small Cv factor can be operated.
Recommended valve/for PB1013 air operated type: SYJ3□4

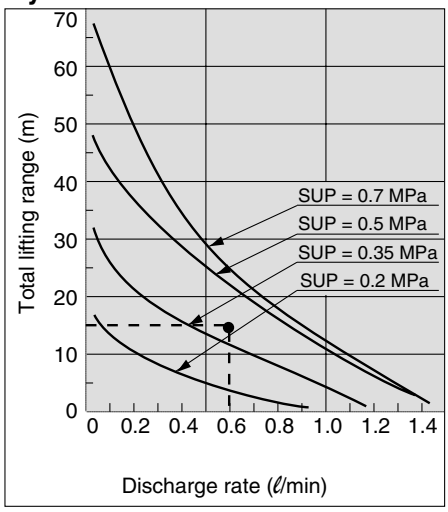
Note 2) After initial suction of liquid operating at 1 to 7 Hz, it can be used with operation at lower cycles. Since a large quantity of liquid will be pumped out, use a suitable throttle in the discharge port if problems occur.

## Performance Curves: Built-in Solenoid Valve Type/Air Operated Type

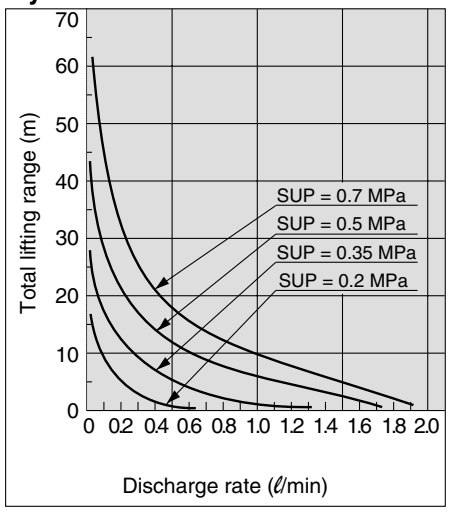
### Cycle 1 Hz



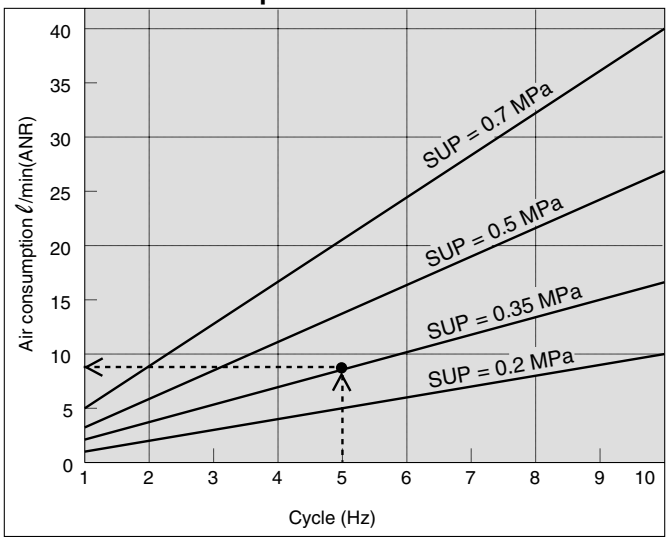

### Cycle 5 Hz



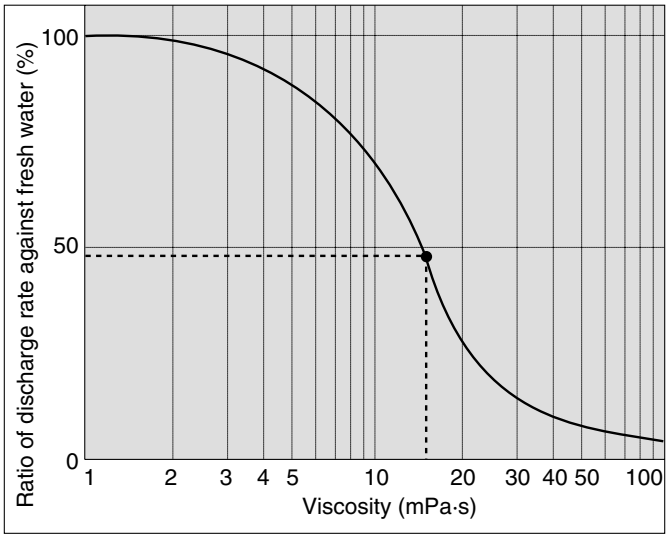

### Cycle 10 Hz




### PB1000 Air Consumption




### Viscosity Characteristics (Flow rate correction for viscous fluids)




### Selection from Flow Characteristic Graph

Required specification example: Find the pilot air pressure and pilot air consumption for a discharge rate of 600 mℓ/min and a total lifting range of 15 m.
<The transferred fluid is clean water (viscosity 1 mPa·s, specific gravity 1.0) solenoid valve cycle 5 Hz>

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

Selection procedure:

1. First mark the intersection point for a discharge rate of 600 m 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 0.35 MPa and 0.5 MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.4 MPa.

### Calculating Air Consumption

Find the air consumption for operation with a 5 Hz switching cycle and pilot air pressure of 0.35 MPa from the air consumption graph.
Selection procedure

1. Look up from the 5 Hz switching cycle to find the intersection with SUP = 0.35 MPa.
2. From the point just found, draw a line to the Y-axis to find the air consumption. The result is approximately 9 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), etc.
3. If operated continuously at 10 Hz, the diaphragm will reach its service life of 20 million cycles in approximately one month.

### Selection from Viscosity Characteristic Graph

Required specification example:
Find the pilot air pressure and pilot air consumption for a discharge rate of 200 mℓ/min, a total lifting range of 10 m, and a viscosity of 15 mPa·s
Selection procedure:

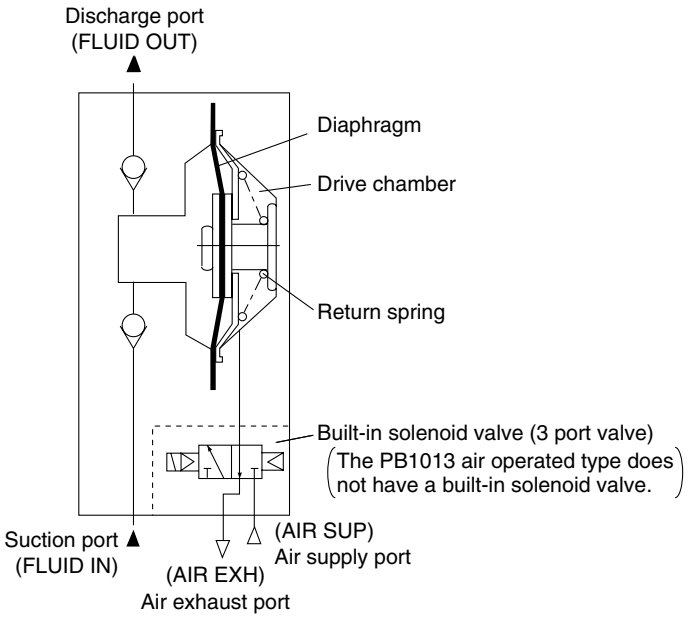
1. First find the ratio of the discharge rate for fresh water when viscosity is 15 mPa·s from the graph to the left. It is determined to be 48%.
2. Next, the viscosity of 15 mPa·s and the discharge rate of 200 ℓ/min in the required specification example are converted to the discharge rate for fresh water.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

Viscosity: Transfer is possible up to about 100 mPa·s.
Dynamic viscosity $\nu$ = Viscosity $\mu$/Density $\rho$.

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

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

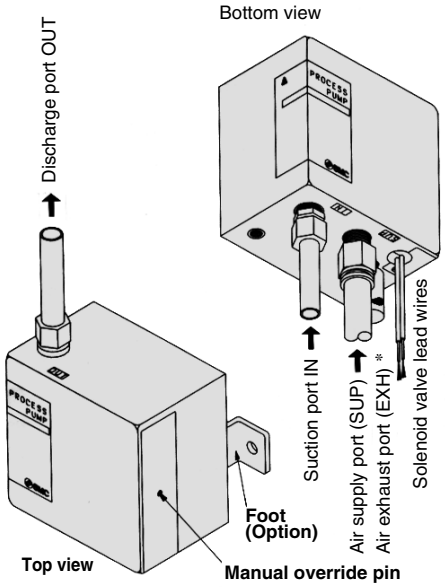
## Working Principle: Built-in Solenoid Valve Type/Air Operated Type




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 FLUID IN side passes through the lower check valve and is sucked into the pump chamber.
The PB1011 repeats this suction and discharge with the repetition of the built-in solenoid valve's ON/OFF operation. The PB1013 air operated type is operated by the ON/OFF operation of an external solenoid valve.

## Piping and Operation: Built-in Solenoid Valve Type/Air Operated Type

### Piping diagram




* The PB1013 air operated type has a plug in the air exhaust port EXH.

### ⚠ 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).

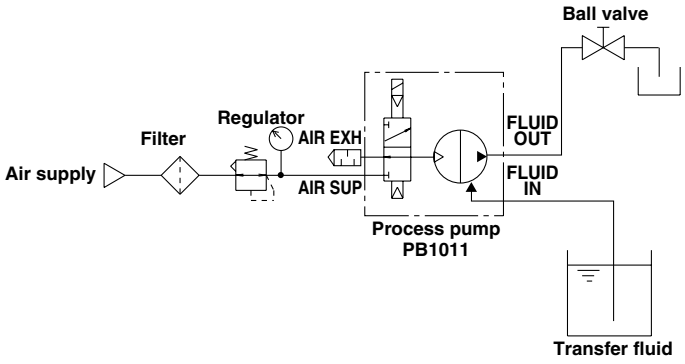
Maintain the proper tightening torque for fittings and mounting bolts, etc.

Looseness can cause problems such as fluid and air leakage, while over tightening can cause damage to threads and parts, etc.

### Operation

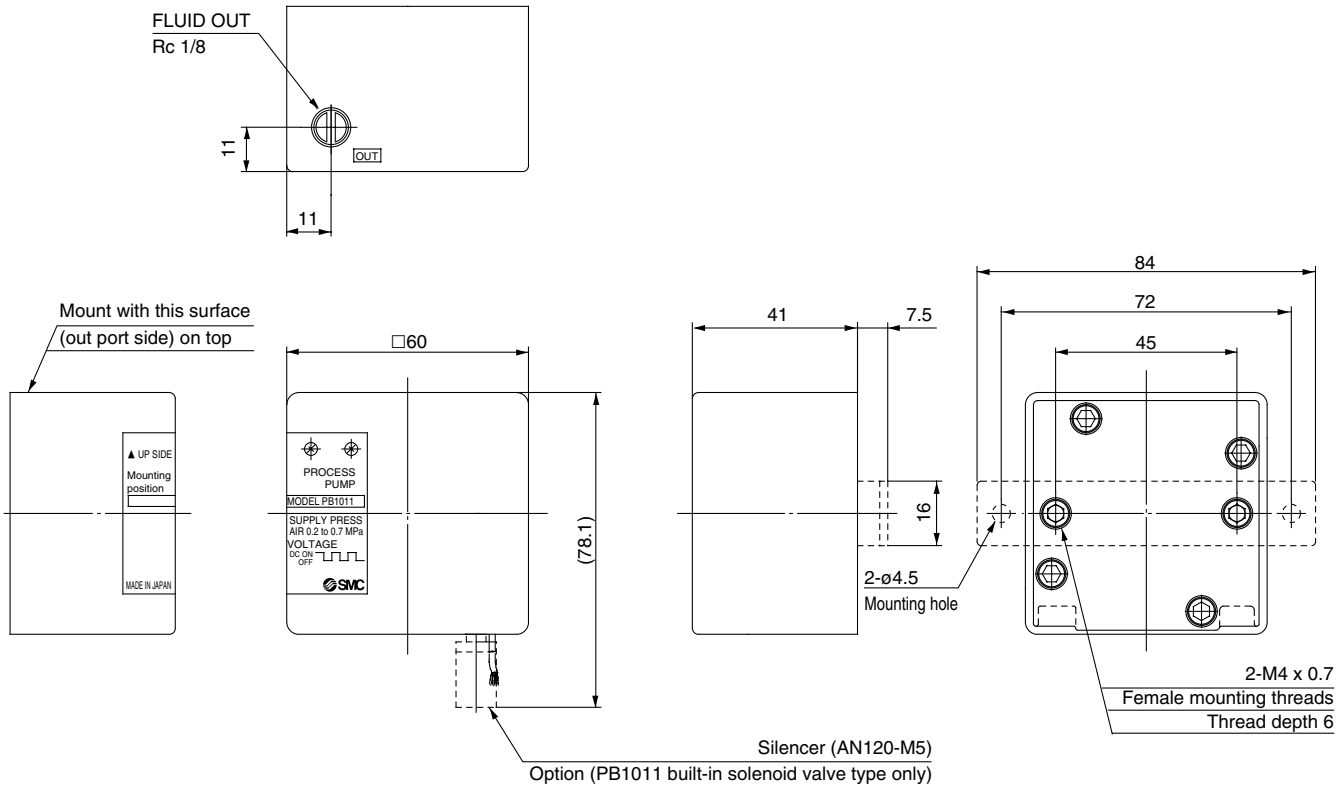
1. Connect air piping to the air supply port SUP, and connect piping for the transfer fluid to the suction port IN and the discharge port OUT.
2. Connect the solenoid valve lead wires to a 24 VDC power supply. Red is (+) and Black is (–). (The PB1013 air operated type must be equipped with a separate solenoid valve.)
3. Using a regulator, set the pilot air pressure within the range of 0.2 to 0.7 MPa. By continuously turning the 24 VDC 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 24 VDC power. Also be sure to turn OFF the power when the discharge side is closed. The manual override pin is used for manual operation when there is no electric power. Each time it is pressed, there is one reciprocal operation.

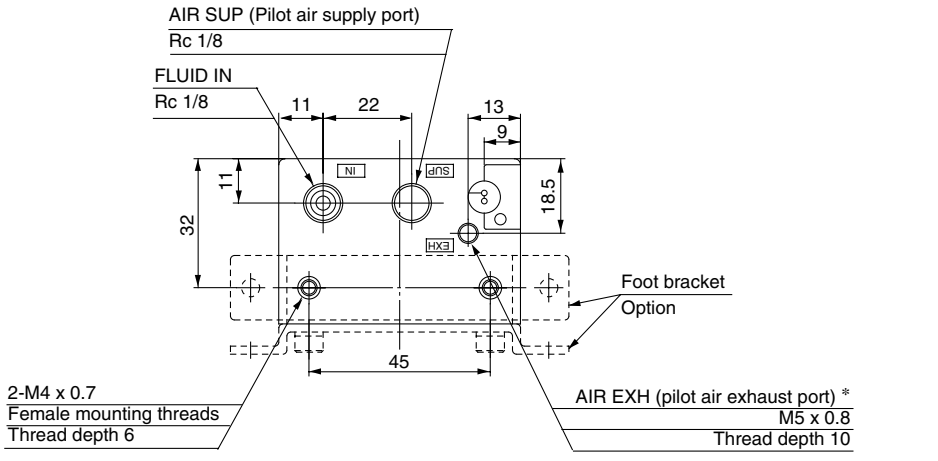
### Circuit example/Built-in solenoid valve



## Dimensions

### PB1000




* The PB1013 air operated type has a plug.