Fluororesin Type

# Process Pump

RoHS

## *PA(P)3000 Series*

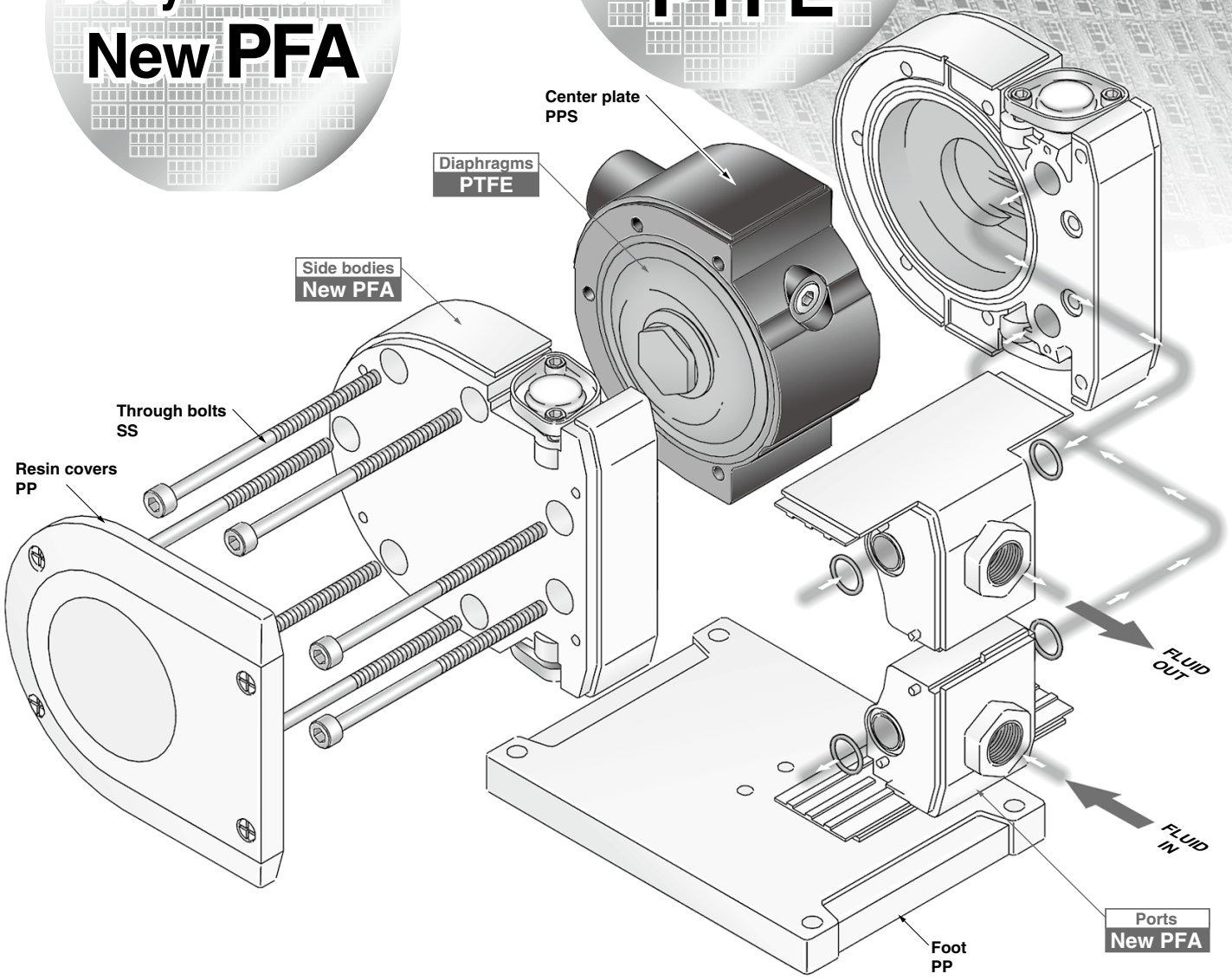
***Body material made from New PFA for superior corrosion resistance.****

* Refer to the “Material and Fluid Compatibility Check List for Process Pumps” on page 485. It is your responsibility to check the suitability for your workpiece and equipment.

# With the use of New PFA for body material,

**Body material**
**New PFA**

**Diaphragm material**
**PTFE**



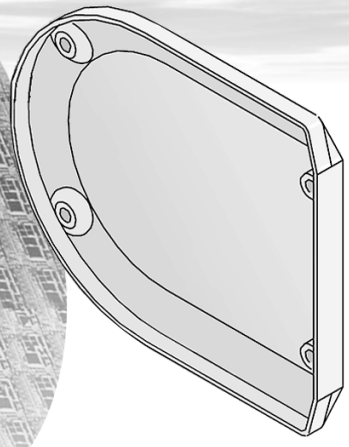

## Variations

| Model | | Body material | Diaphragm material | Assembly environment | Discharge rate (L/min) | Option |
|---|---|---|---|---|---|---|
| Automatically operated type | PA3310 | New PFA | PTFE | Standard | 1 to 13* | • Foot<br>• Silencer |
| | PAP3310 | | | Clean room | | |
| Air pilot operated type | PA3313 | | | Standard | 0.1 to 9 | • Foot |
| | PAP3313 | | | Clean room | | |

* With 3/8" inlet/outlet tube: 1 to 12

# high corrosion resistance is achieved!*

* Refer to the “Material and Fluid Compatibility Check List for Process Pumps” on page 485. It is your responsibility to check the suitability for your workpiece and equipment.



## Clean

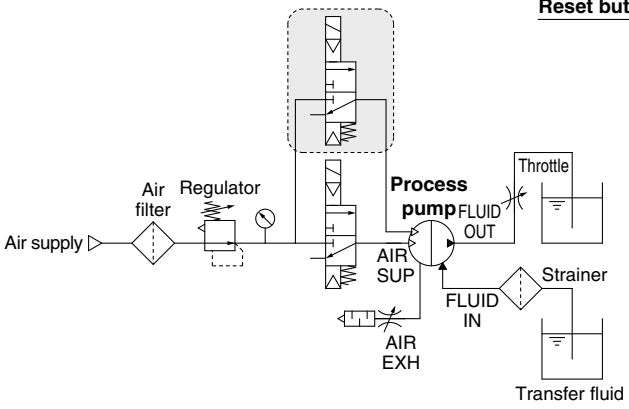
**You can order your process pump assembled in a Clean room environment and double-packaged (Order number PAP331□).**
**Side bodies and ports are molded to achieve a great reduction in dust generation.**

## Air pilot actuation reset is now a standard feature.

**When the pump is used in an environment where manual reset is not possible, designing a circuit as the one shown below allows the use of air pressure for reset purposes.**

With the use of an air pilot actuation reset circuit, resetting can be done by releasing the air pressure after supplying it to the reset port.

**Air pilot actuation reset circuit**



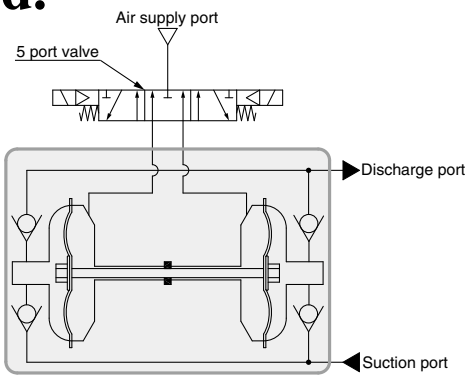

## Compact & Lightweight (Without foot)


**Weight: 2.1 kg**

## Air pilot actuation is standard.

**External switching valve control makes constant cycling possible.**

- **Discharge rate is easily controlled.**
  The flow rate can be easily adjusted by the number of ON/OFF cycles of the external solenoid valve.
- **Stable operation is possible in spite of such conditions as a minimal flow rate, low pressure operation, or the entrainment of gasses.**
- **Can be used for operation with repetitive stopping.**



# Process Pump Clean Room
## Automatically Operated Type (Internal Switching Type)
## Air Operated Type (External Switching Type)
# PA(P)3000 Series RoHS

## How to Order

**Female thread** PA P 331 0 – □ 03 – □

**Actuation** Note 1)

| Symbol | Actuation |
|---|---|
| 0 | Automatically operated |
| 3 | Air operated |

**Assembly environment**

| Symbol | Assembly environment |
|---|---|
| Nil | Standard |
| P | Clean room |

**Thread type** Note 2)

| Symbol | Type |
|---|---|
| Nil | Rc |
| N | NPT |
| F | G |
| T | NPTF |

**Port size**

| Symbol | Port size |
|---|---|
| 03 | 3/8" |

**Option**

| Symbol | Option | Applicable actuation | |
|---|---|---|---|
| | | Automatically operated | Air operated |
| Nil | None | ● | ● |
| B | With foot | ● | ● |
| N | With silencer ** | ● | — |

* When option is more than one, suffix in alphabetical order.
** For AIR EXH: AN20-□02
(□: Either Nil or N is entered as a thread symbol.)

**Tube extension** PAP331 0 – P 13 □ – □

**Actuation** Note 1)

| Symbol | Actuation |
|---|---|
| 0 | Automatically operated |
| 3 | Air operated |

**Assembly environment**

| Symbol | Assembly environment |
|---|---|
| P | Clean room |

**Tubing size**

| Symbol | Main fluid connection size |
|---|---|
| 11 | 3/8" |
| 13 | 1/2" |

**Thread type** Note 2)

| Symbol | Type |
|---|---|
| Nil | Rc |
| N | NPT |
| F | G |
| T | NPTF |

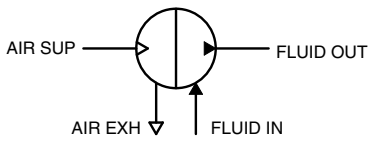
**Option**

| Symbol | Option | Applicable actuation | |
|---|---|---|---|
| | | Automatically operated | Air operated |
| Nil | None | ● | ● |
| B | With foot | ● | ● |
| N | With silencer ** | ● | — |

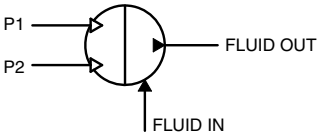
* When option is more than one, suffix in alphabetical order.
** For AIR EXH: AN20-□02
(□: Either Nil or N is entered as a thread symbol.)

Note 1) The port size of the pilot port is 1/4".
Note 2) The thread type is applied to the pilot port thread and the female thread piping connection.

**Symbol**




Automatically operated type




Air operated type

## With nut PAP331 0 S − 1 S 13 □ − □

### Assembly environment

| Symbol | Assembly environment |
|---|---|
| **P** | Clean room |

### Actuation Note 1)

| Symbol | Actuation |
|---|---|
| **0** | Automatically operated |
| **3** | Air operated |

### Fitting type

| Symbol | Fitting type |
|---|---|
| **1** | LQ1 |
| **2** | LQ2 |

### Fitting size

| Symbol | IN side | OUT side |
|---|---|---|
| **11** | 3 | 3 |
| **1113** | 3 | 4 |
| **1311** | 4 | 3 |
| **13** | 4 | 4 |
| **1319** | 4 | 5 |
| **1913** | 5 | 4 |
| **19** | 5 | 5 |

### Thread type Note 2)

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

### Option

| Symbol | Option | Applicable actuation | |
|---|---|---|---|
| | | Automatically operated | Air operated |
| **Nil** | None | ● | ● |
| **B** | With foot | ● | ● |
| **N** | With silencer ** | ● | — |

∗ When option is more than one, suffix in alphabetical order.
∗∗ For AIR EXH: AN20-□02
(□: Either Nil or N is entered as a thread symbol.)

## Integrated fitting type PAP331 0 − S 13 □ − □

### Assembly environment

| Symbol | Assembly environment |
|---|---|
| **P** | Clean room |

### Actuation Note 1)

| Symbol | Actuation |
|---|---|
| **0** | Automatically operated |
| **3** | Air operated |

### Fitting size

| Symbol | Fitting size |
|---|---|
| **11** | LQ2 3/8" |
| **13** | LQ2 1/2" |

### Thread type Note 2)

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

### Option

| Symbol | Option | Applicable actuation | |
|---|---|---|---|
| | | Automatically operated | Air operated |
| **Nil** | None | ● | ● |
| **B** | With foot | ● | ● |
| **N** | With silencer ** | ● | — |

∗ When option is more than one, suffix in alphabetical order.
∗∗ For AIR EXH: AN20-□02
(□: Either Nil or N is entered as a thread symbol.)

Note 1) The port size of the pilot port is 1/4".
Note 2) The thread type is applied to the pilot port thread and the female thread piping connection.
Note 3) Refer to the pamphlet “High-Purity Fluoropolymer Fittings Hyper Fitting/LQ1, 2 series Work Procedure Instructions” (M-E05-1) for connecting tubing with special tools. (Downloadable from our website.)

## Specifications

| Model | | PA3310 | PAP3310 | PA3313 | PAP3313 |
|---|---|---|---|---|---|
| Actuation | | Automatically operated | | Air operated | |
| Port size | Main fluid suction discharge port | Rc, NPT, G, NPTF 3/8" Female thread | Rc, NPT, G, NPTF 3/8" Female thread 3/8", 1/2" Tube extension With nut (size 3, 4, 5) 3/8", 1/2" Integrated fitting type | Rc, NPT, G, NPTF 3/8" Female thread | Rc, NPT, G, NPTF 3/8" Female thread 3/8", 1/2" Tube extension With nut (size 3, 4, 5) 3/8", 1/2" Integrated fitting type |
| | Pilot air supply/exhaust port | Rc, NPT, G, NPTF 1/4" Female thread | | | |
| Material | Body wetted areas | New PFA | | | |
| | Diaphragm | PTFE | | | |
| | Check valve | PTFE, New PFA | | | |
| Fluid | | Refer to the applicable fluids on page 485. | | | |
| Discharge rate | | 1 to 13 L/min Note 1) | | 0.1 to 9 L/min | |
| Average discharge pressure | | 0 to 0.4 MPa | | | |
| Pilot air pressure | | 0.2 to 0.5 MPa | | | |
| Pilot air consumption | | 140 L/min (ANR) or less | | | |
| Suction lifting range | Dry | Up to 0.5 m (Interior of pump dry) | | | |
| | Wet | Up to 4 m (liquid inside pump) | | | |
| Noise | | 80 dB (A) or less (Option: with silencer, AN20) | | 75 dB (A) or less (excluding the noise from the quick exhaust and solenoid valve) | |
| Withstand pressure | | 0.75 MPa | | | |
| Diaphragm life Note 2) | | 50 million times | | | |
| Fluid temperature | | 0 to 100°C (No freezing, heat cycle not applied) | | | |
| Ambient temperature | | 0 to 100°C (No freezing, heat cycle not applied) | | | |
| Maximum viscosity | | 1000 mPa·s | | | |
| Recommended operating cycle | | — | | 2 to 4 Hz | |
| Weight | | 2.1 kg (without foot) | | | |
| Mounting orientation | | Horizontal (with mounting foot at bottom) | | | |
| Packaging | | General environment | Clean double packaging | General environment | Clean double packaging |

∗ Each value of above represents at normal temperatures with fresh water.
∗ For related products, refer to pages 483 and 484.
Note 1) The discharge rates for PAP3310-P11, PAP3310S-□S11, PAP3310S-□S1113, PAP3310S-□S1311, PAP3310-S11 are between 1 to 12 L/min.
Note 2) These are reference values for room temperature and fresh water. These are not guaranteed. For details, refer to page 489. (Notes on the service life of the diaphragm in the "Specific Product Precautions")

## Maintenance Parts

⚠ **●While it is not possible to disassemble this product without voiding the warranty, if disassembly is to be carried out anyway due to necessity, be sure to follow the maintenance procedures.**
**●When carrying out this work, wear appropriate protective equipment.**

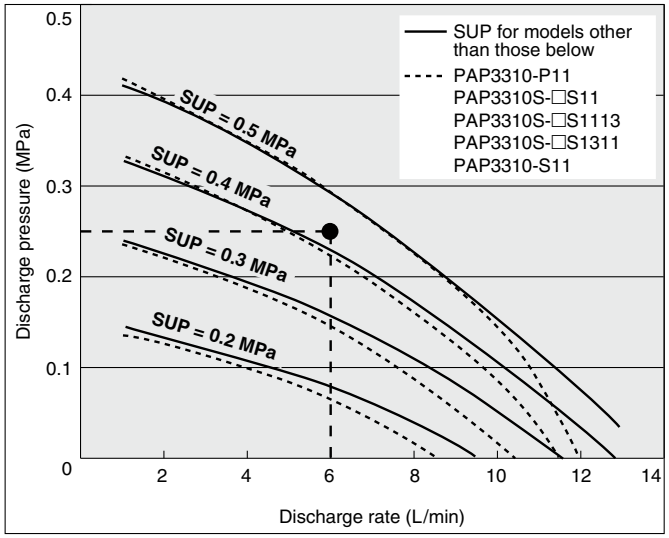
### PA(P)3000 Series

| Description | PA(P)3000 series | | | |
|---|---|---|---|---|
| | PA3310 | PA3313 | PAP3310 | PAP3313 |
| Diaphragm kit | KT-PA3-531 | | KT-PAP3-531 | |
| Check valve kit | KT-PA3-536#1 | | KT-PAP3-536#1 | |
| Pilot valve kit | KT-PA3-538 | — | KT-PA3-538 | — |
| Manual cap assembly kit | KT-PA3-545□ Note) | — | KT-PA3-545□ Note) | — |
| Foot kit | KT-PA3-40 | | KT-PAP3-40 | |
| Switching valve parts kit | KT-PA3-537□ Note) | — | KT-PA3-537□ Note) | — |

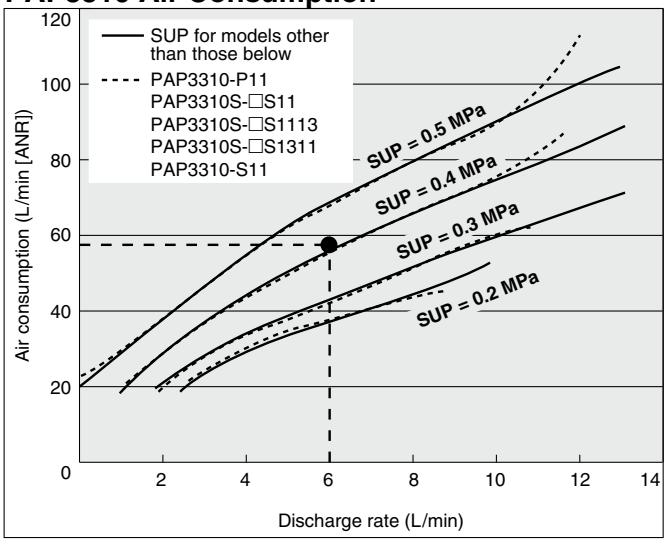
∗ The maintenance procedure is to be distributed individually. Please contact your SMC sales representative for details.
Note) One of Nil, N, F or T is entered as a thread symbol.

## Performance Curve: Automatically Operated Type

### PAP3310 Flow Rate Characteristics




### PAP3310 Air Consumption




### Selection from Flow Rate Characteristic Graph (PAP3310)

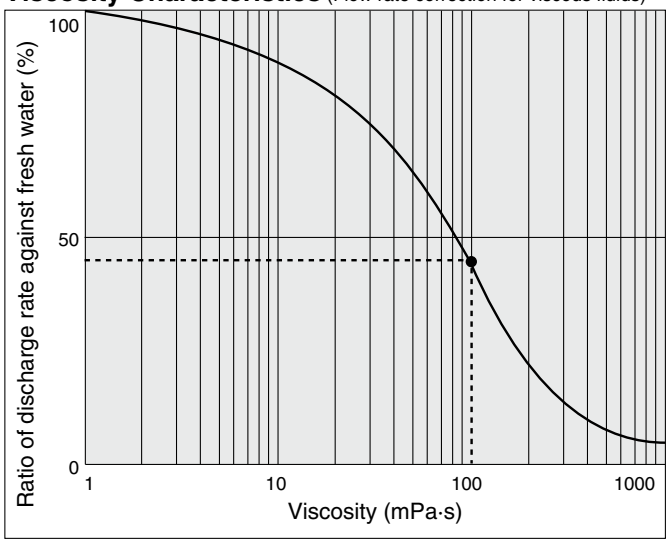
Required specifications example:
Find the pilot air pressure and pilot air consumption for a discharge rate of 6 L/min and a discharge pressure of 0.25 MPa. <The transfer fluid is fresh water (viscosity 1 mPa·s, specific gravity 1.0).
∗ If the total lifting height is required instead of the discharge pressure, a discharge pressure of 0.1 MPa corresponds to a total lift of 10 m.

Selection procedures:
**1**. First mark the intersection point for a discharge rate of 6 L/min and a discharge pressure of 0.25 MPa.
**2**. Find the pilot air pressure for the marked point. In this case, the point is between the discharge curves (solid lines) for SUP = 0.4 MPa and SUP = 0.5 MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.43 MPa.
**3**. Next find the air consumption rate. Find the intersection point for a discharge rate of 6 L/min and a discharge curve (solid line) for SUP = 0.43 MP a. Draw a line from this point to the Y axis to determine the air consumption rate. The result should be approx. 58 L/min (ANR).

### ⚠Caution

**1**. These flow rate characteristics are for fresh water (viscosity 1 mPa·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 (lifting range, transfer distance), etc.
**3**. Use 0.75 kW per 100 L/min of air consumption as a guide for the relationship of the air consumption to the compressor.

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




### Selection from Viscosity Characteristic Graph

Required specifications example:
Find the pilot air pressure and pilot air consumption for a discharge rate of 2.7 L/min, 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 100 mPa·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

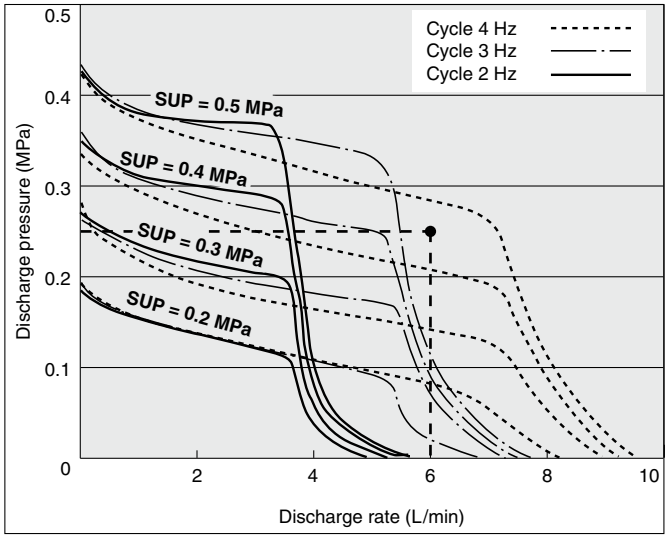
Viscosities up to 1000 mPa·s can be used.
Dynamic viscosity ν = Viscosity μ/Density ρ.

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

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

## Performance Curve: Air Operated Type

### PAP3313 Flow Rate Characteristics




### Selection from Flow Rate Characteristic Graph (PAP3313)

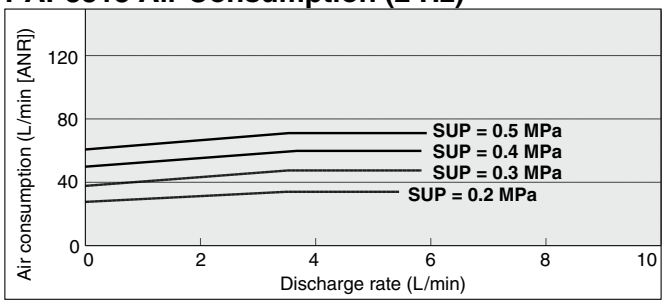
Required specification example: Find the pilot air pressure for a discharge rate of 6 L/min, a discharge pressure of 0.25 MPa, and a cycle of 4 Hz. <The transfer fluid is fresh water (viscosity 1 mPa·s, specific gravity 1.0).>

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

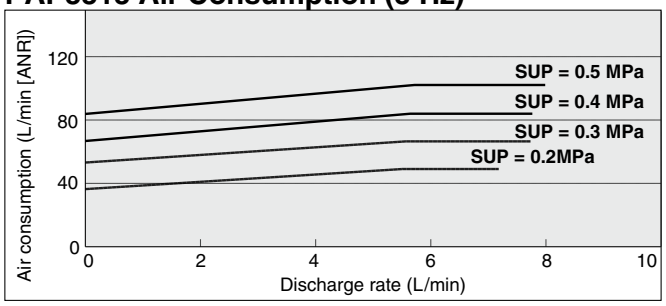
Selection procedures:

1. First mark the intersection point for a discharge rate of 6 L/min and a discharge pressure of 0.25 MPa.
2. Find the pilot air pressure for the marked point. In this case, the point is between the discharge curves (solid lines) for SUP = 0.4 MPa and SUP = 0.5 MPa, and based on the proportional relationship to these lines, the pilot air pressure for this point is approximately 0.45 MPa.

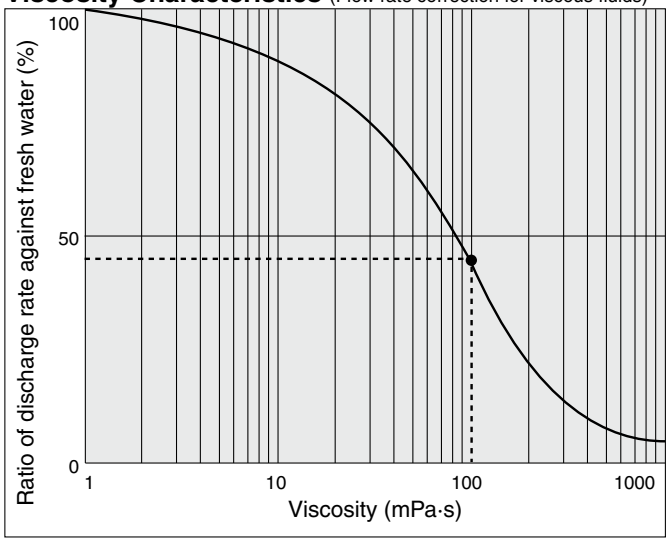
### PAP3313 Air Consumption (2 Hz)



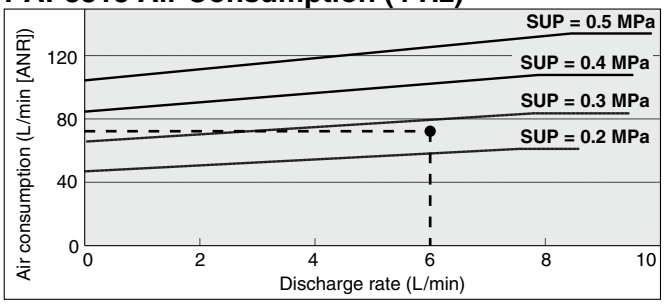

### PAP3313 Air Consumption (3 Hz)




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




### PAP3313 Air Consumption (4 Hz)




### Calculating Air Consumption (PAP3313)

Required specifications example:

Find the pilot air consumption for a discharge rate of 6 L/min, a cycle of 4 Hz and a pilot air pressure of 0.25 MPa.

Selection procedures:

1. In the graph for air consumption (4 Hz), start at a discharge rate of 6 L/min.
2. Mark where this point intersects with the air consumption rate. Based on the proportional relationship between these lines, the intersection point will be between the discharge curves SUP = 0.2 MPa and SUP = 0.3 MPa.
3. From the point just found, draw a line to the Y-axis to find the air consumption. The result is approximately 70 L/min (ANR).

#### ⚠Caution

1. These flow rate characteristics are for fresh water (viscosity 1 mPa·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 for a discharge rate of 2.7 L/min, discharge pressure of 0.25 MPa 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 100m Pa·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.

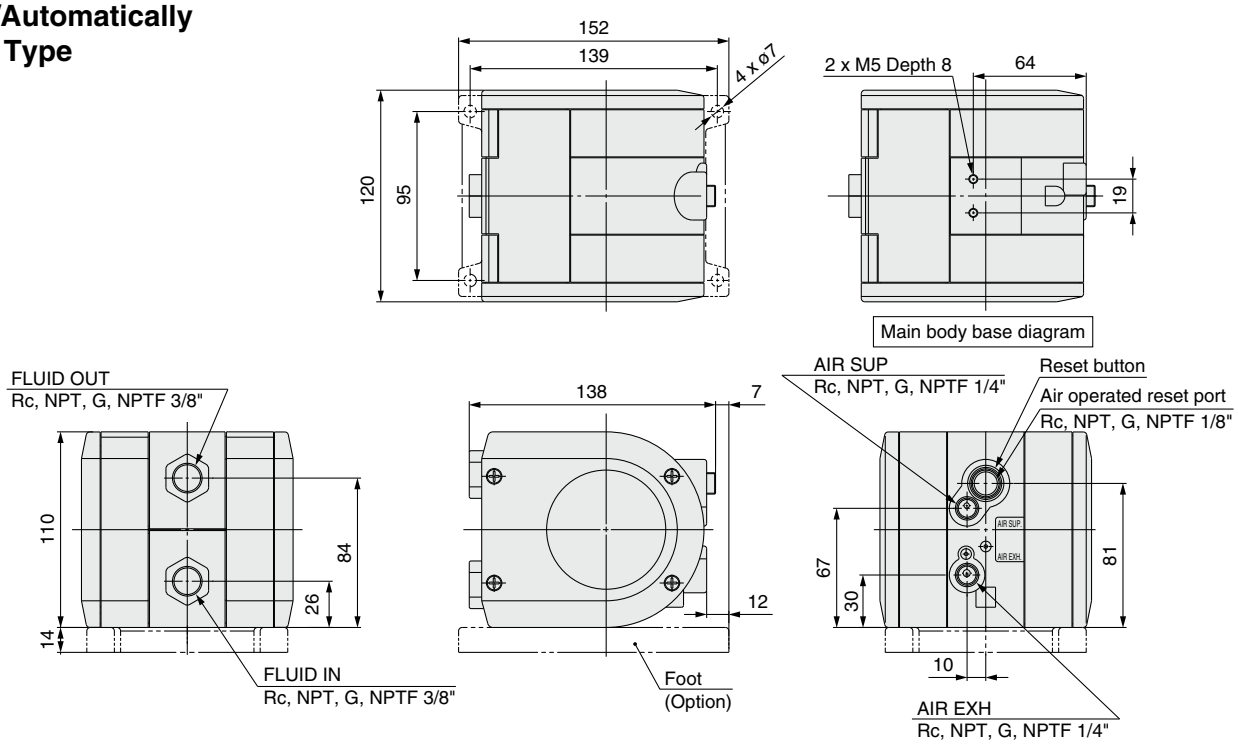
Dynamic viscosity $\nu$ = Viscosity $\mu$/Density $\rho$.

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

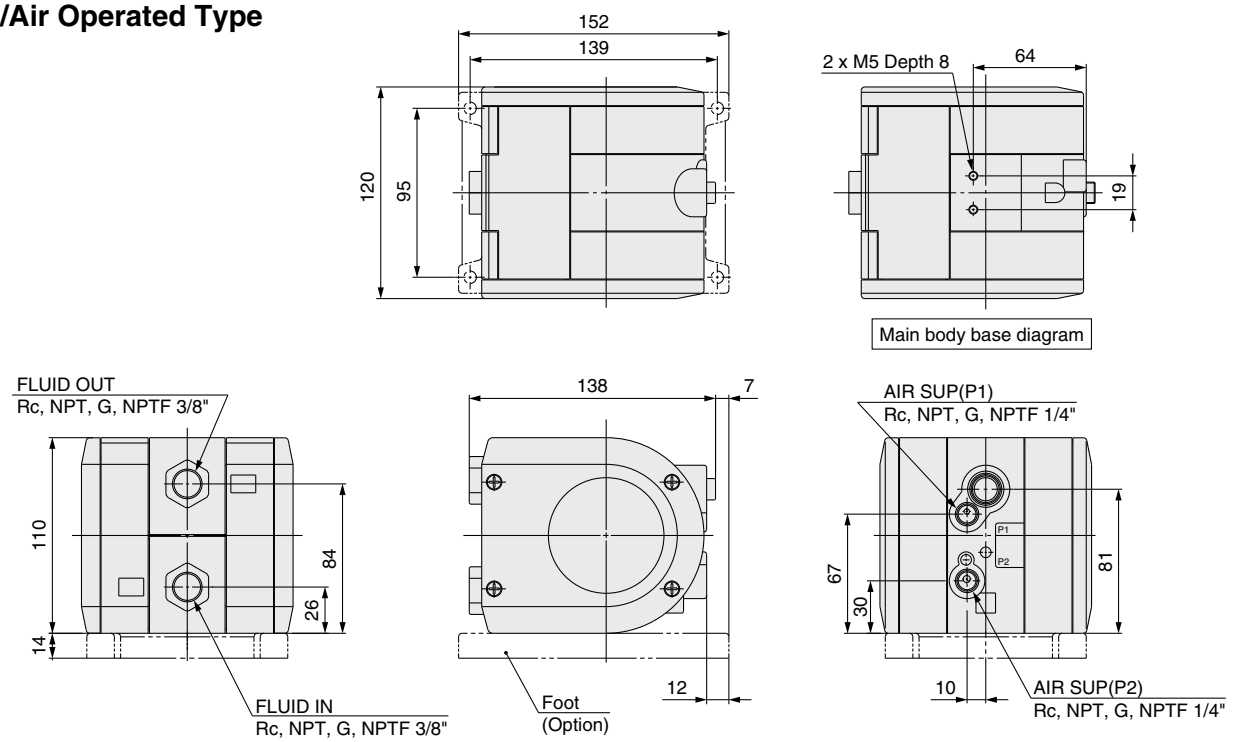
$\nu(10^{-3}\ m^2/s) = \mu(mPa{\cdot}s)/\rho(kg/m^3)$

## Dimensions

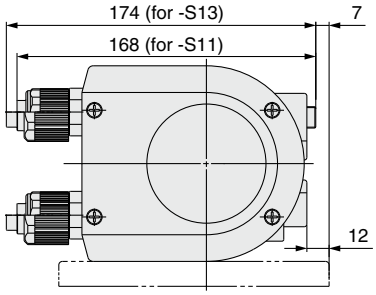
### PAP3310/Automatically Operated Type



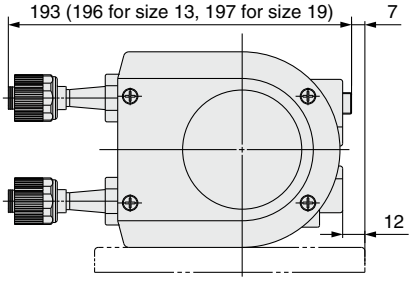

### PAP3313/Air Operated Type




**Integrated fitting type**




**With nut**




**Tube extension**