

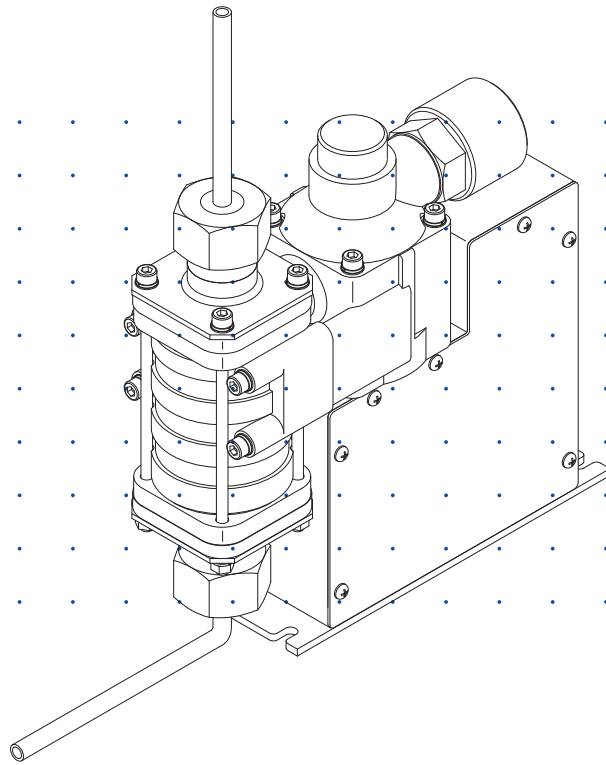
# Iwaki

## Photoresist Dispensing Pump

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### PDS-105 RA/RB

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## Instruction manual

Thank you for choosing our product.

 Please read through this instruction manual before use.

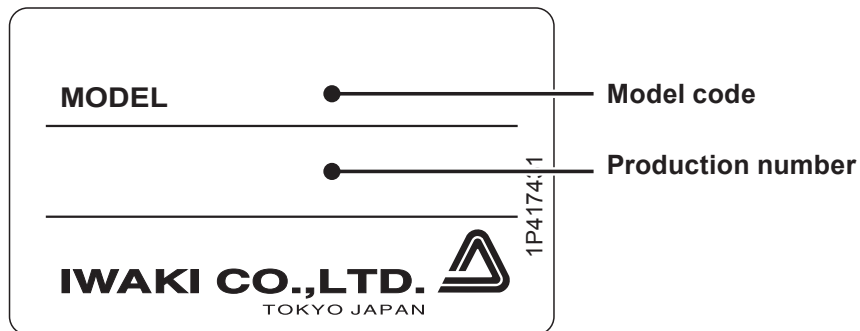
This instruction manual describes important precautions and instructions for the product. Always keep it on hand for quick reference.

## Order confirmation

Open the package and check that the product conforms to your order. If any problem or inconsistency is found, immediately contact your distributor.

### **a. Check if the delivery is correct.**

Check the nameplate to see if the information such as model codes and production number are as ordered.



### **b. Check if the delivery is damaged or deformed.**

Check for transit damage and loose bolts.

# Contents

Order confirmation .....	2
<b>Safety instructions.....</b>	<b>5</b>
Warnings .....	6
Cautions .....	7
Precautions for use .....	8
<b>Overview.....</b>	<b>9</b>
Introduction .....	9
Pump structure & Operating principle .....	9
Discharge process .....	9
Suction process .....	10
Identification codes .....	11
<b>Installation .....</b>	<b>12</b>
Before installation.....	12
Installation/Piping/Wiring .....	13
Installation .....	13
Piping .....	13
Wiring .....	14
A connector (signal) .....	14
B connector (motor).....	14
<b>Operation.....</b>	<b>15</b>
Pump setting .....	15
Pulse input direction & Motor rotation .....	15
Number of pulses & Discharge capacity (RV).....	15
The lower limit of the motor-driven cylinder .....	15
Motor waiting time .....	16
Pump operation.....	16

## **Maintenance.....17**

<b>Troubleshooting .....</b>	<b>17</b>
<b>Inspection .....</b>	<b>18</b>
Daily inspection .....	18
Wear part list .....	18
<b>Specification/Outer dimension.....</b>	<b>19</b>
Specification.....	19
Pump .....	19
Stepping motor .....	20
Encoder (RB type).....	20
Home sensor .....	20
Pressure sensor .....	20
Outer dimension .....	21
PDS-105R A/B .....	21
Part names .....	22
PDS-105R A/B .....	22

# Safety instructions

**Read through this section before use. This section describes important information for you to prevent personal injury or property damage.**

## ■ Symbols

In this instruction manual, the degree of risk caused by incorrect use is noted with the following symbols. Please pay attention to the information associated with the symbols.

 **WARNING** Indicates mishandling could lead to a fatal or serious accident.

 **CAUTION** Indicates mishandling could lead to personal injury or property damage.

A symbol accompanies each precaution, suggesting the use of "Caution", "Prohibited actions" or specific "Requirement".

Caution marks	Prohibited marks	Requirement marks
 Caution  Electrical shock	 Prohibited  Do not rework or alter	 Requirement  Wear protection  Grounding

## Export restrictions

Information contained within this instruction manual may be considered controlled technology as set by the Japanese Ministry of Economy, Trade and Industry (METI). An export license issued by METI may be required when exporting or providing the manual to a 3rd party.

## ⚠ WARNING



Requirement

### Turn off power before work

Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed. Let other people know about the situation by displaying a notice such as "POWER OFF (Maintenance)" near the power switch.



Requirement

### Stop operation

If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.



Prohibited

### Do not use the pump in any condition other than its intended purpose

The use of the pump in any conditions other than those clearly specified may result in failure or injury. Use this product in specified conditions only.



Do not remodel

### Do not modify the pump

Alterations to the pump carries a high degree of risk. It is not the manufacturer's responsibility for any failure or injury resulting from alterations to the pump.



Wear protectors

### Wear protective clothing

Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work. The specific solution will dictate the degree of protection. Refer to MSDS precautions from the solution supplier.



Requirement

### Spill precautions

Ensure protection and containment of solution in the event of plumbing or pump damage (secondary containment).

**⚠ CAUTION**

Requirement

**Qualified personnel only**

The pump should be handled or operated by qualified personnel with a full understanding of the pump. Any person not familiar with the product should not take part in the operation or maintenance of the pump.



Prohibition

**Use specified power only**

Do not apply any power other than that specified on the nameplate. Otherwise, failure or fire may result. Ensure the pump is properly grounded.



Requirement

**Ventilation**

Fumes or vapours can be hazardous with certain solutions. Ensure proper ventilation at the operation site.



Prohibition

**Do not install or store the pump:**

- In a flammable atmosphere.
- In a dusty/humid environment.
- In a corrosive atmosphere.



Requirement

**Flushing before operation**

Flush the inside of the pump and piping with pure water or the liquid to be delivered before the start of operation.



Requirement

**Static electricity**

When low electric conductivity liquids such as ultra-pure water and fluor inactive liquid (e.g. Fluorinert™) are handled, the static electricity may be generated in the pump and may cause static discharge. Take counter-measures to remove the static electricity.



Requirement

**Wear part replacement**

Follow instructions in this manual for wear part replacement. Do not dismantle the pump beyond the extent of the instructions.



Requirement

**Before returning product**

Be sure to drain chemicals and clean the inside of the pump before return so that a harmful chemical does not spill out in transit.



Requirement

**Disposal of a used pump**

Dispose of any used or damaged pump in accordance with relevant regulations. Consult a licensed industrial waste products disposing company.

## Precautions for use

- Electrical work should be performed by a qualified electrician. Otherwise, personal injury or property damage could result.



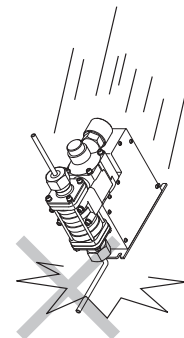
- Do not install the pump:
  - In a flammable atmosphere.
  - In a dusty/humid place.
  - In a corrosive atmosphere.



- Allow sufficient space around the pump for easy access and maintenance.



- Use care handling the pump. Do not drop. An impact may affect pump performance. Do not use a pump that has been damaged to avoid the risk of electrical damage or shock.



- The pump is not waterproof. Do not operate the pump while wet with solution or water. Failure or injury may result. Immediately dry off the pump if it gets wet.



- Do not close discharge line during operation. Solution may leak or piping may break.



- Solution in the discharge line may be under pressure. Release the pressure from the discharge line before disconnecting plumbing or disassembly of the pump to avoid solution spray.



- Wear protective clothing when handling or working with pumps. Consult solution MSDS for appropriate precautions. Do not come into contact with residual solution.





# Overview

**Pump characteristics, features and part names are described in this section.**

## Introduction

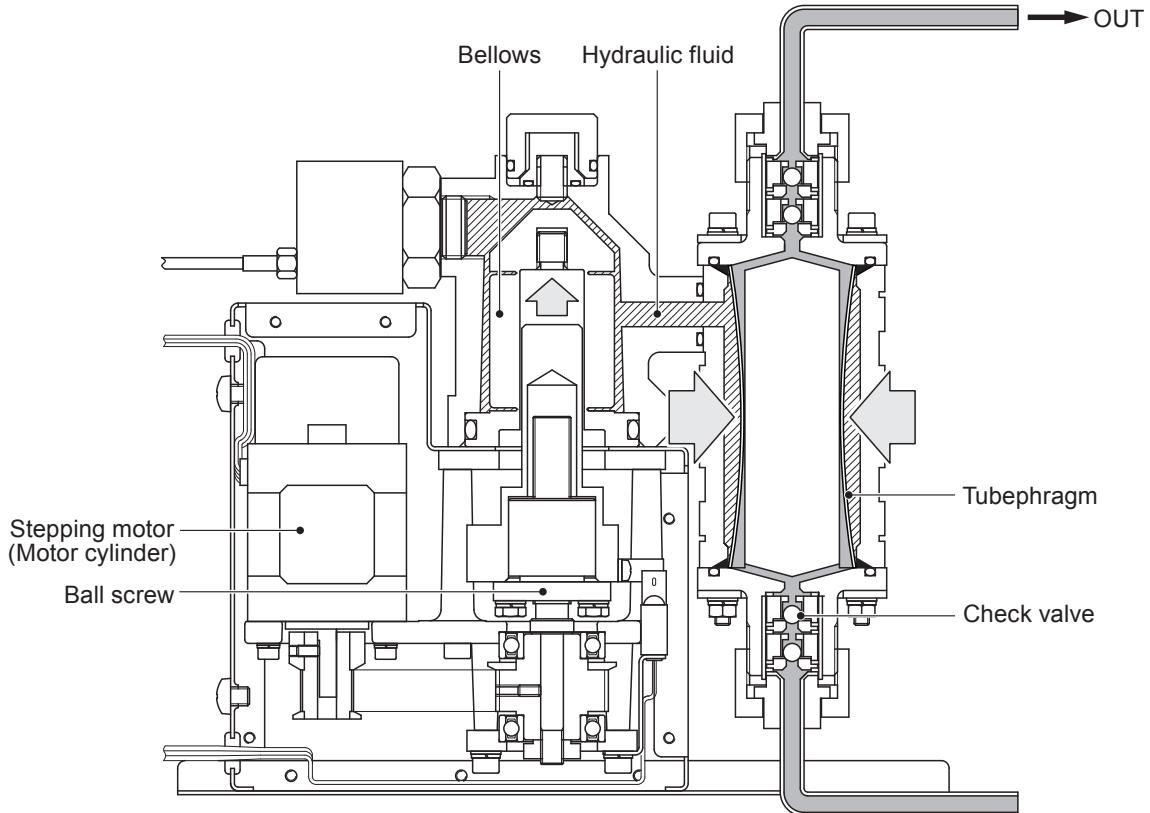
### **Pump structure & Operating principle**

The rotational motion of the stepping motor is changed to linear motion by the direct drive unit. Liquid is loaded into the pump head and then delivered to a discharge line as the bellows reciprocates.

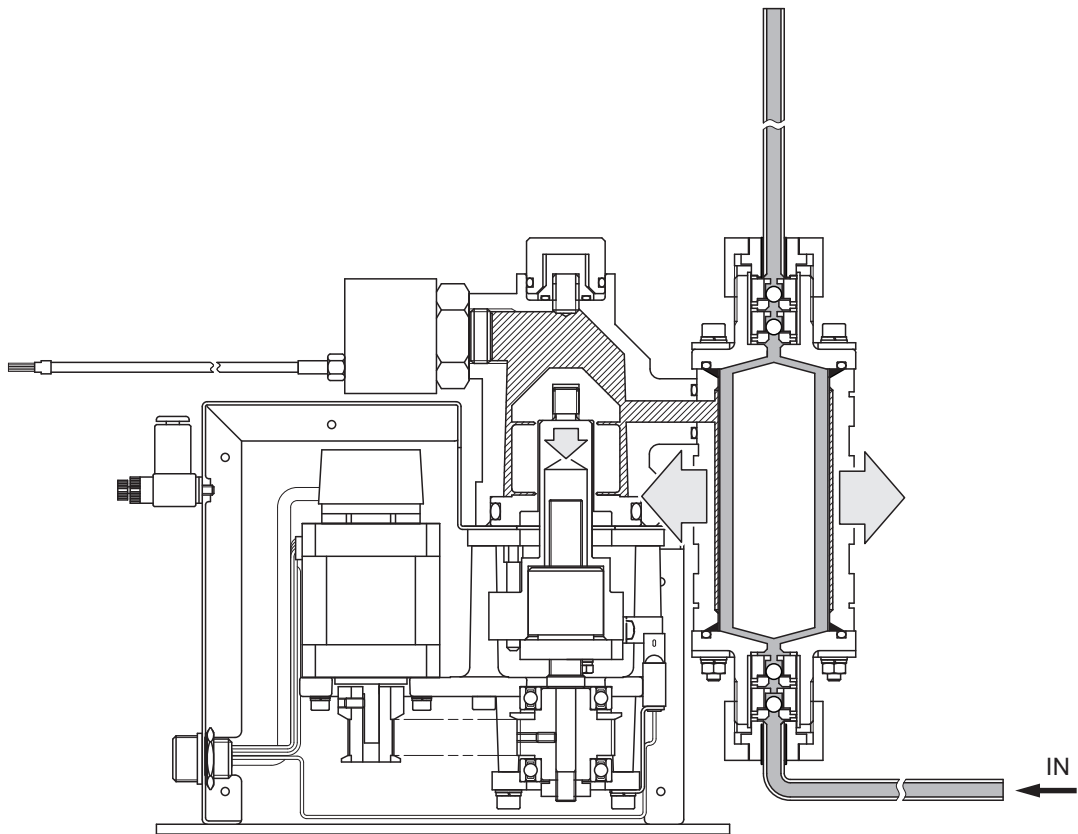
#### **Principle of operation**

- The bellows expands and contracts as the ball screw reciprocates.
- The reciprocating motion of the bellows compresses or expands the shape of the tubeaphragm via hydraulic fluid.
- Volumetric change is created in the tubeaphragm as it is compressed or expanded.
- Liquid is taken in as the tubeaphragm expands and is pushed out as it contracts in sync with the action of the check valves (pump head valves).

#### ■ Discharge process



■ Suction process



## Identification codes

Each code represents the following information.

### **PDS - 1 05 RA - K P W2**

**a      b   c   d      e   f   g**

**a. Series name**

**b. Product classification**

1: Pump

**c. Flow rate**

05: 5.0ml/shot (max discharge capacity)

**d. Drive unit**

RA: Compact type

RB: With an encoder (line driver)

**e. Wet end O ring**

K : Kalrez®

**f. Pressure sensor**

P : Positive pressure sensor (0-1000kPa)

T : Compound pressure sensor (-100 - 300kPa)

**g. Inlet/outlet I.D.**

W2: 1/4" (ø6.35×ø4.35mm) PFA tube connection

M6: ø6×ø4 [mm] PFA tube connection

# Installation

***This section describes the installation of the pump, piping and wiring. Read through this section before work.***

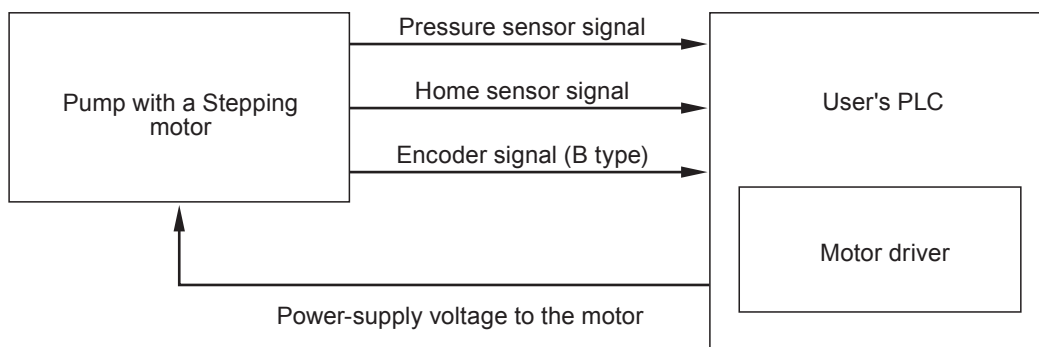
## **! Points to be observed**

Observe the following points when installing the pump.

- Be sure to turn off power to stop the pump and related devices before service is performed.
- Be careful for the power not to be turned on during work.
- If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.
- Do not install the pump in a flammable atmosphere.

## Before installation

*A driver in a user's PLC and other related devices are necessary for operation. Purchase these devices separately as needed. The following diagram is a general system example. Configure your system in accordance with an actual service condition.*



### **! Points to be observed**

Observe the following points during wiring work.

- Electrical work should be performed by a qualified electrician. Always observe applicable codes or regulations.
- Do not perform wiring work while the power is on. Otherwise, an electrical shock or short circuit may result. Be sure to turn off power before wiring work.
- Be careful for the power not to be turned on during work.

#### NOTE

Do not hold the pump head to lift the pump unit up, or the pump head may deform and a leak may result.

### **Installation**

*Observe the following points during installation.*

#### ● **Installation location**

Mount the pump indoors. Allow sufficient space around the pump for easy access and maintenance.

#### ● **Mounting position**

Install the pump as close to a supply tank as possible in a flooded suction system.

#### ● **Mounting direction**

Always direct the outlet upward. Keep the pump head in a vertical position with the check valves upright. Otherwise, performance may be reduced.

#### ● **Anchoring**

Fix the pump with four M4 mounting screws (with PW and SW).

### **Piping**

*Observe the following points during pipework.*

#### ● **Pipe connection**

Both inlet and outlet of the pump have PFA tube joints. Secure every joint properly to eliminate any possibility of air ingress, or performance may be reduced.

#### ● **Fitting and tube**

Take account of corrosion and pressure resistance when selecting fittings and tubes.

#### ● **Pipe resistance**

Keep a piping length shortest with the minimum number of bends.

## Wiring

See the table below for wiring with each device.

### ■ A connector (signal)

Pin number	Terminal assignment
A*	Encoder A phase + Line driver output
B*	Encoder A phase - Line driver output
C*	Encoder B phase + Line driver output
D*	Encoder B phase - Line driver output
E	GND (common)
F	Sensor output (open collector)
G	5-24VDC (home sensor power)
H	5VDC (encoder power)

\*The RA type does not equipped with the encoder.

### ■ B connector (motor)

Pin number	Terminal assignment
A	Driver connector PIN1 (Blue motor lead)
B	Driver connector PIN2 (Red motor lead)
C	Driver connector PIN3 (Orange motor lead)
D	Driver connector PIN4 (Green motor lead)
E	Driver connector PIN5 (Black motor lead)

# Operation

**This section describes pump operation. Observe instructions in this manual. See manufacturer's instruction manual for the motor driver.**

## Pump setting

First, program operation of the pump.

### Pulse input direction & Motor rotation

The pump lets out liquid at the input of the CCW direction command pulse and takes in liquid at the input of the CW direction command pulse.

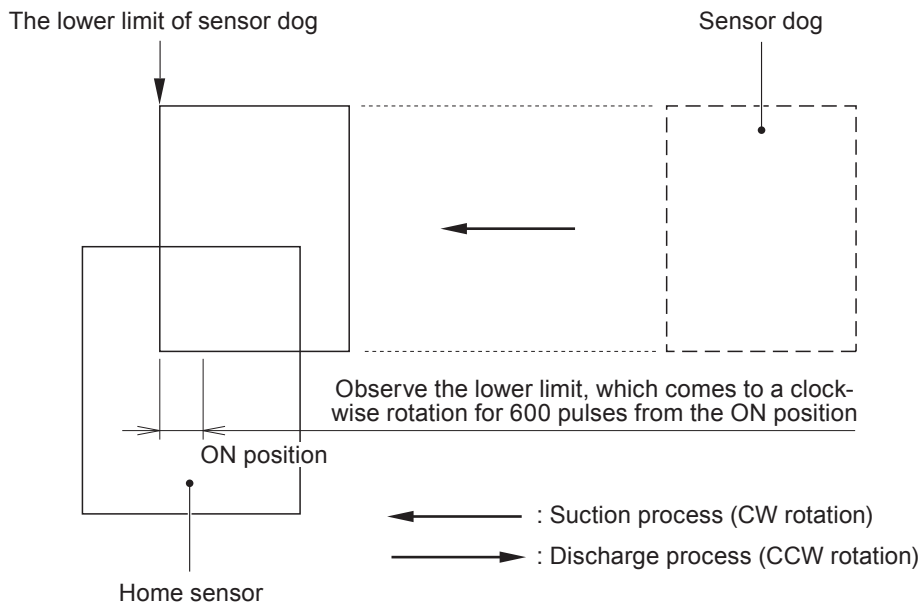
The motor-driven cylinder is at the origin at factory default setting. Before operation, use a tester to check an output of the home sensor is at the "L (GND)" level.

### Number of pulses & Discharge capacity (RV)

Calculated flow rate	Number of input pulses
1ml	2400
2ml	4800
3ml	7200
4ml	9600
5ml	12000

\*The above data is based on the assumption that the driver is set to half step with the motor-driven cylinder at the origin. Actual discharge capacity varies with a piping condition or so.

### The lower limit of the motor-driven cylinder



#### NOTE

Do not move the motor-driven cylinder over the lower limit.

## Motor waiting time

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A discharge and a suction process are repeated in turn during operation, changing the rotational direction of the motor. A motor waiting time until a shift of a rotational direction needs to be programmed before operation. See the formula below for detail.

$$T \geq t/2$$

T: Waiting time

t : Discharge time or suction time, whichever is longer.

---

### NOTE

- The motor may step out if the waiting time is too short. "Step out" means the motor rotates out of a specified step angle and number of pulses.
  - The maximum discharge speed is 4ml/sec, however, hydraulic fluid pressure may rise sharply depending on liquid viscosity and piping conditions, and may overload the bellows. Do not set a discharge speed too fast.
  - Suction pressure may be too low (negative) and trigger cavitation depending on operating conditions such as liquid viscosity, piping layouts and suction speed (max. 3ml/sec). Adjust the suction speed as necessary.
- 

## Pump operation

### 1 Filter flushing

Check that filter has been flushed in user's system.

#### NOTE

See manufacturer's manual for filter flushing.

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### 2 Degassing

Eliminate air from the filter cartridge before operation. Air in a filter or a pipeline reduces a flow rate.

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### 3 Open a suction and a discharge line fully.

#### NOTE

Do not close a valve on a suction line or a discharge line during operation. It may pose a leak or blow out the pump or a pipe.

---

### 4 Operation

Start operation along with a program.

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# Maintenance

**This section describes troubleshooting, inspection, specification and dimensions.**

## **!** Points to be observed

Observe the following points during maintenance work.

- Follow instructions in this manual for replacement of wear parts. Do not disassemble the pump beyond the extent of the instructions.
- Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work. The specific solution will dictate the degree of protection. Refer to MSDS precautions from the solution supplier.
- Solution in the discharge line may be under pressure. Release the pressure from the discharge line before disconnecting plumbing or disassembly of the pump to avoid solution spray.
- Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.

## Troubleshooting

*First check the following points. If the following measures do not help remove problems, contact your distributor.*

States	Possible causes	Solutions
The pump does not run.	Faulty wiring	• Correct wiring and resume operation.
	Power-supply voltage is too low.	• Observe the rated voltage of the pump.
	Motor failure	• Check the motor. Replace as necessary.*
Liquid can not be pumped up.	Air ingress through a suction line.	• Reroute piping.
	A failed O ring seal.	• Check O rings. Replace as necessary.*
	Foreign matters are stuck in the flow path in the pump head or piping.	• Dismantle, inspect and clean the pump head or piping. Replace as necessary.*
	Malfunction of an air-operated valve.	• Check the valve. Replace as necessary.
	A check valve (pump head valve) is stuck on a valve seat.	• Dismantle, inspect and clean the valve. Replace as necessary.*
A flow rate fluctuates.	Foreign matters are stuck in a pipe line.	• Dismantle, inspect and clean the line. Replace as necessary.
	Air stays in the pump head or in a pipe line.	• Expel air.
	A check valve (pump head valve) is stuck on a valve seat.	• Dismantle, inspect and clean the valve. Replace as necessary.*
	A failed O ring seal.	• Check O rings. Replace as necessary.*
	A hydraulic fluid leak	• Check for a leak. Replace as necessary.*
	Motor failure	• Check the motor. Replace as necessary.*
Sensor signal is not outputted.	Faulty wiring	• Correct wiring and resume operation.
	Sensor failure	• Check a sensor. Replace as necessary.*

\*Solutions marked with \* are conducted by us.

## Inspection

*Perform daily inspection to keep pump performance and safety.*

### **Daily inspection**

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*Check for a leak or any other abnormality during operation. Upon sensing abnormality, stop operation immediately and remove problems according to "Troubleshooting".*

### **Wear part list**

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*To run the pump for a long period, wear parts need to be replaced periodically or when pump performance has reduced. Contact your distributor for detail.*

Part names	Q'ty	Estimated life	Remarks
O ring	2	Kalrez®	AS568-129
Valve gasket	10	PTFE	
Valve guide	4	PTFE	
Valve	4	RUBY	
Valve seat	4	PCTFE	
Valve case	2	PCTFE	

## Specification/Outer dimension

### Specification

Information in this section is subject to change without notice.

#### ■ Pump

Item	Spec
Max discharge capacity	5.0 [ml/shot]
Max discharge pressure*4&6	150 [kPa]
Pressure resistance	300 [kPa]
Discharge speed	0.1-4.0 [ml/sec]
Suction speed*1	0.1-3.0 [ml/sec]
Resolution	0.01 [ml]
Discharge accuracy	±0.3 [%]F.S
Linearity*5	±0.5 [%]F.S
Allowable liquid viscosity	Max.100 [mPa·s]
Allowable surface temperature*2	Max.30 [°C]
Number of pulses per discharge capacity*3	2400 [pulse/ml]
Ambient temperature	10-40 [°C]
Ambient humidity	30-45 [%RH]
Allowable liquid temperature	15-25 [°C]
Weight	3 [kg]

\*1 Suction pressure may be too low (negative) and trigger cavitation depending on operating conditions such as liquid viscosity, piping layouts and suction speed (max. 3ml/sec). Adjust the suction speed as necessary.

\*2 The allowable surface temperature is based on operation at ambient of 22±1°C, with full stroke length and 1 shot/min.

\*3 The number of pulses per discharge capacity is a reference value.

\*4 Set the discharge speed not to exceed the max discharge pressure.

\*5 When handling viscous liquid, linearity may reduce depending on piping layout. In this case linearity can be maintained by closing a discharge-side air operated valve after the discharge action of the pump. Determine a delay time in accordance with operating conditions.

\*6 Do not close a valve on a suction line or a discharge line during operation. It may pose a leak or blow out the pump or a pipe.

## ■ Stepping motor

Items	Spec
Manufacturer	ORIENTAL MOTOR Co, Ltd.
Model	PK545-NB or equivalent
Maximum holding torque	0.23 N·m
Rated current	0.75A/Phase
Step angle	0.72°
Insulation resistance	B class (130°C)

The above data is based on use of an ORIENTAL MOTOR CSD5807N2-P driver.

## ■ Encoder (RB type)

Items	Spec
Manufacturer	Microtech Laboratory Inc.
Model	MGH-20-500-E
Supply voltage	5VDC±0.5%
Consumption current	60mA or below
Detection	Incremental
Number of output pulses	500
Output phase	2-phase (A and B)
Output type	Line driver

## ■ Home sensor

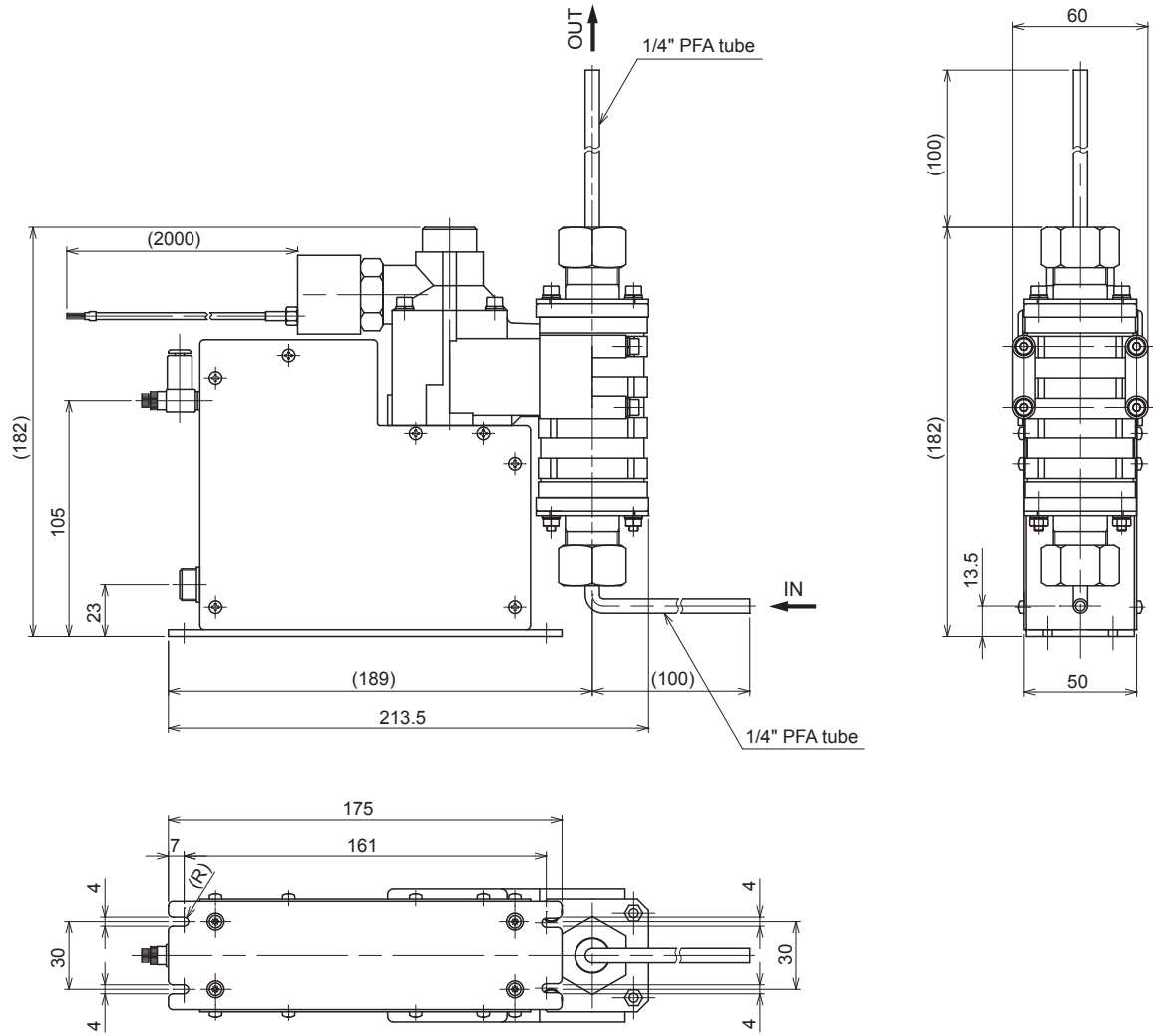
Items	Spec
Manufacturer	OMRON
Model	EE-SX670A
Supply voltage	5-24VDC±10%
Sensor logic	Normally open
Output type	Open collector
Output operation	Dark-ON

## ■ Pressure sensor

Items	Spec		
Manufacturer	Nidec Copal Corporation		
Model	P	PA-850-103G-NGF	
	T	PA-850-302R-NGF	
Rated pressure	P	103G: 0-1000	
	T	302R: -100 - 300	
Supply voltage	10.8-30VDC		
Consumption current	20mA or below		
Output type	Analogue		
Output voltage	1-5VDC		
Lead colour	Brown	Input	10.8-30VDC
	Blue	Input	0VDC (GND)
	White	Output	Analogue

# Outer dimension

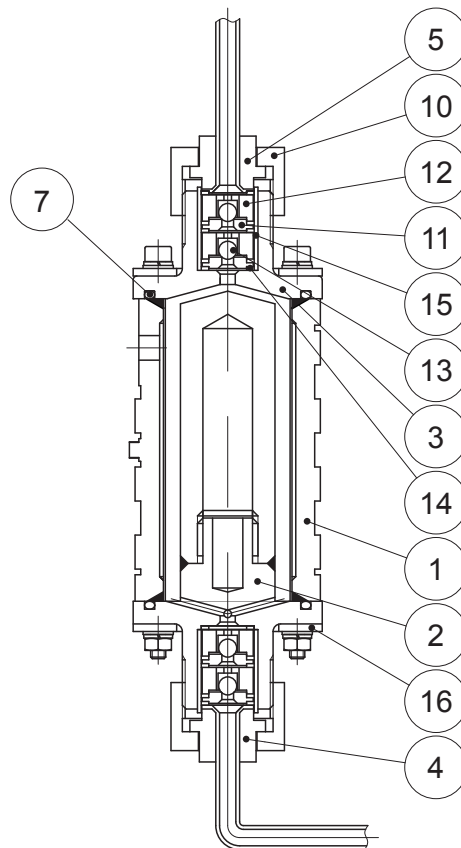
## ■ PDS-105R A/B



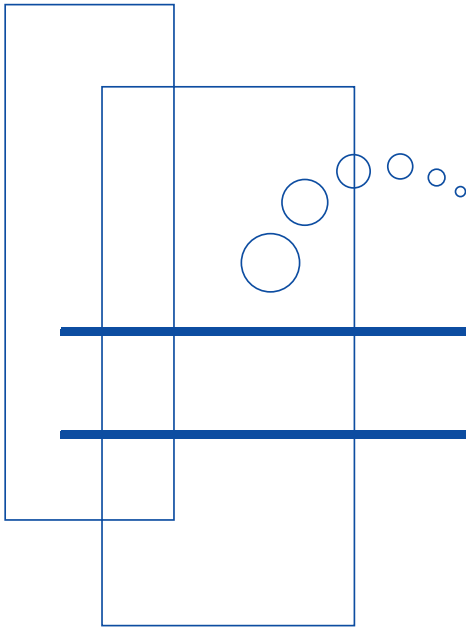
## Part names

### ■ PDS-105R A/B

No.	Name	Q'ty	Material	Remarks
1	Pump head unit	1	PFA	
2	In port unit	1	PFA	
3	Out port	1	PFA	
4	In connecting port	1	PFA	
5	Out connecting port	1	PFA	
7	O ring	2	Kalrez®	AS568-129
10	Valve cap	2	PP	
11	Valve seat	4	PCTFE	
12	Valve guide	4	PTFE	
13	Valve	4	RUBY	3/16"
14	Valve gasket	10	PTFE	
15	Valve case	2	PCTFE	
16	Port support	2	SUS304	







<http://www.iwakipumps.jp>

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