

IWAKI Air Pump

APN-085-D4

Instruction Manual

 Read this manual before use of product

Thank you for selecting an IWAKI APN-085-D4 air pump. 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 distributor 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 personnel 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**

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.



No remodeling

- **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.



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.



Prohibited

CAUTION

- **Qualified personnel only**

The pump should be handled or operated by a qualified personnel with a full understanding of the pump.



Prohibited

- **Ventilation**

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



Caution

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

1. Where ambient temperature falls below 0°C or exceeds 40°C.
2. Under a flammable/corrosive atmosphere.



Prohibited

- **Spill precautions**

Ensure protection and containment of solution 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.



Prohibited

Safety Instructions

CAUTION

- **Do not use a damaged pump**

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



Prohibited

- **Stop operation**

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



- **Preventative maintenance**

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



- **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.



Electrical shock

- **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.



Prohibited

CAUTION

- **Damaged power cable**

Do not use any damaged power cable for the prevention of a fire or electrical shock. The cable is not replaceable, so that the whole pump unit needs to be replaced when the cable is damaged.



Electrical shock

- **Disposal of a used pump**

Dispose of any used or damaged pump in accordance with local rules and regulations. If necessary, consult a licensed industrial waste disposal company.



Outline

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.

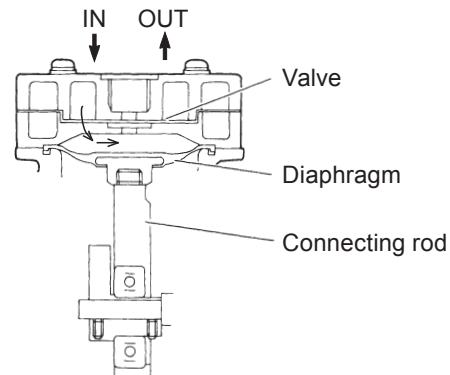
1. Check the nameplate to see if the information such as model codes, discharge capacity and discharge pressure are as ordered.
2. Check for transit damage, deformation and loose bolts.



2. Operating principle

The APN-085-D4 is a diaphragm type air pump and is designed to be built into various devices such as a gas analyser and for contamination-free gas compression, vacuum and delivery.

The rotary motion of the motor is converted through a connecting rod to the reciprocation of the diaphragm in the pump chamber, where gas is transferred from the inlet to outlet.



Outline

3. Identification code

APN - 085 L V X - D4 - 02
 a b c d e f

a. Pump size

b. Pump head

No code : Corrosive resistant (Molded diaphragm)
 L : High vacuum (Horizontally oriented)
 H : High vacuum (Vertically oriented)

c. Diaphragm/Valve materials

N : NBR
 E : EPDM
 V : FKM

d. Pump connection

No code : $\varnothing 8$ tube connection
 X : Rc1/4 female thread connection (JIS taper pipe thread)
 X1 : G1/4 female thread connection (JIS parallel pipe thread)

e. Motor

D4 : 24V BLDC motor (with 1-5VDC control signal)

f. Special specification

No code : Standard
 01-99 : Special design

4. Specifications

■ Pump Performance at 24VDC (power voltage) and 5VDC (control signal)

Type	Max. air flow (L/min)	Max. discharge pressure (MPa)	Max. vacuum (kPa)	Motor		Connection		Weight (kg)	Lowest starting temp. (°C)
				Power con. (W)	Rated current (A)	Tube	Thread		
APN-085V	6	0.08	61.3	15	1.2	$\varnothing 8$	Rc1/4	1.3	10
APN-085E			34.66				Rc1/4 or G1/4		5
APN-085LV/HV							0		
APN-085LE/HE							0		
APN-085LN/HN									

NOTE1. Observe the maximum discharge pressure of 0.08MPa.

NOTE2. Allowable gas temperature range is 0-40°C.

NOTE3. Allowable ambient temperature range is 0-40°C. Observe the lowest starting temperature at the start of operation.

NOTE4. Both the inlet and outlet of the pump are Rc1/4 female thread connections (JIS taper pipe thread) or G1/4 female thread connections (JIS parallel pipe thread).

■ Wet end material

Parts	Model	LN/HN	V	LV/HV	E	LE/HE
Pump head		GFRPP				
Diaphragm		NBR	FKM		EPDM	
Valve						
Valve seat		GFRPP				
Retainer plate	GFRPPS	-	GFRPPS		-	GFRPPS
Screw	SUS304 equiv		SUS304 equiv			SUS304 equiv
Gasket (X1 type)	FKM		FKM			FKM

GFRPP : Glass fiber reinforced polypropylene

NBR : Nitrile Butadiene Rubber

FKM : Fluorine-contained rubber

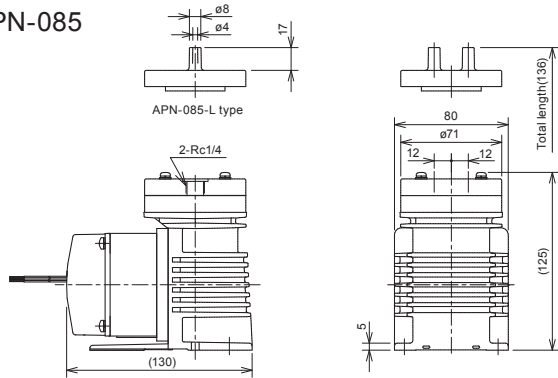
EPDM : Ethylene propylene diene monomer

GFRPPS : Glass fiber reinforced polypropylene sulfide

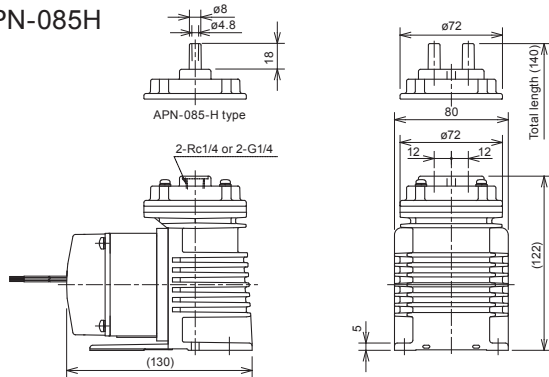
SUS304 : Austenite stainless steel

5. Outer dimension

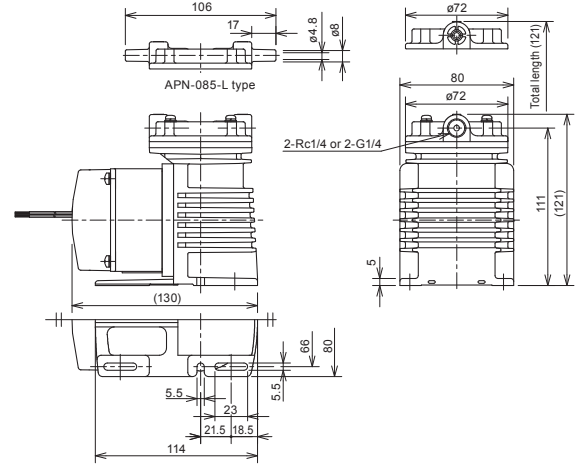
■ APN-085



■ APN-085H

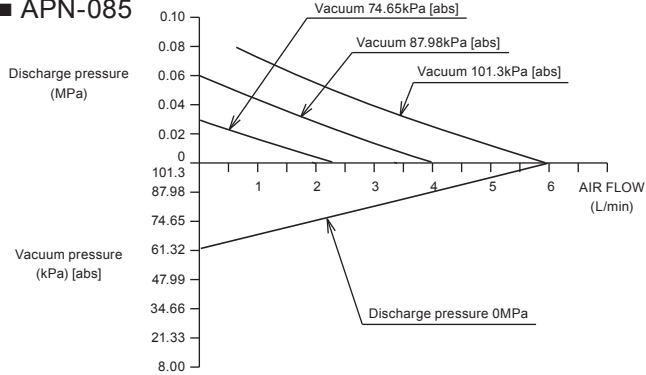


■ APN-085L

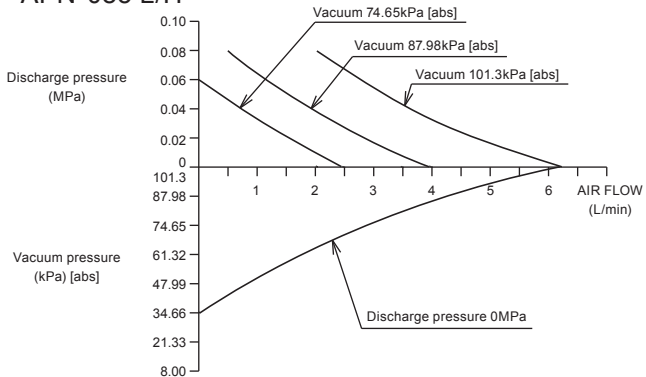


6. Performance curve

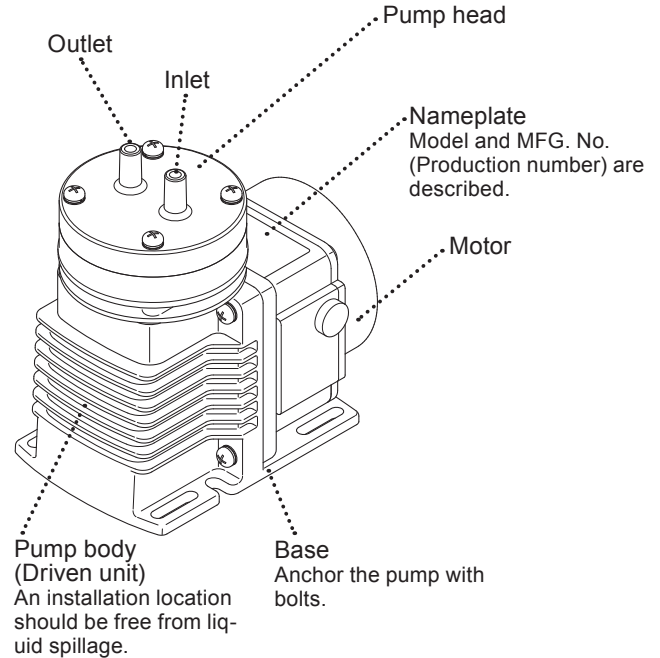
■ APN-085



■ APN-085 L/H

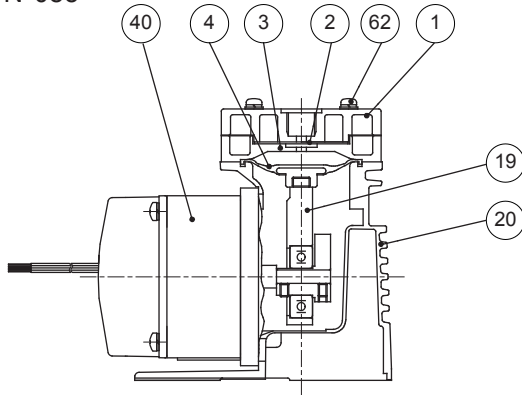


7. Overview & Label



8. Part names & Structure

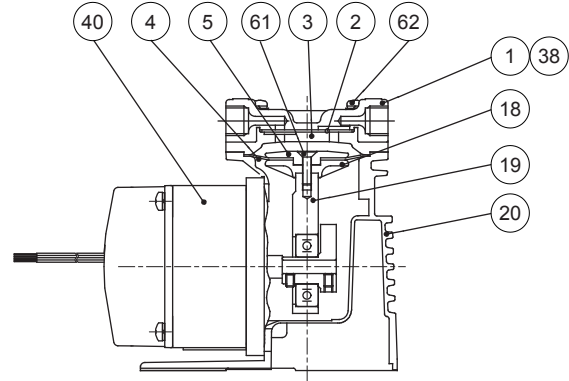
■ APN-085



No.	Part names	Q'ty
1	Pump head	1
2	Valve	1
3	Valve seat	1
4	Diaphragm	1

No.	Part names	Q'ty
19	Connecting rod	1 set
20	Bracket	1
40	Motor	1
62	Screw	4

■ APN-085 L/H



No.	Part names	Q'ty
1	Pump head	1
2	Valve	1
3	Valve seat	1
4	Diaphragm	1
5	Retainer plate	1
18	Under retainer plate	1

No.	Part names	Q'ty
19	Connecting rod	1 set
20	Bracket	1
38	Gasket*	2
40	Motor	1
61	Screw	1
62	Screw with washer	4

The Gasket is provided to the X1 type (APN-085 with G1/4 female thread connection) only.

Installation

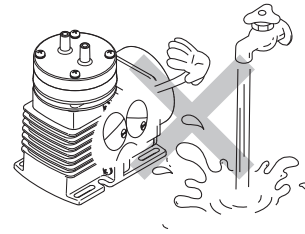
1. Before Installation

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

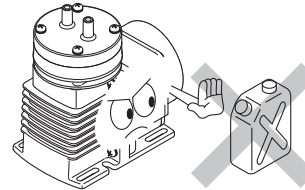


CAUTION

- **Do not operate the pump in a flammable atmosphere**
Do not place explosive or flammable material near the pump.
- **Do not use a damaged pump**
Use of a damaged pump could lead to an electric shock or death.



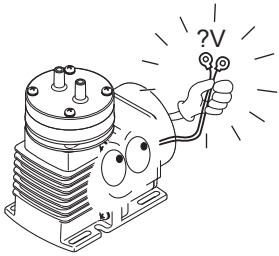
- Do not install the pump in a place where the pump can get wet. Avoid using wet gas, or internal condensation will build up and consequently result in the short lives of the valve and diaphragm.



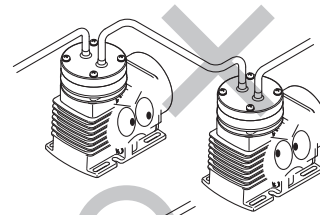
- Do not install the pump in a corrosive or flammable gas atmosphere. Keep good ventilation in a working area.

- Ambient temperature should not fall below 0°C or exceed 40°C. Observe the allowable gas temperature range of 0 and 40°C.

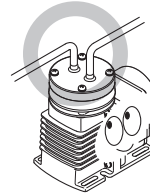
Installation



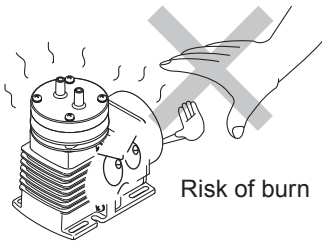
- Observe the rated voltage specified on the name plate. Applying any voltage than the rated one may result in failure.



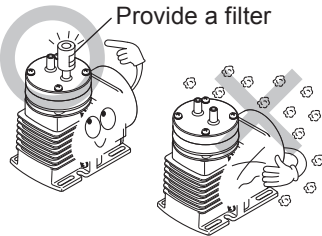
- Do not tube two or more pumps in series. It may prevent the motor from starting and lead to a burn out.



- 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.



Risk of burn



Provide a filter

- 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 valves and diaphragm remarkably shorten.

Installation

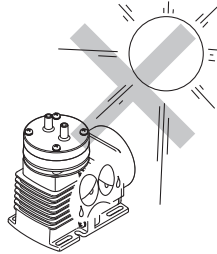
2. Installation/ Tubing/ Electrical wiring

WARNING

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

2.1 Installation

1. Do not expose the pump to direct sunlight, vibration and wind & rain.
2. Keep good ventilation. The pump should always be free from the possibility of getting wet.
3. Ambient temperature should not fall below 0°C or exceed 40°C. Observe the allowable maximum ambient humidity of 90%RH.
4. Install the pump in a clear and level place.
Select a convenient place for maintenance and inspection.

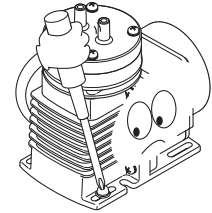


5. Pump fixation

Set the pump baseplate on a concrete foundation and fasten anchor bolts tightly to prevent the pump from vibrating during operation.

CAUTION

Do not install the pump on a unstable place.

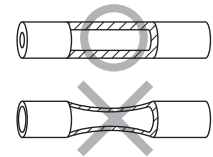


2.2 Tubing

1. The short tubing with the minimum bends is optimal to reduce resistance.
2. Use vinyl tubes resistant to the pumping pressure.

CAUTION

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



Installation

3. Tube size

Select proper tube size, otherwise liquid leaks and failure may result.

CAUTION

Use of a wrong tube size bears the risk of coming off, causing an air leak.

4. Valve installation

Install valves on both discharge and suction lines.

- Suction valve:

For adjustment of an air flow and a vacuum.

- Discharge valve:

For maintenance and shutoff.

5. Tube connection

Push the tubes into the inlet and outlet as far as they will go.

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

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. When an external fuse is used and has blown out, always investigate and solve root causes. Replace the fuse before resuming operation.
Be sure to unplug the pump before investigating the cause of blowout. If the fuse blows frequently, starting current may be a root cause. In this case review the system.

Installation

5. For wire lead colours, red ⊕ and black ⊖ are for power voltage. Yellow ⊕ and black ⊖ leads are for external variable signal. The black ⊖ lead is common for both the power and the signal. Observe the maximum signal voltage of 5.5VDC.

⚠ CAUTION

Observe polarity, otherwise failure or malfunction may result. Note that rotational direction of the motor does not change by reversing polarity.

Red: 24VDC (+)

Black: GND (-)

Yellow: 1-5VDC external variable signal(+)

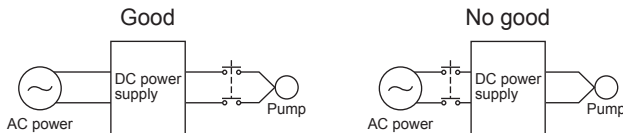
Orange: Encoder output (Max output current: 3mA)

6. In order to make ON-OFF operation, install a switch between the DC power supply and the pump. Installing it between the DC power supply and the AC power source, the pump may not run.

7. After wiring work, check that the system is free from the inductive noise at start-up.
8. Noise accompanies the high-speed switching of the drive circuit. Check it does not affect peripheral devices.
9. If a power source is shared with inductive loads such as a solenoid relay, take protective measures against surge.

■ Rated current & Starting current

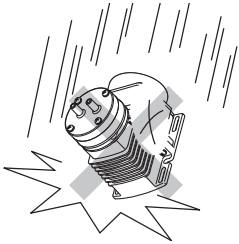
Model	Rated current	Starting current
APN-085-D4	1.2A	4A or below



Wiring example

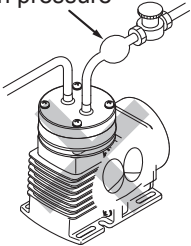
Operation

1. Before operation



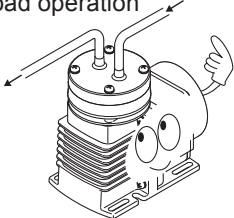
- Dropping or subjecting the pump to strong impact, failure may result. Handle the pump with care.

Suction pressure



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

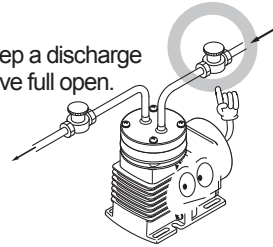
No load operation



- After a long period of stoppage, pump performance at the beginning of operation becomes occasionally unstable. In this case, warm the pump up for 10 minutes with no discharge line pressure.

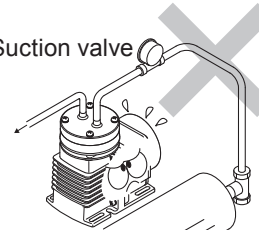
Suction valve

Keep a discharge valve full open.



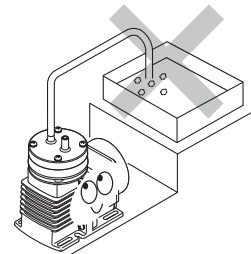
- Always use a suction valve to adjust an air flow.

Suction valve



Do not increase suction line pressure

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



- Injection point must be below the pump position. Or siphon action/back flow may result.

Operation

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

2. Pump operation

■ Start-up

1. Before pump operation, check that each tube connection is secured.
2. Check that a suction line is connected to the inlet and a discharge line to the outlet.

CAUTION

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

3. Check that the pump is firmly fixed on a mounting position.

■ Operation

Operate the pump according to the following steps.

No.	Procedure	Points to be Checked
1	Check tubing, wiring and voltage.	<ul style="list-style-type: none">• See "2.2 Tubing" and "2.3 Electrical wiring" sections.• Check the spec label to see if power supply voltage is correct.
2	Open valves.	<ul style="list-style-type: none">• Fully open both discharge and suction lines.
3	Supply power to the pump.	<ul style="list-style-type: none">• Check the item 1 and 2. Then turn on power and start the pump.• Smooth starting may not be obtained when ambient temperature is 10°C or below. In this case, run the pump with no discharge line pressure for a few minutes to warm it up.
4	Adjust air flow.	<ul style="list-style-type: none">• Provide a running-in period before full scale operation.• Always adjust an air flow by a suction valve.

Operation

5	Points to be checked during operation	<ul style="list-style-type: none">• 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.
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■ Stop and Storage

Before a long period of stoppage (1 week or more):

- Release pressure and turn off main power.
- Make sure both supply air and gas are stopped.

Before resuming operation:

- Warm up the pump under no load operation. Operation may occasionally be upset in the beginning.
- Follow the "■ Operation" table to resume operation.

Maintenance

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					Measures
Causes	Pump does not run.	Pump stops running.	Poor air flow or discharge pressure	Pump makes noise.	
No power distribution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check wiring.
Motor trouble (disconnection or capacitor failure)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace the motor.*
Wrong tubing or poor connection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check and fix tubing.
Pump head mounting screws are loose.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tighten the screws.
Diaphragm insertion is loose.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tighten diaphragm.
Diaphragm is damaged.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace diaphragm.
Filter is clogged.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Remove foreign matters.
Valve is worn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace the valve.
Higher suction pressure than atmospheric	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Reduce suction pressure.
Eccentric shaft has worn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace the connecting rod unit.*
Connecting rod bearing has worn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace the connecting rod unit.*
Motor bearing has worn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace the motor.*
Voltage reduction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Increase voltage to the rated level.
Bracket tightening screws are loose.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Secure them.
Condensation in the pump head.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Dry up the pump.

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.

We are not responsible for personal injury or property damage due to nonobservance of this warning. Contact us or your nearest distributor as necessary.

■ Daily inspection

Pay attention to the following items during operation. Stop operation on sensing danger and solve problems on the Troubleshooting section. If pump performance has remarkably reduced, replace wear parts.

No.	Check that...	Measure
1	pump operation is normal.	<ul style="list-style-type: none"> Apply correct voltage and amperage. Adjust discharge/suction pressure.
2	there is no noise or vibration problem.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Retighten connections.

Maintenance

■ Wear parts

If pump performance has remarkably reduced, replace diaphragms and valves with new ones. Wear part duration varies with the pressure, temperature and characteristics of gas/liquid.

The estimated life below is calculated based on continuous operation with clean water at ambient temperature (Room temperature range is 0-40°C.).

Application	Load range	Estimated life	
		Valve	Diaphragm
Gas transfer	All range	8000hr	8000hr

*The above lives are reference values and not warranted.

■ Cleaning

Turn off power and wait until the pump has cooled down. Then clean off the surface of the pump with a wet cloth. Use a neutral detergent for greasy dirt as necessary and dry it with a dry cloth.

Check the pump surface has dried up before operation.

CAUTION

Risk of electrical shock. Do not wet electric parts or wiring.

■ Storage

Protect the pump from dust during storage.

Do not store the pump:

- Where ambient temperature falls below 0°C or exceeds 40°C.
- Under a flammable or corrosive atmosphere.
- Under heavy dust or high humidity.
- Under direct sunlight or wind & rain.
- Under vibration.

Maintenance

3. Wear part replacement

For a long period of operation wear parts need to be replaced periodically.

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.

See page 7 "8. Part names & Structure" as necessary.

■ Diaphragm replacement

<APN-085>

1. Unscrew all the pump head fixing screws and take out the pump head, valve and valve seat.
2. Catch the diaphragm nut with a special spanner and turn the diaphragm anti-clockwise so as to detach it from the con rod (Fig.1).
3. Mount a new diaphragm into the rod and fasten as far as it will rotate with the spanner.
4. Push down the diaphragm until it bottoms out and then mount and secure the valve seat, valve and pump head onto the bracket with the screws by 1.39N•m.

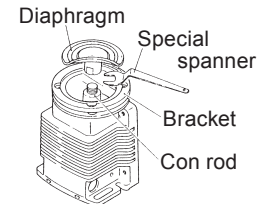
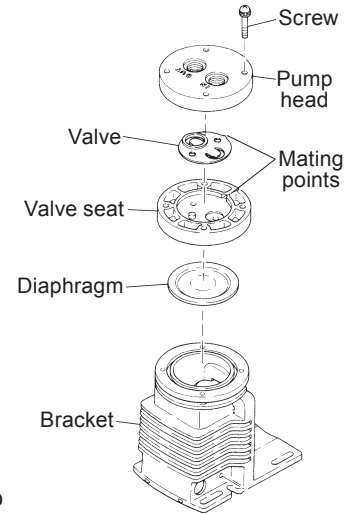


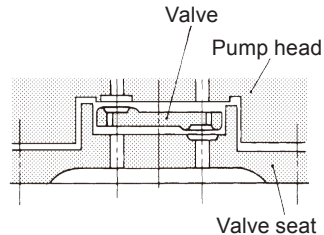
Fig.1

Maintenance

■ Valve replacement

<APN-085>

1. Unscrew all the pump head fixing screws and take out the pump head and valve.
2. Replace the old valve with new one. Always check the mating points and fit the valve and the pump head in place.
3. Supply air into the pump head unit through the inlet and check the air is discharged through the outlet.
4. Push down the diaphragm until it bottoms out and then secure the pump head unit onto the bracket with the screws by $1.39\text{N}\cdot\text{m}$.



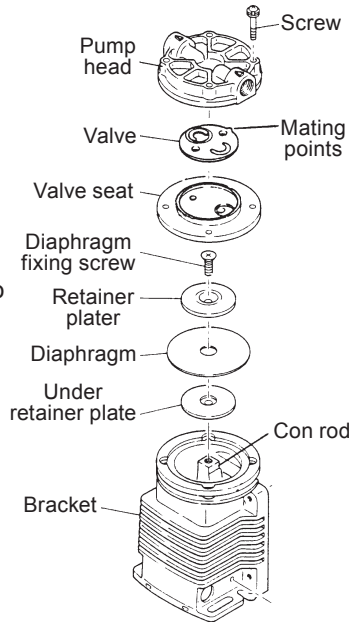
NOTE1. Do not loosen the motor fixing screws during maintenance work.

NOTE2. Contact your nearest distributor for the replacement of the connecting rod and the motor.

■ Diaphragm replacement

<APN-085L/H>

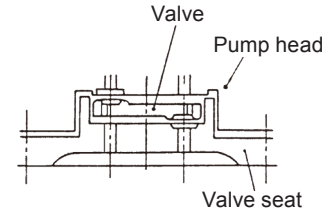
1. Unscrew all the pump head fixing screws and take out the pump head, valve and valve seat.
2. Remove the diaphragm fixing screw and detach the retainer plate and diaphragm.
3. Place a new diaphragm onto the under retainer plate.
4. Place the retainer plate onto the diaphragm. Apply the LOCTITE® 222 to the diaphragm fixing screw and tighten it by $1.98\text{N}\cdot\text{m}$ so as to secure the retainer plate.
5. Push down the diaphragm until it bottoms out and then mount and secure the valve seat, valve and pump head onto the bracket with the screws by $1.98\text{N}\cdot\text{m}$.



■ Valve replacement

<APN-085L/H>

1. Unscrew the pump head fixing screws and take out the pump head and valve.
2. Replace the old valve with new one. Always check the mating points and fit the valve and the pump head in place.
3. Supply air into the pump head unit through the inlet and check the air is discharged through the outlet.
4. Push down the diaphragm until it bottoms out and then secure the pump head unit onto the bracket with the screws by $1.39\text{N}\cdot\text{m}$.







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