IWAKI PUMPS

IWAKI
Gas-Liquid Transfer Pump
APN-P60-W (built-in type)
Instruction Manual

⚠ Read this manual before use of product

Thank you for selecting an IWAKI APN-P60-W gas-liquid transfer pump (BLDC motor). This instruction manual deals with "*Safety Instructions*", "*Outline*", "*Installation*", "*Operation*" and "*Maintenance*" sections.

Please read through this instruction manual to ensure the optimum performance, safety and service of your pump.

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This instruction manual should be kept on hand by the end user for quick reference.

Contact us or your nearest dealer if you have any questions.

Important Instruction

For the Safe and Correct Handling of the Pump

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

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

Types of Symbols

⃠	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.

⚠Export Restrictions

Technical information contained in this instruction manual might be treated as controlled technology in your countries, due to agreements in international regime for export control.
Please be reminded that export license/permission could be required when this manual is provided, due to export control regulations of your country.

Safety Instructions

⚠WARNING

- **Turn off power before service**
  Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.


Electrical shock

- **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.


Prohibited

- **Do not modify the pump**
  Alternations to the pump carry a high degree of risk. It is not the manufacturer's responsibility for any failure or injury resulting from alterations to the pump.


No remodeling

⚠WARNING

- **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 SDS precautions from the solution supplier.


Wear protectors

- **Use specified power only**
  Do not apply power other than that specified on the nameplate. Otherwise failure or fire may result. Ensure the pump is properly grounded.



- **Do not damage the power cable**
  Do not pull, knot, or crush the power cable. Damage to the power cable could lead to a fire or electrical shock if cut or broken.


Prohibited

- **Do not operate the pump in a flammable atmosphere**
  Do not place explosive or flammable material near the pump.


Prohibited

⚠ CAUTION

- **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.



- **Ventilation**

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



- **Do not install/store the pump:**
  - Where ambient temperature can exceed 0-40ºC (32-104ºF).
  - In a flammable/corrosive atmosphere.
  - In a dusty/humid place.



- **Spill/Gas leak precautions**

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



⚠ CAUTION

- **Keep electric parts and wiring dry**

  Risk of fire or electric shock. Install the pump where it can be kept dry.



- **Do not use a damaged pump**

  Use of a damaged pump could lead to an electric shock or death.



- **Stop operation**

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



- **Do not use the pump in a wet location**

  The pump is not waterproof. Use of the pump in wet or extremely humid locations could lead to electric shock or short circuit.



- **Do not touch the pump or pipe with bare hands**

  Risk of burns. The surface temperature of the pump or piping becomes very high during and immediately after operation, depending on the gas/liquid temperature.



⚠ CAUTION

- **Electromagnetic precautions**
  This product is not protected against electromagnetic fields. Take appropriate measures as necessary.



- **The power cable is not replaceable**
  Do not use a damaged power cable, as it may result in fire or electric shock. If the cable is damaged, the entire pump unit must be replaced.



Prohibited

- **Disposal of a used pump**
  Dispose of any used or damaged pump in accordance with local rules and regulations. See page 19 to comply with the European Directive 2012/19/EU on waste electrical and electronic equipment.



⚠ CAUTION

- **Release the pressure from the discharge line**
  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 or gas leakage.



- **Potentially-flammable or -explosive liquid or gas**
  When using this pump for handling a potentially-flammable or potentially-explosive liquid or gas, users must take all necessary measures with their equipment so such a gas is handled safely.

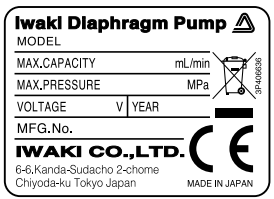


Before use, check the specification, limitation and hazardous nature of the pump.

1. Unpacking & Inspection

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

1. Check the nameplate to see if the information such as model codes, discharge capacity and discharge pressure are as ordered.

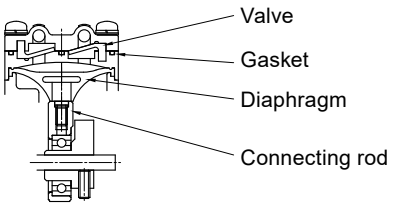


*The CE marking on our product(s) is for us to market the product(s) into the European market, however, the CE marking does not ensure any safety or conformity of the product(s) outside the European market.
When the pump is incorporated into the equipment marketed in the European market, such equipment must meet all the requirements of applicable directives.
In such a case, any person who places the equipment on the market must carry a CE mark on the equipment as a manufacturer.

2. Check for transit damage, deformation and loose bolts.

2. Operating principle

The APN-P60-W is a gas-liquid transfer pump with a small size diaphragm.
The rotary motion of the motor is converted via a connecting rod to the reciprocation of the diaphragm in the pump chamber, where the mixture of gas and liquid is transferred from the inlet to outlet.



3. Identification code

APN- P 60 G E D4 - W 02

a b c d e f g

a. Pump head
P : Dual-head with parallel tubing

b. Series name
60 : APN-60

c. Bracket type
No code : without base
G : with base

d. Valve materials
No code : FKM
E : EPDM

e. Rated voltage
D4 : 24V BLDC (with variable speed control)

f. Gas-liquid transfer type

g. Special specification
No code : Standard
01-99 : Special design

4. Specifications

■ Pump

Gas transfer			Liquid transfer		Motor		Connection	Weight (g)
Max. air flow (mL/min)	Max. discharge pressure (MPa)	Max. vacuum (kPa)	Max. liquid flow (mL/min)	Max. discharge pressure (MPa)	Rated voltage (V)	Rated current (A)	Tube ID	
2400 (1200×2)	0.08	47.99	1000 (500×2)	0.05	24DC	0.86	ø5.5	240

NOTE1. Observe the maximum discharge pressure.
NOTE2. The max liquid flow is based on the operation with clean water at 20°C and may change with liquid temperature, viscosity and specific gravity.
NOTE3. Allowable gas temperature range is 5-40°C.
Allowable liquid temperature range is 10-40°C.
NOTE4. Allowable ambient temperature range is 5-40°C.
NOTE5. Maximum noise level is 65dB at 1m (A scale) in operation with clean water at 20°C.

■ Wet end material

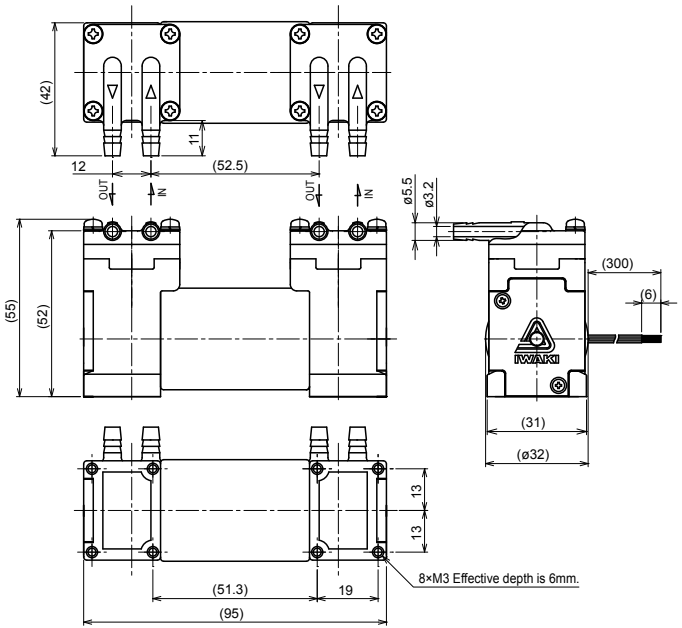
Parts \ Materials	FKM	EPDM
Pump head	GFRPP	
Diaphragm	PTFE/EPDM (EPDM is not a wet end.)	
Valve	FKM	EPDM
Valve seat	GFRPP	
Gasket	FKM	EPDM

GFRPP: Glass fiber reinforced polypropylene
PTFE: Polytetrafluoroethylene
EPDM: Ethylene propylene diene monomer
FKM: Fluorine-contained rubber

5. Outer dimensions

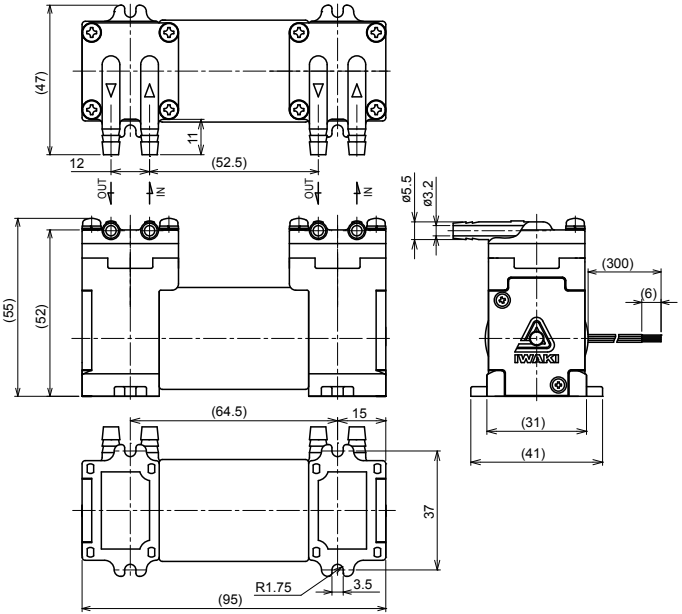
■ APN-P60D4-W

Dimension in mm



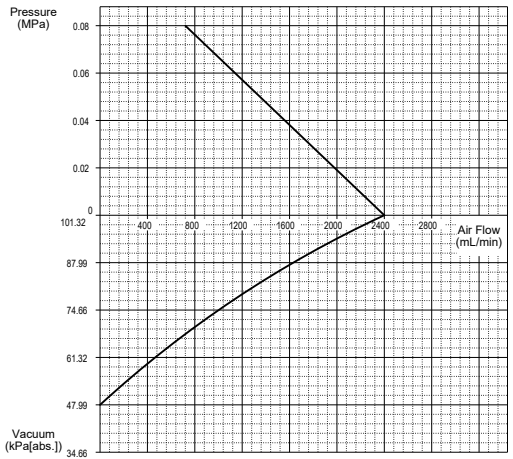
■ APN-P60GD4-W

Dimension in mm

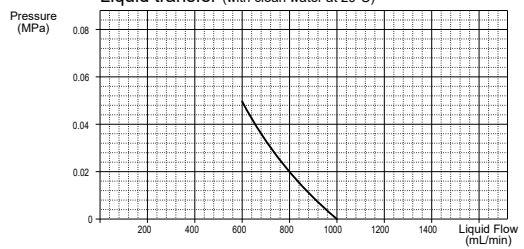


6. Performance curve

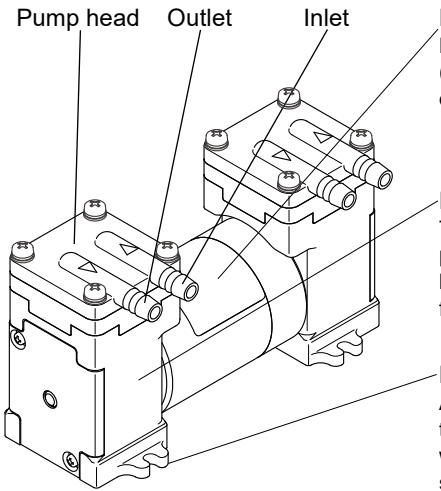
Gas transfer (with ambient air at 20ºC)



Liquid transfer (with clean water at 20ºC)



7. Overview & Label

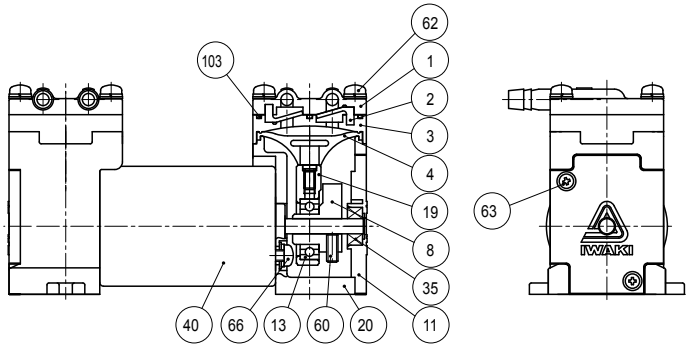


Name plate
Model and MFG. No. (Production number) are described.

Driven unit
This pump is not drip-proof. An installation location should be free from liquid spillage.

Base part
Anchor the pump via the base. For the pumps with no base, use the M3 screw holes beneath the driven units.

8. Part names & Structure

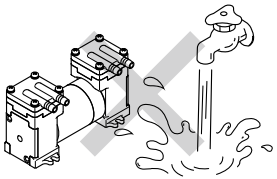


No.	Part names	Q'ty
1	Pump head A	2
2	Valve	4
3	Valve seat A	2
4	Diaphragm	2
8	Eccentric cam	2
11	Bracket cover	2
13	Bearing	2
19	Connecting rod	2

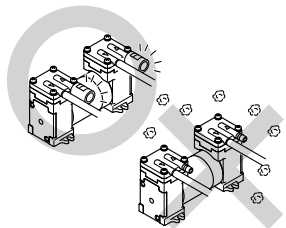
No.	Part names	Q'ty
20	Bracket	2
35	Bearing	2
40	Motor	1
60	Set screw (M3×8)	4
62	Screw washer (M3×16)	8
63	Screw (2×6)	4
66	Screw (M3×6)	4
103	Gasket	2

1. Before Installation

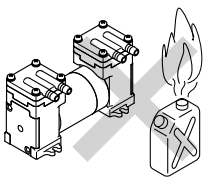
Read through this instruction manual before use. Carry out installation work with a full understanding.



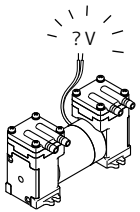
- Do not install the pump in a place where the pump can get wet.



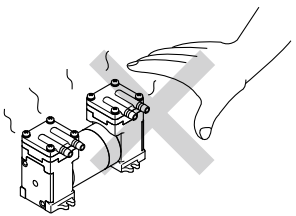
- For gas transfer, do not use the pump in a dusty place. Be sure to provide the inlet with a filter to prevent foreign matters from getting into the pump. Otherwise, the pump performance may reduce or the lives of the valve and diaphragm may remarkably shorten.



- Do not install the pump in a corrosive or flammable gas atmosphere. Keep good ventilation in a working area. The allowable ambient and air temperature is between 5 and 40°C. Liquid temperature should be between 10 and 40°C.



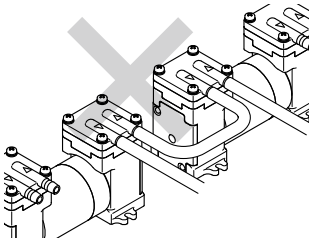
- Observe the rated voltage specified on the name plate. Applying any voltage than the rated one may result in failure.



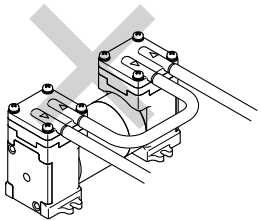
- Surface temperature may rise high in operation but it dose not mean failure. Do not touch the pump body directly or place the objects which may be deformed by heat close to the pump.



- 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.



- Do not tube two or more pumps in series. It may prevent the motor from starting, causing burning out or may damage the diaphragm or piping.



- Do not tube pump heads in series. It may prevent the motor from starting, causing burning out or may damage the diaphragm or piping.

2. Installation/ Tubing/ Electrical wiring

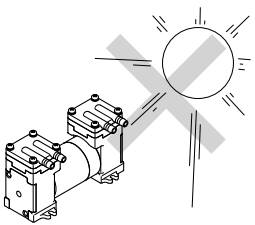
⚠ WARNING

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

2.1 Installation

1. Installation location

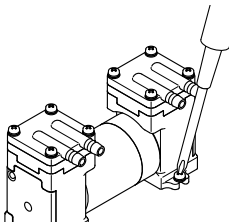
This pump is designed to be built into equipment under proper protection.



- Do not install the pump in direct sunlight, wind & rain or mechanical vibration.
- Select a level location, free from vibration, that won't hold liquid.
- Keep good ventilation. The pump should always be free from liquid spillage.
- Observe the allowable ambient temperature of 0-40°C and max ambient humidity of 90%RH.
- Allow sufficient space around the pump for easy access and maintenance.

2. Pump fixation

Use M3 bolts to anchor the pump.



⚠CAUTION

Do not install the pump on a unstable place.

2.2 Tubing

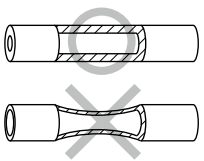
1. Before tubing

The short tubing with the minimum bends is optimal to reduce resistance.

⚠CAUTION

Do not have tubing bent or pressed. Otherwise, the tube end may break.

2. Tube preparation



- Cut the tube ends flat beforehand.
- Use chemically-resistant tubes or temperature-/pressure-resistant braided tubes as necessary.
- For liquid transfer, a suction and discharge line I.D. should be ø4mm or less. Otherwise, a overloaded/locked motor will result.

3. Tube connection

Push the tubes into the inlet and outlet as far as they will go. Use tube bands to make sure tubes are fastened as necessary.

NOTE: If suction line connection is imperfect, the pump sucks air and it prevents the pump from bringing out full performance.

4. Connection checkout

Check that a suction line is connected to the inlet and a discharge line is connected to the outlet.

⚠CAUTION

If a suction line and a discharge line are connected the other way around, pumping process is inverted.

5. Valve mounting

For adjustment of an air flow and a vacuum (not for liquid flow adjustment), install a control valve on a suction line.

2.3 Electrical wiring

Electrical wiring must be performed by a qualified electrician. We are not responsible for personal injury or property damage due to nonobservance of this warning. Contact us or your nearest distributor for wiring as necessary.

■ Before wiring

1. Confirm that power is disconnected before work.
2. Wiring work should be done in accordance with local electric codes. Use the recommended wiring accessories.
3. Observe the rated voltage specified on the name plate.
4. After wiring work, check that the system is free from the inductive noise at start-up. The maximum length of power and signal leads is 3m. Take appropriate measures when extending the leads over the maximum length.
5. The drive circuit generates noise because of its high-speed switching. Check if peripheral devices are not affected by the noise.
6. When an earth leakage breaker is used and has tripped, always investigate and solve root causes. Be sure to unplug the pump before investigation is performed.
7. This pump can be controlled by 1-5VDC control signal and make feedback control when used with a flow sensor.
8. Always use the 1-5VDC control signal for ON-OFF control.
9. Always stop the 1-5VDC control signal before turning ON or OFF the pump power.

■ Wiring

1. Power lead polarity

The red power lead leading from the pump is positive polarity and must be connected to a positive contact of a DC power supply, and the black power/signal lead leading from the pump is negative polarity and must be connected to a negative contact of the power supply.

2. 1-5V control signal polarity

The white signal lead leading from the pump is positive polarity and must be connected to a positive contact of a 1-5VDC signal generator, and the black power/signal lead leading from the pump is negative polarity and must be connected to a negative contact of the signal generator.

NOTE: The black power and signal leads are leading from the common negative terminal of the pump.

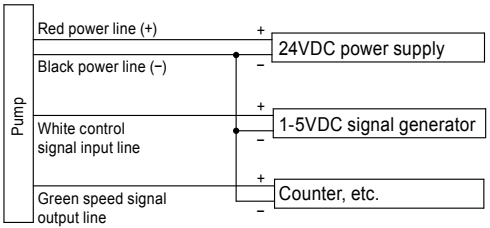
3. Pump speed signal polarity

The green signal lead leading from the pump is positive polarity and must be connected to a positive polarity of the counter.

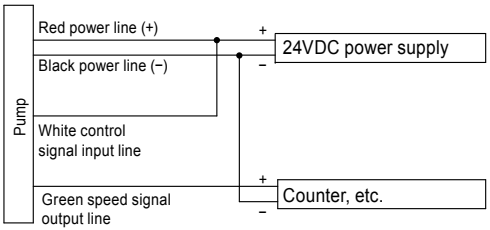
4. Wiring diagram

Optimal diagram changes depending on if the 1-5VDC control signal is used or not.

Operation with 1-5VDC control signal



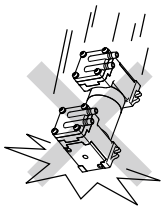
Operation with no control signal



5. External fuse

Install an external fuse in the power line for overcurrent protection.

1. Before operation



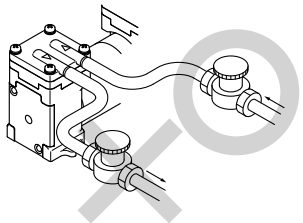
- Use care handling the pump. Do not drop. An impact may affect pump performance.

- The pump can not start with full discharge/suction pressure or liquid. Remove pressure or liquid before operation.

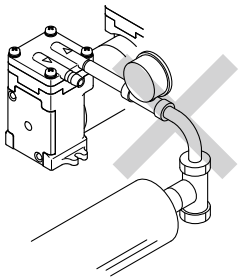
- After a long period of stoppage, pump performance at the beginning of operation becomes occasionally unstable. In this case, warm the pump up by running pump dry for about ten minutes.

Prohibited

- Do not use solvents such as benzine, alcohol, thinner for maintenance or cleaning, otherwise a coat discolours or comes off.



- Always use a suction valve to adjust an air flow.



- If the compressed air or liquid (higher pressure than atmospheric pressure) is transferred to the pump, the lives of the valves, diaphragm and bearing may be sharply reduced. Always keep atmospheric or lower pressure in the suction line.

Prohibited

- Do not close discharge line during operation. The pump and piping may be damaged. Always observe the maximum discharge pressure.

2. Pump operation

■ Operation

Operate the pump according to the following steps.

No.	Procedure	Points to be checked
1	Check tubing, wiring and voltage	● Check installation, tubing and wiring are properly done and wiring system is fused. ● Check the spec label to see if power supply voltage is correct.
2	Open valves	● Fully open both discharge and suction lines.
3	Supply power to the pump	● Smooth starting may not be obtained when ambient temperature is 10ºC or below. In this case, run the pump with no discharge line pressure for a few minutes to warm it up. ● Smooth starting may not be obtained when the pump chamber is filled with liquid. Get rid off liquid before operation.
4	Adjust air flow	● Provide a running-in period (about 10 minutes) before full scale operation. ● Always adjust an air flow by a suction valve.
5	Check the operation	● After starting, check a pressure gauge to see if suction and discharge line pressure are correct and an air flow meter to see if the specified air flow is obtained. ● Keep a suction line pressure at or below atmospheric pressure. ● In case electric power has failed while the pump is running, switch off main power. Otherwise, the motor may not restart or may burn out depending on a line pressure at the time of power recovery.

■ Stop and Storage

● Before a long period of stoppage (1 week or more): Depressurize/empty the pump. Some liquids may harden or crystallize when they are left for a long time. In this case clean wet ends before resuming operation.

● Do not store the pump:
  • In a flammable/corrosive atmosphere.
  • In a dusty/humid environment.
  • Where ambient temperature can exceed 0-40°C.
  • Under mechanical vibration or wind & rain.

1. Troubleshooting

Turn off power on sensing danger and check the following. In case trouble can not be solved, contact us or your nearest distributor.

Phenomenon / Causes	Pump does not run.	Pump stops running.	Poor air flow or discharge pressure	Pump makes noise.	Measures
No power distribution	○				Check wiring.
Motor trouble (disconnection)	○	○			Replace the pump.
Wrong tubing or poor connection	○		○		Check and fix tubing.
Pump head mounting screws are loose.			○	○	Tighten the screws.
Diaphragm insertion is loose.	○		○	○	Tighten diaphragm.
Diaphragm is damaged.			○	○	Replace diaphragm.*
Filter is clogged.			○		Remove foreign matters.
Valves are worn.			○		Replace valves.*
Front cover fixing screws are loose.			○	○	Secure them.
Eccentric shaft has worn.	○			○	Replace the pump.
Connecting rod bearing has worn.	○	○		○	Replace the pump.
Motor bearing has worn.	○	○		○	Replace the pump.
Voltage reduction	○	○			Increase voltage to the rated level.
Higher suction pressure than atmospheric	○	○			Reduce suction pressure.

Contact us for the measures marked with *.

2. Maintenance & Inspection

Handling of the pump, maintenance and inspection should be carried out within the descriptions of this instruction manual.
It is not manufacturer's responsibility for personal injury or property damage due to nonobservance of this warning. Contact us or your nearest distributor as necessary.

■ Daily inspection

Check the following points every day. If you notice any abnormal or dangerous conditions, suspend operation immediately and remove problems according to the troubleshooting section. When wear parts come to the life limit, replace them by new ones. Contact your distributor for detail.

No.	Check that:	Measure
1	pump operation is normal.	• Apply correct voltage and amperage. • Adjust discharge/suction pressure.
2	there is no noise or vibration problem.	• Unusual noise/vibration may occur when pump operation is not normal.
3	there is no air leak or air ingress from pump parts and tubing connections.	• Retighten connections.

3. Wear part replacement

⚠ CAUTION

- **Turn off power before service**
  Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.
- **Do not touch the pump or pipe with bare hands**
  Risk of burning. The surface temperature of the pump or pipe gets high in or right after operation.
- **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.

■ Pump replacement

Replace the pump at the end of life span or when performance has remarkably reduced.

Conditions \ Part names	Diaphragm	Valve	Gasket
<gas transfer> 0.08MPa or below (pressurization) or 47.99KPa (abs.) or below (vacuum)	4000hr	4000hr	4000hr
<gas transfer> 0MPa	4000hr	4000hr	4000hr
<liquid transfer> 0.05MPa or below (pressurization)	2000hr	2000hr	2000hr

*Part lives vary with the pressure, temperature and character of gas/liquid. Values on the above table are collected in continuous operation with 20°C gas or liquid at rated voltage.

■ Diaphragm replacement

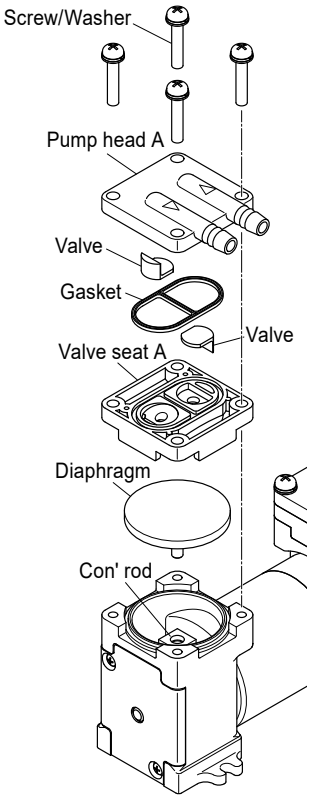
1. Unscrew the screws and take out the pump head A, valves, gasket and valve seat A.

2. Turn the diaphragm anti-clockwise so as to detach it from the connecting rod.

3. Mount a new diaphragm into the rod and fasten as far as it will rotate.

NOTE: Hold the midmost of the diaphragm then fasten it. Damage or deformation of diaphragm will reduce the pump performance.

4. Push down the diaphragm until it bottoms out and then rebuild the pump head. Fasten the fixing screws by 0.58N•m.

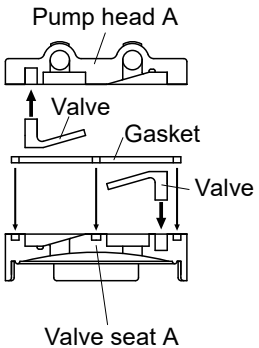


■ Valve & Gasket replacement

1. Unscrew the pump head fixing screws and take out the pump head A, valves, gasket and valve seat A.

2. Replace old valves and gaskets with new ones.

3. Push down the diaphragm until it bottoms out and then rebuild the pump head. Fasten the fixing screws by 0.58N•m.



NOTE1. Finish either pump head first and then start with the other.

NOTE2. Do not loosen the motor-bracket fixing screws during maintenance work.

EC DECLARATION OF CONFORMITY

A copy of the original Declaration of Conformity

(SUPPLIER'S NAME)
WE
IWAKI CO.,LTD.

(ADDRESS)
6-6 2-CHOME KANDA-SUDACHO CHIYODA-KU TOKYO JAPAN

(PRODUCT)
DECLARE UNDER OUR SOLE RESPONSIBILITY THAT THE PRODUCTS
AIR PUMP

(MODEL NAME)
APN-W SERIES DC TYPE

TO WHICH THIS DECLARATION RELATES ARE IN CONFORMITY
WITH THE FOLLOWING STANDARDS OR DIRECTIVES AS FAR AS APPLICABLE

(DIRECTIVES)
MACHINERY DIRECTIVE 2006/42/EC (ANNEX IIA)
RoHS DIRECTIVE 2011/65/EU

NOTE: THIS PRODUCT IS INTENDED FOR FITTING INTO ANOTHER MACHINE OR INSTALLATION. CONFORMITY WITH THE DIRECTIVE 2014/30/EU SHOULD BE ESTABLISHED BY THE END PRODUCT.

(STANDARDS)
EN ISO12100:2010 EN809:1998+A1:2009 EN IEC63000:2018

(A PERSON WHO IS AUTHORISED TO COMPILE THE TECHNICAL FILE IN THE COMMUNITY)
IWAKI EUROPE GMBH
SIEMENSRING 115 D-47877 WILLICH GERMANY

NOTE: THIS DECLARATION BECOMES INVALID IF TECHNICAL OR OPERATIONAL MODIFICATIONS ARE INTRODUCED WITHOUT THE MANUFACTURER'S CONSENT.

T. Sawada

TSUTOMU SAWADA
SENIOR GENERAL MANAGER,
QUALITY ASSURANCE HEAD OFFICE

Tokyo, Dec. 18, 2023

(PLACE AND DATE OF ISSUE) **(NAME AND SIGNATURE OR EQUIVALENT MARKING OF AUTHORIZED PERSON)**

DOCUMENT NO. IS-51K-538-4

Waste Electrical and Electronic Equipment (WEEE)



In accordance with the European Directive 2012/19/EU on waste electrical and electronic equipment, this product features the crossed-out wheelie bin symbol. When this product is disposed of in household wastes, toxic components included in it can cause major environmental and human health problems. Use appropriate waste collection systems for recovery and recycling. Contact your local distributor or nearest Iwaki company for the detailed collection systems.

IWAKI

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