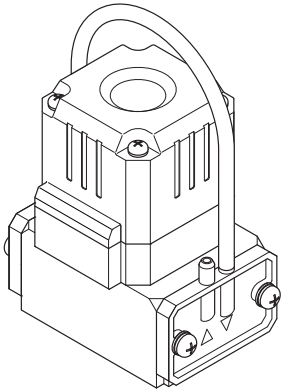
IWAKI

Iwaki Air Pump

APN-S041-D3/-D4 (built-in type)



Instruction manual

Thank you for choosing our product.

⚠ Please read through this instruction manual before use.

T982-1 '17/11

Contents

Order confirmation

a. Check if the delivery is correct.

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

b. Check if the delivery is damaged or deformed.

Check for transit damage and loose bolts.

Safety instructions

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

■ Symbols

⚠ **Warning**	Indicates mishandling could lead to a fatal or serious accident.
⚠ **Caution**	Indicates mishandling could lead to personal injury or property damage.

⚠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.

⚠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.

Stop operation

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

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 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.

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.

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.

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.

⚠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.

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

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

Do not install /store the pump:
- In a flammable atmosphere or a dusty/humid environment.
- Where ambient temperature can exceed 0-40°C. (lowest storage temp: 0°C)
- In direct sunlight or wind & rain.

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

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

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.

Electromagnetic precautions
This product is not protected against an electromagnetic field. Take appropriate measures as necessary.

Do not touch the pump or pipe with bare hands
Risk of burning. The surface temperature of the motor rises high in or right after operation.

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

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.

This dedicated pump is designed for built-in application only.
The bottom of the pump (case) is opened and the eccentric cam in the case is not entirely protected. Always mount the pump on the opened bottom, or cover the open surface, so make sure nothing will interfere with the cam motion.

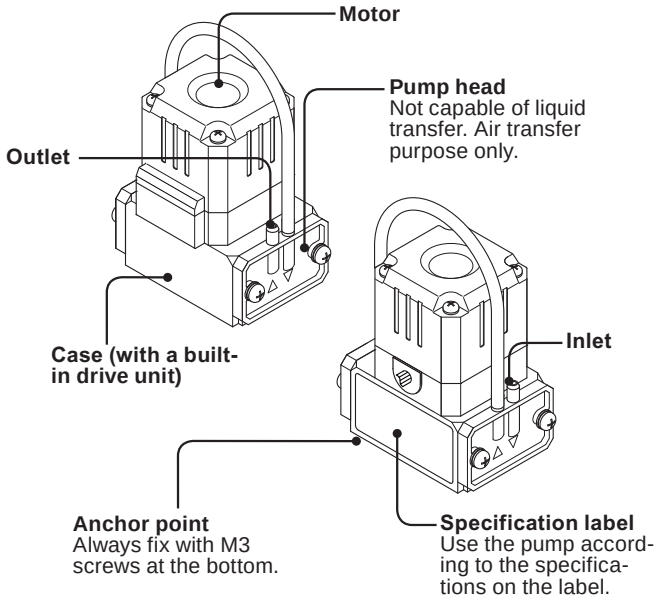
Precautions for use

- Electrical work should be performed by a qualified electrician. Otherwise, personal injury or property damage may result.
- 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 reduction of pump performance or the short lives of the valve and diaphragm.
- 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 remarkably shorten.
- Do not install the pump in a corrosive or flammable gas atmosphere. Keep good ventilation in a working area. Ambient and gas temperature should not fall below 0°C or exceed 40°C.
- If the compressed air (higher pressure than atmospheric pressure) is transferred to the pump, sharp deterioration to the lives of the valve, diaphragm and bearing may result. Always keep atmospheric or lower pressure in the suction line.
- Do not tube pump heads in series. It may prevent the motor from starting, causing burning out or may damage the diaphragm or piping.
- Do not tube two or more pumps in series. It may prevent the motor from starting and lead to a burn out.
- An air injection point below the liquid level must be lower than the pump position. Or siphon action or back flow may result.
- 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.
- Do not apply power other than that specified on the nameplate. Otherwise, failure or fire may result.
- The pump can not start with full discharge/suction pressure. Remove pressure 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 for 10 minutes with no discharge/suction line pressure.
- Always use a suction valve to adjust an air flow.
- Do not clean the pump or nameplate with a solvent such as benzine, thinner or kerosene. This may discolour the pump or erase printing. Use a dry or damp cloth or a neutral detergent.

Overview

The APN-S041-D3/-D4 is a built-in type small diaphragm air pump.
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.

Part names



Identification codes

The model code represents the following information.

APN - S 041 M E _ - D4 - 01
a b c d e f g h

a. Series name
Air pump

b. Pump head
S: Dual-head with in-line tubing

c. Pump size

d. Type
M: Vacuum

e. Diaphragm/valve materials
E: EPDM

f. Pump connection
No code: ø4.5 tube connection

g. Power voltage
D3: 24VDC BLDC motor (without speed control)
D4: 24VDC BLDC motor (with variable speed control)

h. Special specification

Installation

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

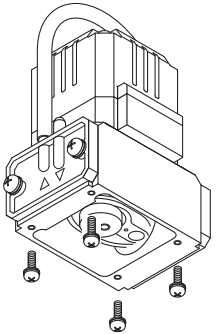
! Observe the following points

- Do not operate the pump in a flammable atmosphere.

Pump mounting

1. Select a suitable place.
See the Precautions for use section before installation.

2. Anchor the pump at four fixing point at the bottom.
Use M3 screws.

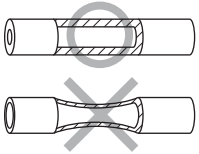


NOTE
Install the pump on a level location, free from vibration

Pipework

Connect tubes to the pump.

- Cut tube ends flat.
- The short tubing with the minimum bends is optimal to reduce resistance.
- Use tubes resistant to the pumping pressure. A proper tube size should be used according to the O.D. of the pump inlet/outlet for the prevention of gas ingress/leak or other failure.

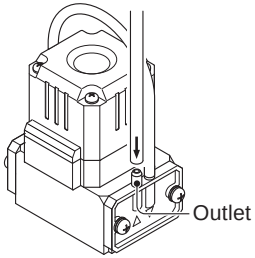


NOTE

Do not have tubing bent or pressed. Otherwise, the inlet and outlet of the pump may break.

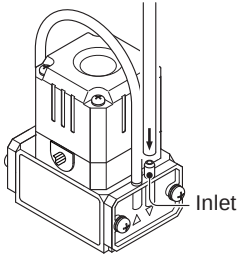
1. Push the tubes into the inlet and outlet as far as they will go.

*If suction line connection is imperfect, the pump entrains air and will not run correctly.



2. Valve mounting

Install a valve in the suction line for adjusting an air flow.



Wiring

Wiring for power source, earthing and external signal.

! Observe the following points

- Electrical work should be performed by a qualified electrician. Confirm to local electric codes.
- Do not perform wiring work while power is on. Otherwise, an electrical shock or short circuit may result, and consequently the pump may fail. Be sure to turn off power before service is performed.

■ Before wiring

- Check that the main power is turned off.
- Apply the specified power voltage. See the spec label.
- When an external fuse is used and it has blown, always solve the root cause of blowout. Be sure to unplug the power cable before investigation. If the fuse blows frequently, the starting current may be a root cause.
- For the APN-S041-D3, red(+) and black(-) leads are for power voltage.
- For the APN-S041-D4, red(+) and black(-) leads are for power voltage. Yellow(+) and black(-) leads are for 1-5VDC external variable signal. The black(-) lead is common for both the power and the signal.

NOTE

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

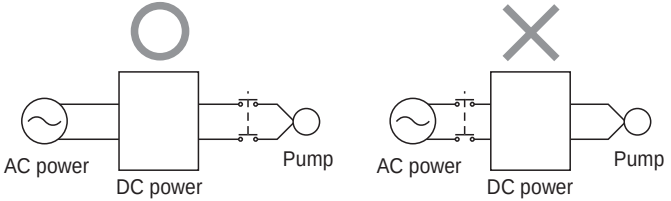
D3 Type

Red: 24VDC (+)
Black: GND (-)

D4 Type

Red: 24VDC (+)
Black: GND (-)
Yellow: 1-5VDC external variable signal (+)
White: Encoder output (Max output current: 3mA)

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



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

Operation

The pump becomes ready after tubing and wiring is completed.

Before operation

- Check that the pump is firmly fixed on a mounting position.
- Check that a suction tube is connected to the inlet and a discharge tube is connected to the outlet.
  *If a suction line and a discharge line are connected the other way around, pumping process is inverted.
- Check that every tube connection is secured.
- Check that electrical wiring is properly done without the possibility of short-circuit and protected by an fuse.
- Check that power voltage that is specified on the nameplate is applied to the pump.

1. Open the suction and discharge lines.

2. Turn on power.

*Operation may occasionally be upset when starting temperature is low. Warm up the pump under no load operation (a few minutes).

3. After the pump has reached a specified stroke rate, initiate full scale operation.

- Always adjust an air flow by a suction valve.
- 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.

4. 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.

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

Depressurize the system and stop air/gas supply. Do not install/store the pump:

- In a flammable/corrosive atmosphere.
- In a dusty/humid environment.
- In direct sunlight or wind & rain.
- Under vibration.
- Where ambient temperature can exceed 0-40°C.

Maintenance

This section describes troubleshooting, inspection, wear part replacement, exploded views and specifications.

! Observe the following points

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

Troubleshooting

If you notice any abnormal or hazardous conditions, suspend operation immediately and check the following points. If the following measures do not help remove problems, contact your nearest distributor.

States	Possible causes	Solutions
The pump does not run.	The pump is not powered.	• Check the pump is powered.
	Power voltage is too low or too high.	• Observe the rated voltage of 24VDC.
	Wrong tubing or poor connection	• Check and fix tubing/connections.
	Diaphragm fixing screw is loose.	• Tighten the screw.
	Eccentric shaft has broken.	• Replace the connecting rod unit. Contact us.
The pump does not run.	Connecting rod bearing has worn.	• Replace the connecting rod unit. Contact us.
	Motor trouble	• Replace the motor. Contact us.
	Suction line pressure is higher than atmospheric pressure.	• Keep it lower than atmospheric pressure.
Pump operation unintentionally stops.	Power voltage is too low or too high.	• Observe the rated voltage of 24VDC.
	Connecting rod bearing has worn.	• Replace the connecting rod unit. Contact us.
	Motor trouble	• Replace the motor. Contact us.
	Suction line pressure is higher than atmospheric pressure.	• Keep it lower than atmospheric pressure.
	Discharge line pressure is higher than atmospheric pressure.	• Keep it lower than 0MPa.
An air flow rate and a discharge pressure are too low.	Wrong tubing or poor connection	• Check and fix tubing/connections
	Pump head mounting screws are loose.	• Tighten the screws.
	Diaphragm fixing screw is loose.	• Tighten the screw.
	Diaphragm is broken.	• Replace the diaphragm.
	Filter is clogged.	• Clean the filter.
	Valve has worn.	• Replace the valve.
Significant noise	Pump head mounting screws are loose.	• Tighten the screws.
	Diaphragm fixing screw is loose.	• Tighten the screw.
	Diaphragm is broken.	• Replace the diaphragm.
	Eccentric shaft has broken.	• Replace the connecting rod unit. Contact us.
	Connecting rod bearing has broken.	• Replace the connecting rod unit. Contact us.
	Motor trouble	• Replace the motor. Contact us.

Inspection

Perform daily and periodic inspections to keep pump performance and safety.

■ Daily inspection

Check the following points every day. If you notice any abnormal or hazardous 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 us or your distributor for detail.

No.	States	Points to be checked
1	Pumping	• If the specified power voltage & starting current are observed.
		• If suction pressure is normal.
2	Noise and vibration	• If abnormal noise or vibration occurs. They are signs of abnormal operation.
3	Gas ingress/leak from pump head joints and a suction line.	• Check lines for a leak and retighten as necessary.

Wear part replacement

To run the pump for a long period, wear parts need to be replaced periodically. It is recommended that the following parts are always stocked for immediate replacement. Contact your nearest distributor for detail.

■ Wear part list

If pump performance has remarkably reduced, replace diaphragms, valves, and sheet with new ones.

Application	Estimated life		
	Valve	Diaphragm	Sheet
All APN-S041 models	8000hr	8000hr	8000hr

*Wear part duration varies with the pressure, temperature and characteristics of gas.
*The estimated life above is calculated based on continuous operation at the room temperature of 20°C.
*The estimated life above is not guaranteed.

■ Before service

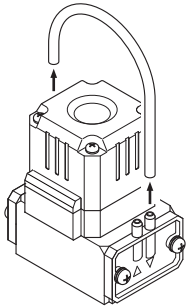
Depressurize the pump system before service is performed.

1. Turn off power to stop the pump.

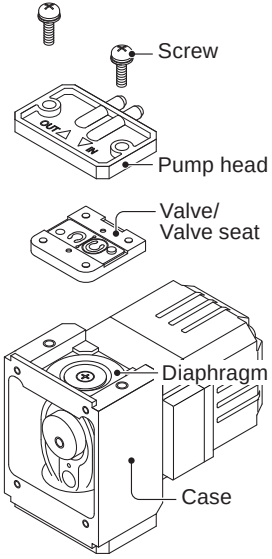
2. Open both the suction- and discharge-line valves or remove the pump from tubing system.

■ **Diaphragm replacement**

1. Remove the tube.



2. Take apart the pump head.
Remove the screws, pump head, valve, and valve seat.
*Do not remove the valve from the valve seat.



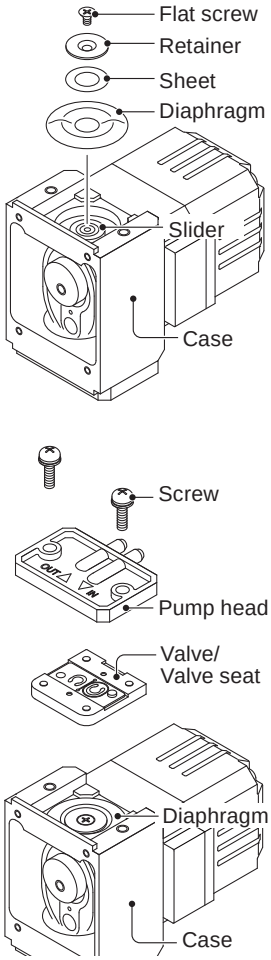
3. Remove the flat screw, retainer, sheet, and diaphragm.

4. Mount a new diaphragm.
*The diagram has a mounting direction as shown.

5. Mount the sheet and retainer.
Use the Loctite® 222 to the flat screws and tighten them by 0.59N•m.

6. Push down the diaphragm to the lowest position.
Replace the valve and the valve seat to original positions.

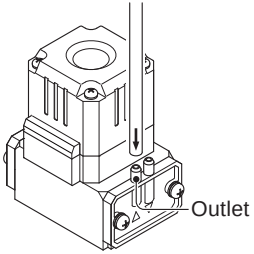
7. Fasten the pump head by 1.18-1.27N•m.

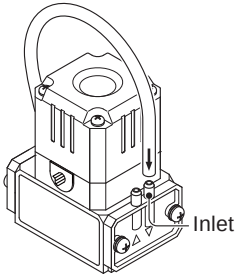


8. Fit the tube to the inlet and outlet.
One end of the tube to the inlet and the other to the outlet.

NOTE

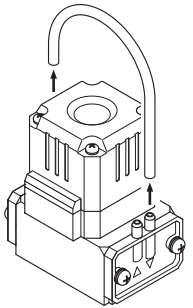
The pump may fail if the tube is connected improperly.



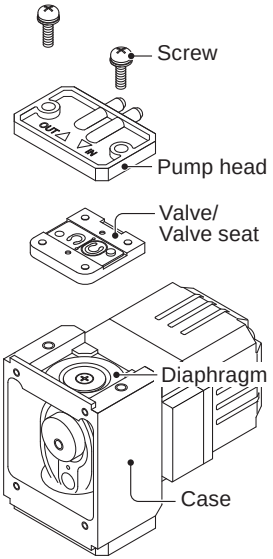


■ Valve replacement

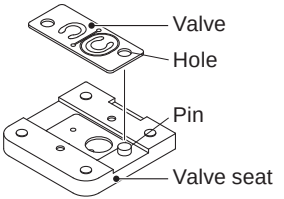
1. Remove the tube.



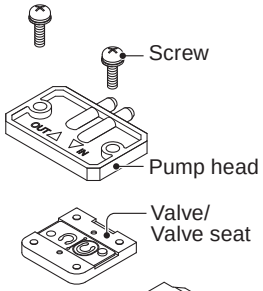
2. Take apart the pump head.
Remove the screws, pump head, valve, and valve seat.



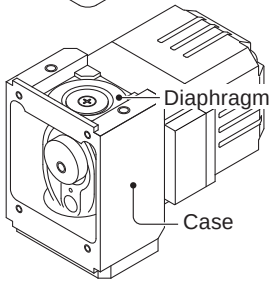
3. Mount the new valve to the valve seat.



4. Push down the diaphragm to the lowest position.
Replace the valve and the valve seat to original positions.



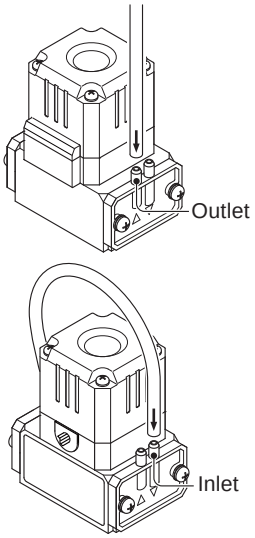
5. Fasten the pump head by 1.18-1.27N•m.



6. Fit the tube to the inlet and outlet.
One end of the tube to the inlet and the other to the outlet.

NOTE

The pump may fail if the tube is connected improperly.



NOTE

- When the pump is taken apart for diaphragm/valve replacement, do not remove or loosen any other screws which hold the pump or motor.
- Contact us or your distributor when the slider, the eccentric shaft, or the motor is to be replaced.

Specification/Outer dimension

Information in this section is subject to change without notice.

Specification

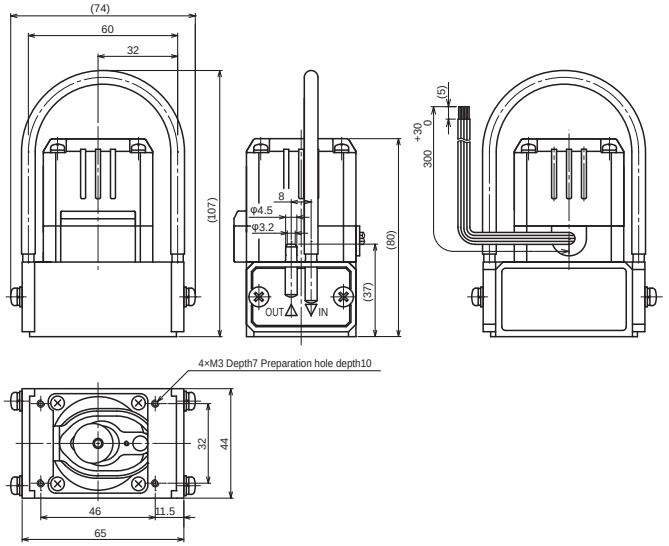
Model Code	Max air flow L/min	Max vacuum	Motor		Connec-tion	Weight	Lowest Starting Temp
			Power cons.	Rated current	Tube		
APN-S041	0.8 L/min	9.33 kPa	6W	0.25A	ø4.5	0.4kg	0ºC

*This data is based on operation at 24VDC power voltage and 5VDC control voltage.
*Observe the maximum allowable discharge pressure of 0.0MPa.
*Allowable gas temperature range is 0-40ºC.
*Allowable ambient temperature range is 0-40ºC.
*Maximum operating noise is 41dB at 1m (A scale).

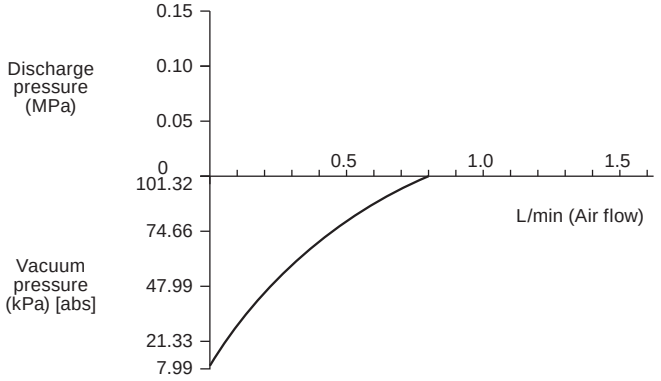
Names	Materials
Pump head	GFRPPS
Diaphragm	EPDM
Valve	
Valve seat	GFRPPS
Retainer	
Sheet	PTFE
Tube	CR

GFRPPS: Glass fiber reinforced polypropylene sulfide
EPDM: Ethylene propylene diene monomer
PTFE: Polytetrafluoroethylene
CR: Polychloroprene

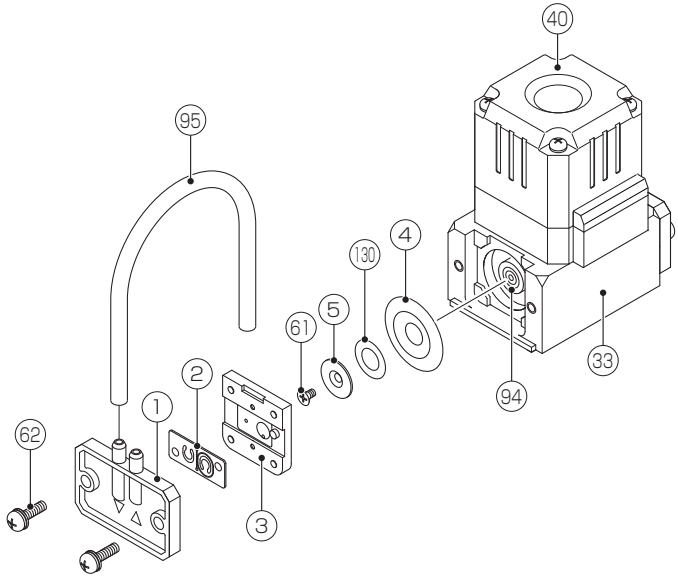
Outer dimension



Performance curves



Parts names & Structure



No.	Part names	Q'ty	No.	Part names	Q'ty
1	Pump head	2	40	Motor	1
2	Valve	2	61	Flat screw	2
3	Valve seat	2	62	Screw	4
4	Diaphragm	2	94	Slider	1
5	Retainer	2	95	Hose	1
33	Case	1	130	Sheet	2

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