IWAKI PUMPS

IWAKI
PNEUMATIC-DRIVEN BELLOWS PUMP

CFD-8T-B TYPE

Instruction Manual

⚠ Read this manual before use of product

Thank you for having purchased the Iwaki Bellows Pump Model: CFD-8T-B. This pump is designed for use in metering strong acids, etc.

(1) This instruction manual deals with the correct handling, maintenance and inspection, and troubleshooting methods for the pump. To ensure safe and efficient operation, please read this manual carefully before actually handling or operating the pump.

(2) The use of this pump involves the handling of considerably dangerous liquids such as strong acids. Be sure to take adequate safety measures before operation.

(3) The APD-3 type controller and other safety devices are used to operate this pump. Please read the respective instruction manuals carefully to ensure safe and efficient operation.

Contents

Important instruction

For the Safe and
Correct Handling of the controller

- "Safety Instruction" section mentions important details about the handling of the product. Before the use of controller, read this section carefully for the prevention of personnel injury or loss.
- Observe the instructions accompanied with "WARNING" or "CAUTION" in this manual. These instructions are very important for protecting pump users from the dangerous situations.
- The symbols on this instruction manual have the following meanings:

⚠ **WARNING**	**Nonobservance or misapplication of the contents of the "Warning" section could lead to a serious accident which may result in death.**
⚠ **CAUTION**	**Nonobservance or misapplication of the contents of the "Caution" section could lead to the personal injury to users or serious damage to the product.**

Types of Symbols

Indicates that "Warning" or "Caution" must be exercised. Inside this triangle, a concrete and practical image provided as a warning or caution message is depicted.

Indicates a prohibited action or procedure. Inside or near this circle, a concrete and practical image of the activity to be avoided is depicted.

Indicates an important action or procedure which must be performed or carried out without fail. Failure to follow the instructions herein can lead to malfunction or damage to the pump.

Safety Instructions

⚠ WARNING

- **Look around**
  Make sure there is no one around the pump when connecting the power cable. The power supply switch is not provided on the pump. Connecting the power cable, the pump starts pump operation.


Caution

- **Do not remodel pump**
  Never remodel the pump. Iwaki is not responsible for the accidents or damages that may result from any remodeling without first obtaining permission from Iwaki.


No Remodeling

- **For specified application only**
  The use of a pump in any application other than those clearly specified may result in injury or damage to the pump. Use the pump strictly in accordance with the pump specifications and application range.


Prohibited

- **Do not drain**
  Never discharge the hazardous liquid such as chemical liquid over the ground or floor in the plant directly.
  Abide by local regulations when disposing of hazardous substances.


Prohibited

- **Do not touch**
  The pump or piping can be extremely hot due to the circulation of a hot liquid. Touching them directly in the high temperature liquid transfer may cause severe burns. Arrange adequate hand-protective measures when feeding a liquid at temperatures higher than 50 °C.


DO not touch

⚠ CAUTION

- **Do not exceed the specified voltage**
  Do not supply power voltage in excess of the level specified. Otherwise, a fire or electric shock may result.


Prohibited

- **Wear protectors**
  Be sure to wear protective gear (protective goggles, cap, mask, acid-resistant gloves) when disassembling, assembling, or maintaining the pump. In addition, clean the pump carefully with pure water before working on the pump.


Wear protective gear

- **Qualified operator only**
  The pump must be operated only by the operator(s) who have been trained for the safe operation of the pump.


Caution

- **Power OFF**
  Make sure no one turns on the power switch while at work. Be sure to turn off the power switch before starting any maintenance/repair work concerning the pump. If the working site is noisy or under low visibility, display a notice which clearly states "Men working(Maintenance)," near the power switch in order to inform other personnel about the situation. If power is turned ON by any other person than the operator/service personnel, a serious accident may result. The operator must take special precautions to avoid accidents.


Power off

Safety Instructions

⚠ CAUTION

- **Storage limit**
  Do not store the pump in explosive atmosphere, dusty place, or corrosive atmosphere(such as chlorine gas). Otherwise, fire or health damage may result.


Prohibited

- **Ventilate site**
  When handling a toxic liquid or odorant, ventilate the working site well. In addition, wear protective gear (protective mask, goggles, gloves, etc.).

- **Disposal of used pump**
  Disposal of the used or damaged pump should be done in accordance with local laws and regulations. (Consult a licensed industrial waste products disposing company.)


Caution

- **Send-back to Iwaki**
  Before sending the pump back to Iwaki, drain the liquid out of the pump and clean the inside thoroughly with water to prevent any accidents during transportation.


Caution

- **Pump stroke speed**
  Do not run the pump in excess of the max. 30 spm. A stroke speed higher than the maximum shortens the life of the bellows.


Caution

- **Supply air pressure**
  Supply air pressure should be maintained within the specified supply air pressure of 0.294MPa{3.0kgf/cm^2}.


Caution

- **Liquid temperature range**
  The temperature of pumped liquid should be 20-60 deg.C.


Caution

- **Prohibited liquids**
  Do not operate the pump with the following liquids.
  · Liquid easily crystallized
  · Liquid containing slurry
  · Solvent naphtha


Prohibited

- **Stopping pump operation**
  Do not leave the pump stopping with chemical in pump for a long time. Some gas penetrates the bellows and may cause corrosion on metal material. Replace the atmosphere inside the pump by running the pump for 10 minutes a day before leaving it stopped for a few days.


Caution

- **During pump operation**
  Make sure to open both the suction and discharge-side valves fully. In addition, confirm that the piping is fully supplied with liquid.


Caution

1. Unpacking and Inspection

After unpacking the pump, check the following points to verify that the contents are exactly as you ordered. If you find any discrepancy, please contact your dealer.

(1) Does the model on the nameplate conform to your order?

(2) Has the pump been damaged in transit?

2. Specifications

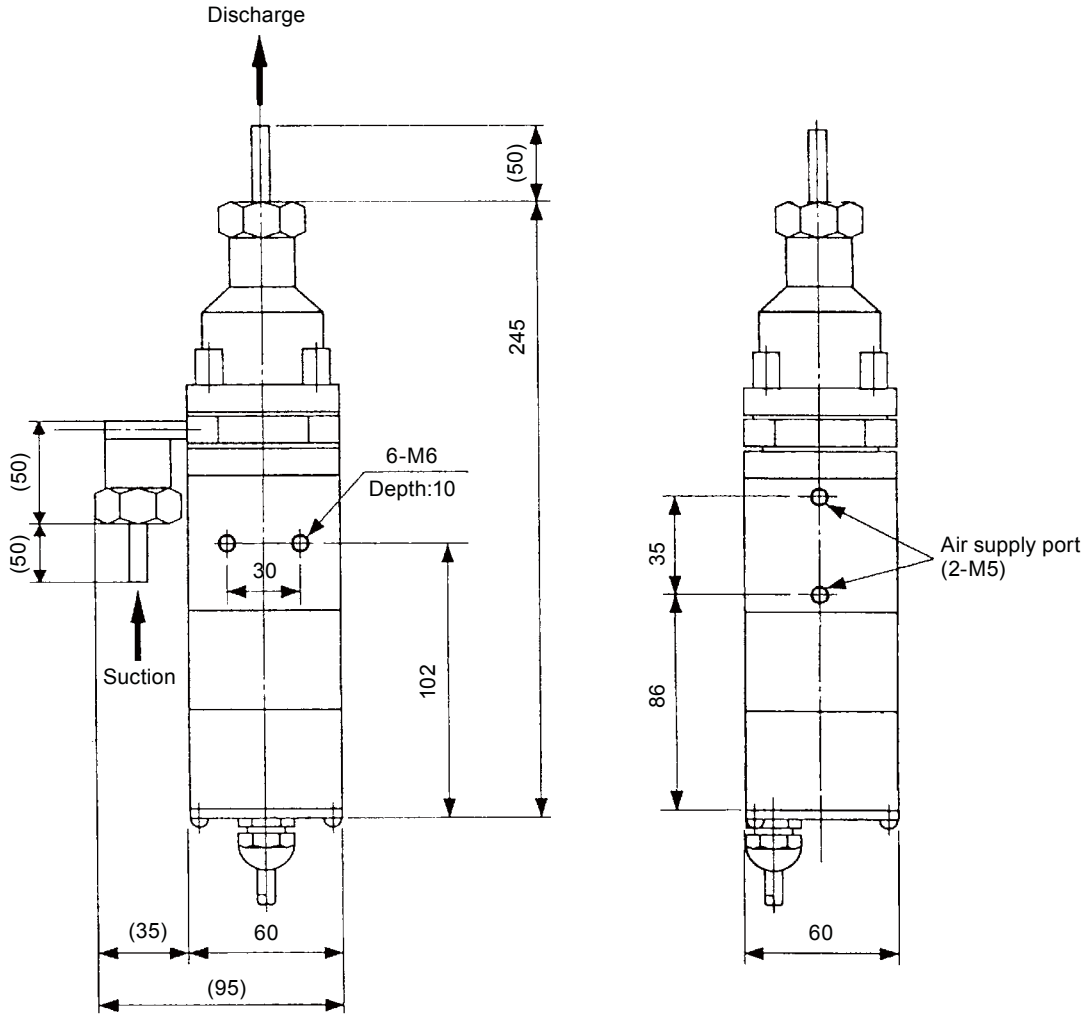
■ Pump Specifications

Specifications		CFD-8T-B Type
General specifications	Discharge mℓ	8
	Max. pressure MPa (PSi)	0.05 (7.11)
	Max. stroke spm	30
	Supply air pressure MPa (PSi)	0.15~0.3 (21.3~43)
	Temperature range of liquid handled deg.F (℃)	68~140 (20~60)
	Air consumption Nℓ/shot	0.18
	Liquid end material	PTFE, PFA
	Pump connection port diameter	1/4" tube (∅ 6.34 × ∅ 4.35mm)
	Supply air connection port diameter	M5
	Mass kg (1b)	1.5 (3.3)
Sensor specifications	Type	Transmission type photo microsensor
	Power source voltage	DC5V
	Output current	Max. 50mA
	Length of lead wire	5m (PVC multicore cable, 4 cores of 6.5mm^2) with round terminal

Note 1. CFD-8T-B is provided with the mechanism of inhibition against syphon action, however, the minute leak (1cc or below/hr) still occurs. Install an air operated valve before a long period of shout down for the prevention of the small leak.

3. Handling Instructions

■ External Dimensions



(1) Use this pump together with the APD-3 type controller.

(2) Prepare the solenoid valve, which changes air direction to operate the pump, and regulator to keep steady air pressure.

(3) Never operate the pump with the discharge side closed. This will raise the pressure in the pump excessively, resulting in faulty operation.

(4) Handle the photo sensor lead wire carefully. Note that forcibly twisting the cord during the wiring process or readjusting on site may result in damage or poor connection in the soldered section for the inner element and the cord.

DANGER

When using a liquid that could injure workers or damage machinery in the vicinity, take appropriate protective measures against possible pump malfunctioning. Never fail to carry out daily and other periodic inspections.

CAUTION

To prevent malfunctioning due to a mixture of water, oil, dust, etc., use humidity- and dust-free, clean instrumentation air as the air supply.

CAUTION

If pump operation is suspended for a long period (more than one week), remove all chemicals from inside of the pump and fill with pure water. Some chemicals (HCR etc) can penetrate the PTFE bellows and metallic shafts can be corroded, if chemicals stay inside of the pump while pump operation is suspended for a long period. As a result, pump operation would be damaged.

4. Installation, Piping, and Wiring

■ Installation

(1) Install the pump as close to the liquid tank as possible.

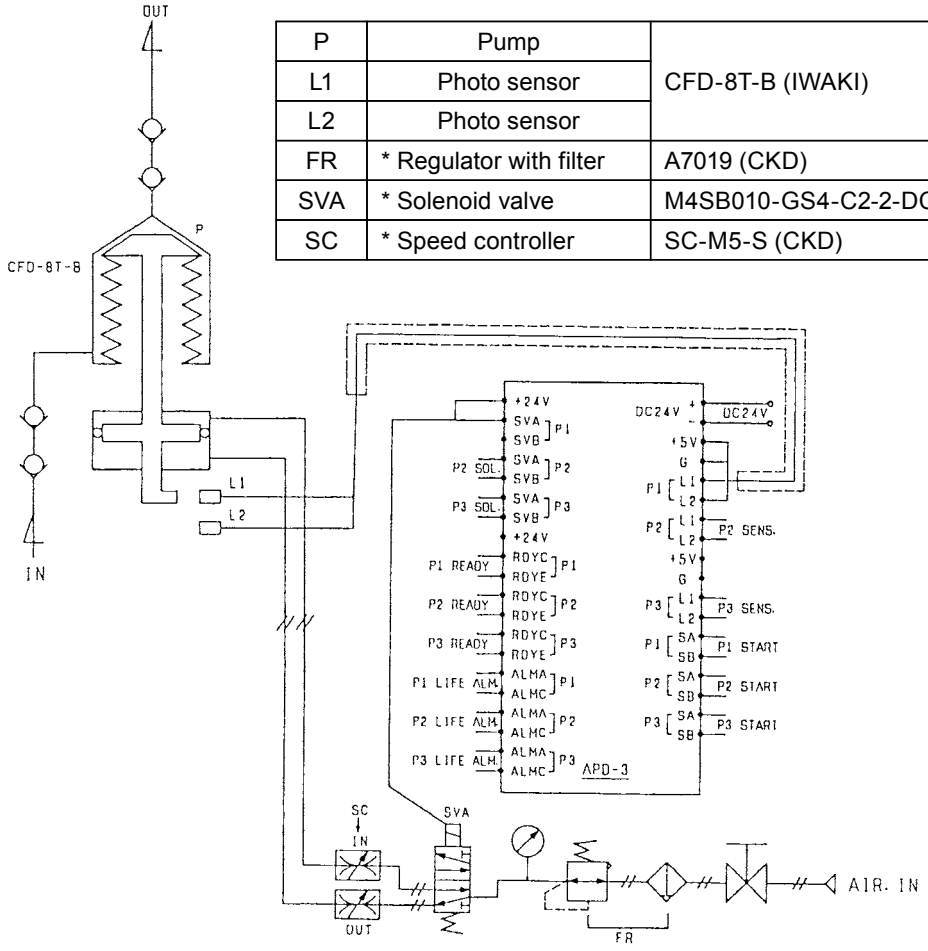
(2) Orient the discharge port upward and the suction port downward, and make sure the bellows in the pump moves up and down. If the pump is not positioned vertically, its performance will be affected.

(3) Use M6 screws to mount the pump firmly.

■ Connection

Carry out the connection of the pump, air-operated valves, and controller in accordance with the Basic Connection Diagram.

Basic Connection Diagram



P	Pump	CFD-8T-B (IWAKI)
L1	Photo sensor	
L2	Photo sensor	
FR	* Regulator with filter	A7019 (CKD)
SVA	* Solenoid valve	M4SB010-GS4-C2-2-DC24V (CKD)
SC	* Speed controller	SC-M5-S (CKD)

Note: The user should prepare the regulator with filter, solenoid valve, and speed controller. The model and maker are given here as examples. If you use products by any other manufacturer, please select the respective equivalent items.

■ Pump Piping

PFA tubes are used for the standard discharge and suction ports. Observe the following piping procedures.

(1) Joints available in the market may be used. However, select those that assure a leakproof connection, considering corrosion resistance and the pressure of the operating liquid.

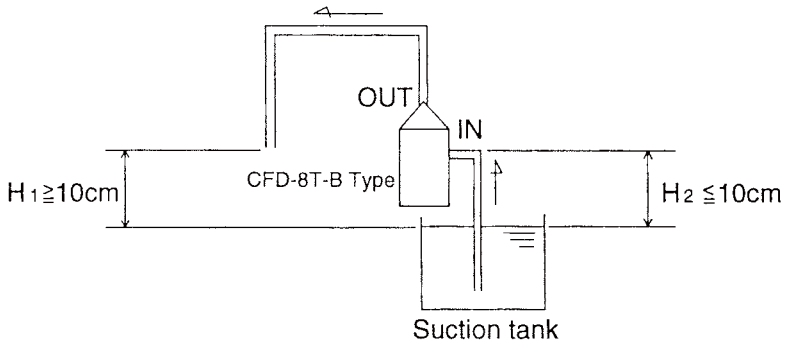
(2) The joints must be fastened firmly so that no air suction or liquid leakage can occur.

(3) The piping must be as short as possible. In addition, the number of bends, joints, cocks, and solenoid valves that increase piping resistance must be kept to a minimum.

(4) The diameter of the pipe must be larger than that of the pump discharge and suction ports.

(5) In case of self-priming application

Recommended flow chart

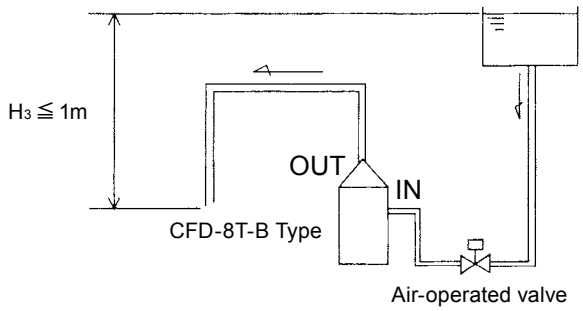


a) Minimum differential height between discharge end and liquid level at suction tank (H1) must be 10cm or more.

b) Differential height between pump and liquid level at suction tank (H2) should be kept within 10cm. If this value is too big, some chemicals create bubbles by their propertry and liquid temperature condition. And this decreases pump performance. For detail, please contact IWAKI.

(6) In case of flooded suction

Example of flooded suction



In case the end of discharge port is below the tank level, siphon phenomenon happens.
This pump is equipped with anti-siphon mechanism but attention must be paid to:

a) When the pump is stopped, the air must be supplied and kept to the direction of discharge.

b) The distance between the end discharge port and the tank level must been kept within 50cm.
If it exceeds 50cm, flow rate increases and discharge accuracy goes down, also the leakage can not be avoided while pump is stopped.
*50cm is value for clear water (δ=1.0)
When high specific gravity liquid is handled, value is changed. In order to get value, please use following formula. Max. differential height=1/specific gravity (m)

c) Pump speed must be fixed between 30 - 20spm. If the speed is slower than 20spm, discharge flows increases thus accuracy goes down.

d) When the pump is stopped more than 24hours, a slight leakage happens. To avoid any leakage, air-operated valve must be installed at suction side piping.

■ Air piping

Use M5 thread for connecting the pipe to the pump air supply port. Observe the following piping procedures.

(1) Use a ∅6 × ∅4mm tube to connect the air pipe with air instruments.

(2) Carry out sufficient flushing inside the pipe to eliminate rust, burrs, and other foreign matter prior to installation.

(3) Use humidity- and dust-free, clean instrumentation air as the air supply.

(4) Extend the pipe from the secondary side of the regulating valve to the "P" port of the solenoid valve.

(5) Connect the pump (CFD-8T-B) and the solenoid valve by connecting OUT with "A" port and IN with "B" port on the solenoid valve and the pump.

* Refer to the 'APD-3 Type Controller Instruction Manual' for details.

■ Electrical Wiring

Faulty wiring may cause failure or malfunctioning of the photo sensor built into the pump or controller.

(1) Connection with power source
Connect a power source of DC 24V ±10% with the DC 24V (+, -) terminals.

(2) Connection with lead wire
Connect the pump lead wires (+5V, G, L1, L2) of the pump with the IN (+5V, G, L1, L2) terminals respectively.

(3) Connection with external control systems
Connect each system with each terminal on the controller, such as LIFE ALM (ALMA ALMC), READY (RDYC, RDYE), and START (SA, SB).

Note: Refer to the 'APD-3 Type Controller Instruction Manual' for details.

5. Operation, Adjustment, and Alarms

■ Operation

(1) Supply power (DC 24V ±10%) to the APD-3 type controller.

(2) Set the pressure at 0.2 to 0.3 MPa {2 to 3 kgf/cm^2} (28 to 43 PSi) by adjusting the regulating valve on the air pipe.

(3) Fully rotate the speed controller clockwise on air piping.

(4) Set the ON LINE/OFF LINE selector switch to 'OFF LINE' and press the MANU. START button. The pump operates only for the set shot number and then stops. Adjust the action speed of the pump by setting the speed controller.

(5) Set the ON LINE/OFF LINE selector switch to 'ON LINE' when activating the pump via the external input method. When the start signal has been input, the pump starts operation.

■ Adjustment of Discharge

The discharge is controlled by a dual system, i.e.; adjustment of the number of strokes through the APD-3 type controller and adjustment of the length of stroke through the built-in adjusting screw of the pump itself.

[1] Method of Control

The number of strokes is adjusted by the speed controller on air piping in a range from 0 to 30 spm. As the pump is set at 8 mℓ/shot by the factory, this means that the discharge can be controlled in a range from 0 to about 240 mℓ/min.

○Adjustment of the length of stroke

This method is used to change the range of discharges (i.e., to increase or decrease the discharge per shot). The length of stroke is adjusted by means of the control screw provided in the pump. For this adjustment, the pump should not be operating. It must be stopped.

Range of adjustment (guideline) : 7~10mℓ (Set at 8mR by factory)

<Control screw>

The control screw is turned by the use of a minus driver. (The length of stroke is changed by 1mm when the screw is rotated to make a full turn.)

Range of adjustment: 0~about 5 turns (0~5mm in stroke length)

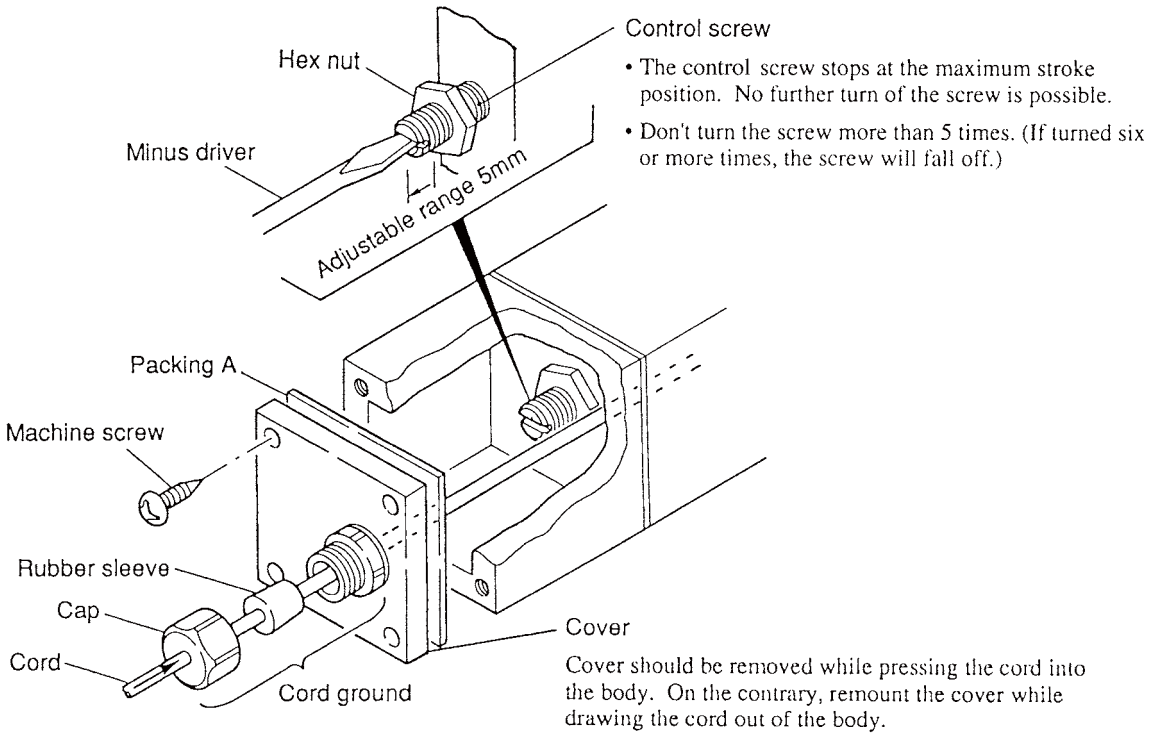
► Turn to the right (clockwise) decreases the stroke length to reduce the discharge.
► Turn to the left (counterclockwise) increases the stroke length to raise the discharge.

※ When accurate adjustment is intended, do it while measuring the discharge per shot.

○ Adjustment of the number of strokes

For adjusting the number of strokes, the APD-3 controller is used.

※ For the procedure of this adjustment, see the instruction manual of the Model APD-3 Controller.



[2] Procedure for Adjusting Stroke Length

To adjust the stroke length, stop the pump and follow the steps described below, referring to the exploded view on page 13 "Structure of Pump and Names of Parts".

① Detach the small machine screw (45) from the pump body and remove the cover (10).
The cord is fixed to the cord ground. Undo the cap and pull the rubber sleeve out.
Remove the cover while pressing the cord into the body.

② Hold a minus driver to the control screw (41) and loosen the hex nut (42).
The pump is set at 8mℓ/shot by the factory. Use this position of the screw as your reference (guideline).

③ Adjust the length of stroke.
· If the reference position of the screw driver is not clear, turn it to the leftmost position first. The stroke length is adjustable up to 5 turns (5mm).

· For a more accurate setting, measure the discharge per shot. The pump should be put out of operation during adjustment and should be activated only when you measure the discharge.

④ Upon completion of adjustment, tighten hex nut (42) and reattach the cover (10).
· Tighten the hex nut while fixing the control screw lest the latter should get out of position.

· When you attach the cover, take care not to allow packing A (11) to project or twist.

■ Alarms

(1) Life alarm

If the pump operation reaches the set total count (the number of strokes representing the pump service life), the LIFE ALARM LED (red) on the APD-3 controller turns on and the pump stops. At the same time, an alarm is generated.

> ⚠ **CAUTION** **After inspecting the pump, air-operated valve, etc., replace worn components and reset the controller.**

Note: Refer to the 'APD-3 Type Controller Instruction Manual' for the resetting procedure.

6. Maintenance and Inspection

■ Daily Inspection

Verify that the pump operates normally and that the following points are all satisfied.

(1) The sealed sections of the air piping have no leakage.

(2) The supply air is clean.

(3) The air pressure is at a normal level.

(4) The supply air amount is at a normal level.

(5) No liquid leakage is detected.

7. Consumable Parts

Replace the consumable parts shown as below at the time to be replaced shown as below.

No.	Part Name	Q'ty./ pump	Remarks	Time to be replaced (Actual running time)
2	Bellows	1		1 year
19	O ring	1	P-8	
20	O ring	1	P-10	
21	O ring	1	P-14	
22	O ring	2	P-26	
52	Valve gasket	10		
54	Valve	4	3/16"	
55	Valve seat	4		

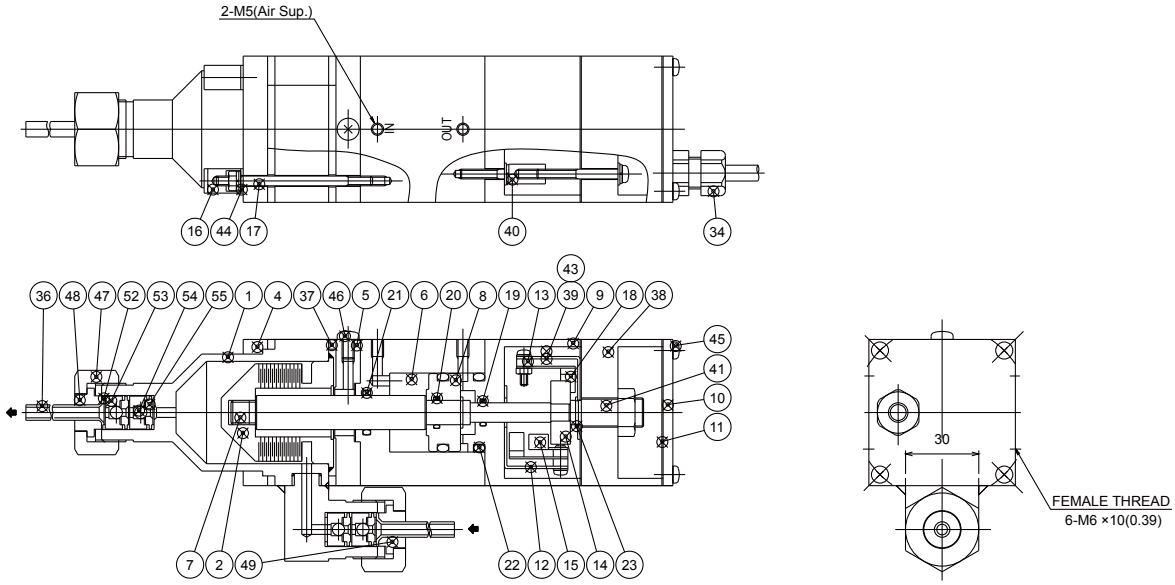
Note 1. The time to be replaced shown as above is based on pumping clear water at ambient temperature and it depends on the characteristics of pumped liquid and other condition.

2. Replace O ring and valve gasket every time when the pump is disassembled regardless of the time to be replaced mentioned as above.

8. Trouble shooting Guide

Problem	Causes	Countermeasures
Pump does not start.	Faulty setting of photo sensor	Reset or replace photo sensor.
	Bellows is damaged. (Alarm output)	Replace pump.
	Supply air pressure or amount is lowered. ·Compressor is out of order.	Inspect and repair compressor.
	·Pressure set for reducing valve is insufficient.	Set pressure correctly.
	·Air filter, etc., is clogged.	Clean or replace element.
	·Air leaks from pipe.	Repair pipe.
	·Speed controller is set to excessively low speed.	Readjust controller.
	·Switching action of solenoid valve is affected.	Inspect, repair, or replace valve.
	Controller is out of order. ·Faulty wiring or disconnection	Inspect, repair, or replace valve.
	Faulty wiring	Inspect and set up normal wiring.
	Faulty piping	Inspect and set up normal piping.
Pump starts but does not discharge liquid.	Valve is clogged with foreign matter.	Inspect, clean, or repair valve.
	Air enters via suction pipe.	Further tighten pipe joints.
Discharge volume is reduced.	Supply air pressure or amount is lowered.	See 'Pump does not start' column.
	Valve is clogged with foreign matter.	Inspect, clean, repair, or replace valve.
	NPSHa is insufficient.	Check suction condition and take necessary measures.
	Discharge pressure is raised.	Check discharge condition and take necessary measures.
	O ring in drive section is worn out.	Inspect and replace O ring.

9. Parts Description and Exploded View



[LEAD WIRE] PVC FOUR CORE CABLE: ∅0.26 × 197 INCH

No.	Parts Name	Q'ty	Material	Remarks
1	PUMP HEAD	1	PTFE	
2	BELLOWS	1	PTFE	
4	FLANGE A	1	PVC	
5	FLANGE B	1	PVC	
6	CYLINDER	1	PVC	
7	PISTON ROD	1	SUS304	
8	PISTON	1	POM	
9	CYLINDER COVER	1	PVC	
10	COVER	1	PVC	
11	PACKING A	2	PTFE	
12	INSTALLED BASE A	1	SUS304	
13	SPACER	3	PVC	
14	GUIDE PLATE	1	PVC	
15	GUIDE	1	SUS304	
16	NUT A	4	PVC	
17	STUD BOLT	4	SUS304	
18	SENSOR	2	——	
19	O RING	1	FKM	P-8
20	O RING	1	FKM	P-10
21	O RING	1	FKM	P-14

No.	Parts Name	Q'ty	Material	Remarks
22	O RING	2	FKM	P-26
23	STOP RING	2	SUS304	S-10
34	CORD GROUND	1	PP	SCL-6B
36	TUBE	2	PFA	1/4B(Ø6.34×Ø4.35)
37	PACKING B	2	SILICON RUBBER	
38	CONTROL CASE	1	PVC	
39	INSTALLED BASE B	1	SUS304	
40	FIXED BOLT	4	SUS304	
41	CONTROL SCREW	1	SUS304	
43	SPRING PIN	1	SUS304	
44	GASKET	4	PTFE	
45	SCREW	4	STNLS STL	M4×8 PTFE COATED
46	SCREW	1	STNLS STL	M5×8 PTFE COATED
47	VALVE CAP	2	PP	
48	DISCHARGE PORT	1	PTFE	
49	SUCTION PORT	1	PTFE	
52	VALVE GASKET	10	PTFE	
53	VALVE GUIDE	4	PTFE	
54	VALVE	4	PTFE	3/16"
55	VALVE SEAT	4	PTFE	

IWAKI PUMPS

( )Country codes

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