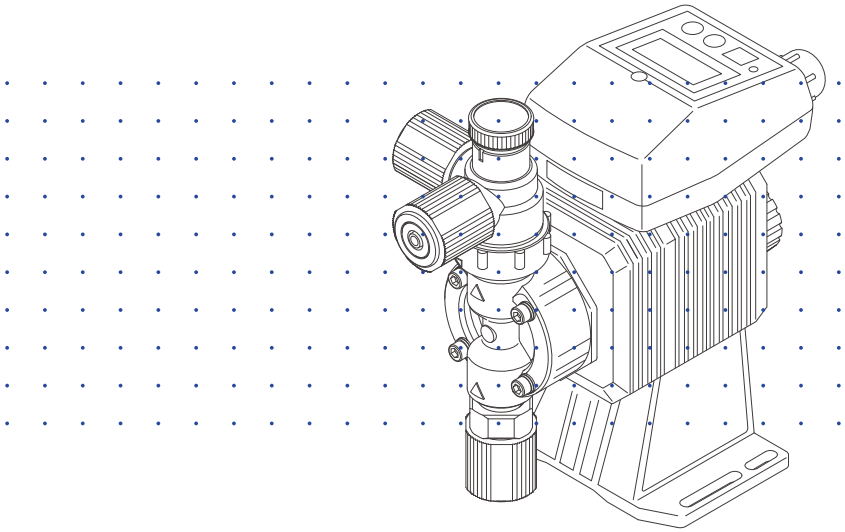
Iwaki
Electromagnetic Metering Pump

ES-B/-C M-3D-K6



Instruction manual

Thank you for choosing our product.

Please read through this instruction manual before use.

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

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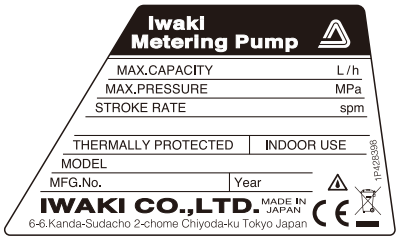
Order confirmation

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

a. Check if the delivery is correct.

Check the nameplate to see if the information such as model codes, 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.

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Safety instructions

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

■ Symbols

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

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

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

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

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



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.



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.



Do not operate the pump in a flammable atmosphere

Do not place explosive or flammable material near the pump.



⚠ 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.


Requirement

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

Do not run pump dry

Do not run pump dry for more than 30 minutes (even when the pump runs for degassing). Otherwise, the pump head fixing screws may loosen and liquid may leak. Optimise your system. If the pump runs dry for a long period (for more than 30 minutes), the pump head and the valve guide may deform by friction heat and consequently leakage results.


Caution

Keep electric parts and wiring dry

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


Prohibited

Ventilation

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


Caution

Do not install /store the pump:

- In a flammable atmosphere
- In a dusty/humid environment.
- Where ambient temperature can exceed 0-40°C.
- In direct sunlight or wind & rain.
- Where ambient humidity can exceed 90%RH.

Protect the pump with a cover when installing it out of doors.


Prohibited

Spill precautions

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


Requirement

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

Grounding

Risk of electric shock! Always properly ground the pump. Conform to local electric codes.


Grounding

Install a GFCI (earth leakage breaker)

An electrical failure of the pump may adversely affect other devices on the same line. Purchase and install a GFCI (earth leakage breaker) separately.


Electrical shock

Preventative maintenance

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


Requirement

Do not use a damaged pump

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


Prohibited

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.


Requirement

Check pump head bolts

Liquid may leak if any of the pump head bolts become loose. Tighten the bolts diagonally and evenly by the following torque before initial operation and at regular intervals (once a three month).


Caution

Tightening torque

ES-B11/-C21	: 2.16 N•m

Install a relief valve

Install a relief valve on a discharge line near the pump so as to automatically release the discharge pressure when it exceeds the maximum level.

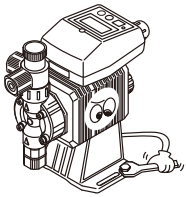

Requirement

Precautions for use

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



- Select a level location, free from vibration, that won't hold liquid. Anchor the pump with four M5 bolts so it doesn't vibrate. If the pump is not installed level, output may be affected.



- When two or more pumps are installed together, vibration may be significant, resulting in poor performance or failure. Select a solid foundation (concrete) and fasten anchor bolts securely to prevent vibration during operation.



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



- Install the pump as close to the supply tank as possible.



- When handling liquids that generate gas bubbles (sodium hypochlorite or hydrazine solution), install the pump in a cool and dark place. Flooded suction installation is strongly recommended.



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



- The pump has a rating of IP65 equivalent, but is not waterproof. Do not operate the pump while wet with solution or water. Failure or injury may result. Immediately dry off the pump if it gets wet.



- Do not close discharge line during operation. Solution may leak or piping may break. Install a relief valve to ensure safety and prevent damaged plumbing.



- Do not use the control unit to a different drive unit of other pumps. An electrical circuit or the drive unit may fail.



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



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



- Do not clean the pump or nameplate with a solvent such as benzine or thinner. This may discolor the pump or erase printing. Use a dry or damp cloth or a neutral detergent.



- In accordance with the European Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), 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.



Overview

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

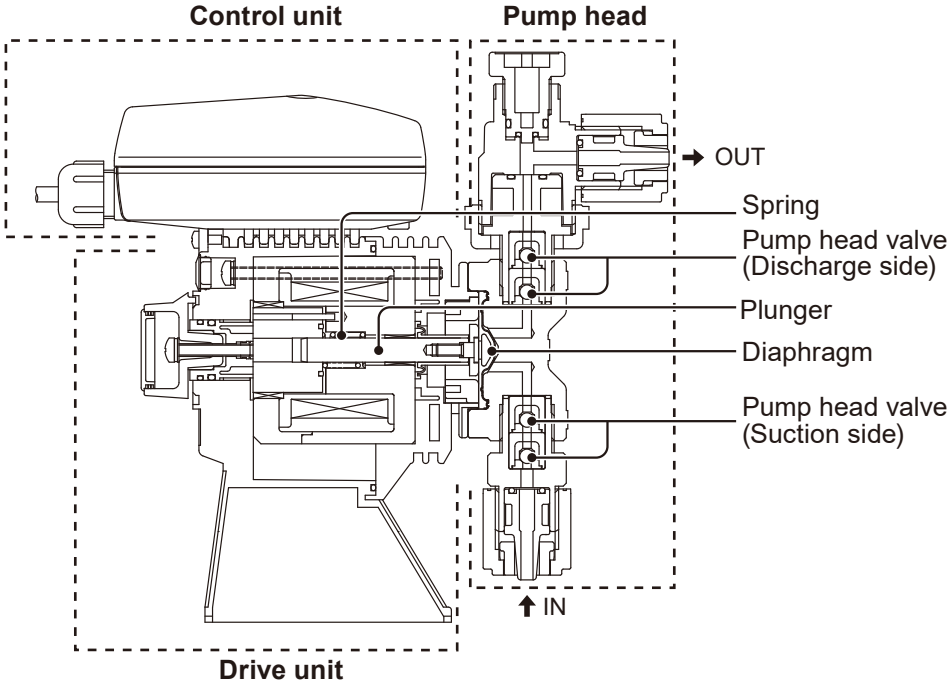
Introduction

Pump structure & Operating principle

The ES series is a diaphragm metering pump which consists of a pump head, a drive unit, and a control unit. A diaphragm is directly driven by electromagnetic force.

Principle of operation

The pulse signal via the control unit generates the electromagnetic force to make reciprocating motion with the assistance of the spring force. The reciprocating motion is transferred to the diaphragm through the plunger and then volumetric change occurs in the pump head. This action transfers liquid along with pump head valve action.



Features

- **High turndown ratio**

  A wide range, digitally-controlled, turndown ratio of 1-360spm with fine flow tuning (stroke length adjustment)

- **Waterproof and dustproof structure**

  The sealed drive unit and control unit assure IP65 equivalent.

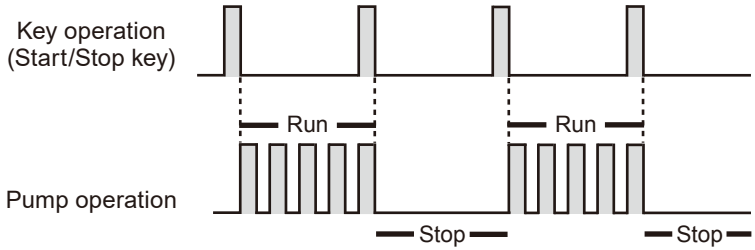
  *This pump is not waterproof. Protect the pump with a cover when installing it out of doors.

Operational functions

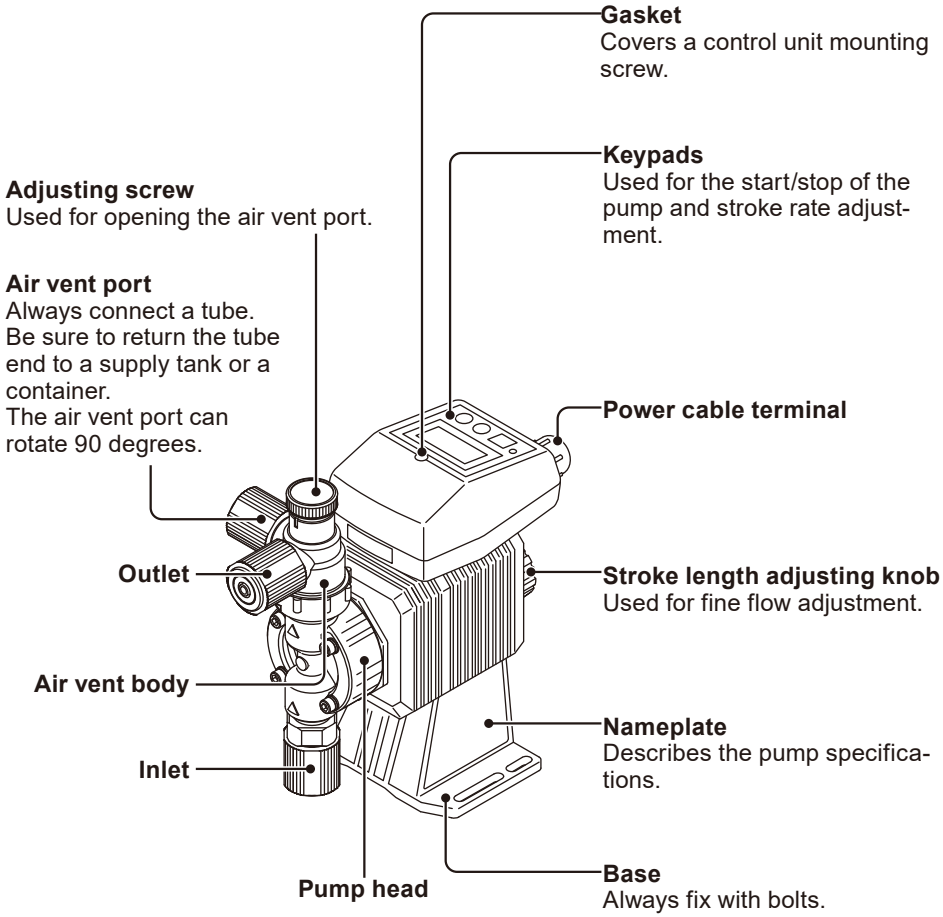
Manual mode

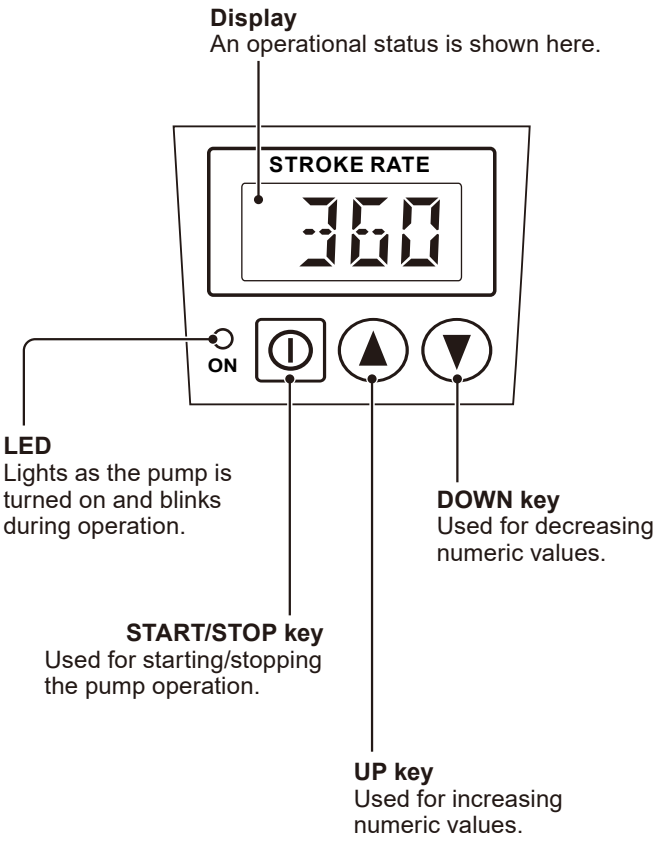
Run/stop the pump by the start/stop key. A stroke rate (MAN speed) can be changed in the range of 1-360spm by the up and down keys at any time during operation or stop. See page 36 for detail.

*The pump can also be turned ON/OFF by switching the main power.



Pump


Gasket
Covers a control unit mounting screw.
Keypads
Used for the start/stop of the pump and stroke rate adjustment.
Adjusting screw
Used for opening the air vent port.
Air vent port
Always connect a tube.
Be sure to return the tube end to a supply tank or a container.
The air vent port can rotate 90 degrees.
Power cable terminal
Outlet
Stroke length adjusting knob
Used for fine flow adjustment.
Air vent body
Nameplate
Describes the pump specifications.
Inlet
Pump head
Base
Always fix with bolts.



■ Basic displays & Pump states

	LED lights	LED blinks
360	A wait state in MAN mode The screen shows the MAN speed (spm).	Operation in MAN mode. The screen shows MAN speed.

Identification codes

The model codes of the pump/drive units and the control unit represent the following information.

Pump/Drive units

ES - B 11 VC _ M - 3 D - K6
a b c d e f g h i

a. Series name

ES: Manual stroke speed control

b. Drive unit (average power consumption)

B: 16W

C: 22W

c. Diaphragm effective diameter

11: 10mm

21: 20mm

d. Wet end materials

Code	Pump head	Valve	O ring	Valve seat	Gasket	Diaphragm
VC	PVC	Alumina ceramic	FKM	FKM	PTFE	PTFE (bonded to EPDM)
VH		HC276	EPDM	EPDM		

Material code

PVC : Transparent polyvinyl chloride

EPDM : Ethylene-propylene rubber

FKM : Fluorine-contained rubber

PTFE : Polytetrafluoroethylene

HC276 : HASTELLOY C276

e. Tube size

No.	Tube I.D. × O.D.	Applicable pumps
No code	ø4×ø6	ES-11/-21

f. Fitting

M: Multi-tube connection

g. Power voltage (50Hz)

3: 207-253VAC

h. Control unit function

D: Digital type

i. Special version

Control unit

ES - B D 3

a b c d

a. Model

ES: Manual stroke speed control

b. Drive unit

B: 16W

C: 22W

c. Control unit function

D: Digital type

d. Power voltage

Code	Rated voltage	Permissible voltage range
3	230VAC	207-253VAC

Installation

Installation of the pump, tubing, and wiring are described in this section.

Observe the following points when installing the pump.

- Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.
- If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems. Install a pump in such a way that the plug can easily be removed under those conditions.
- 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.

Pump mounting

Select the optimal installation location and mount the pump.

Necessary tools

- Four M5 bolts (pump mounting)
- An adjustable wrench or spanner

1 **Select a suitable place.**

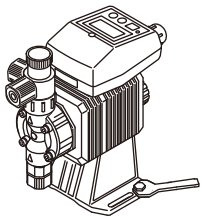
Select a level location, free from vibration, that won't hold liquid. See page 9 for detail. Flooded suction installation is strongly recommended when handling liquids that generate gas bubbles (sodium hypochlorite or hydrazine solution).

2 **Anchor the pump with the M5 bolts.**

Be sure to fix the pump at four points.

NOTE

If the pump is not installed level, output may be affected.



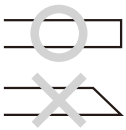
Plumbing

Connect tubes to the pump and install a check valve.

Before operation

• Cut the tube ends flat.

Tube end (side view)

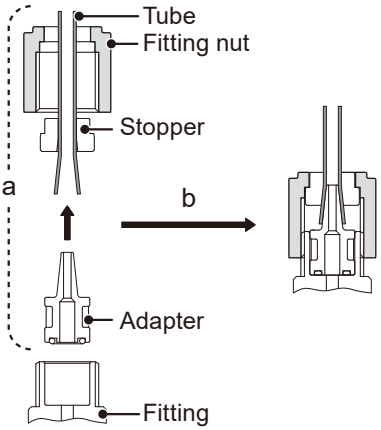


Necessary tools

• An adjustable wrench or a spanner

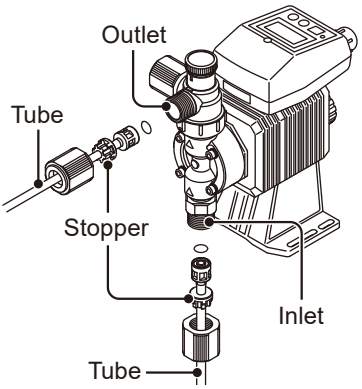
Tube connection

a. Pass a tube into the fitting nut and stopper and then slide it down to the adapter as far as it will go.
b. Put the tube end (adapter) in the fitting. Then hand tighten the fitting nut.
c. Retighten the fitting nut by turning it further 180 degrees with an adjustable wrench or spanner (crush tube mount).



*Do not use excessive force to the plastic fitting nut.
*In your try to remove the connection, the adapter may be stuck in the crushed tube and the stopper. Try not to damage the taper of the adapter that is crushing the tube against the stopper. If it has been damaged, contact us for the new adapter/stopper.
*Do not reuse the same tube end for the crush sealing. Cut it off for ensuring the new seal is established.

1 Connect tubes into the inlet and outlet.

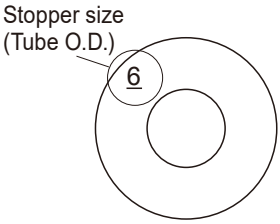


*You can tell the stopper size (tube O.D.) by the numeric number on stopper back.

Stopper size	Applicable tube size
6	ø4×ø6

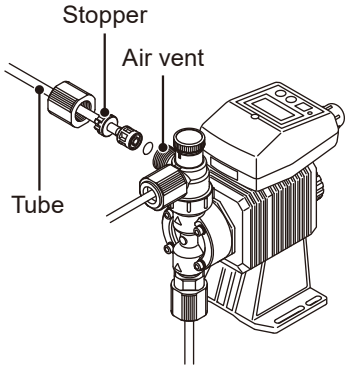


6 size hose stopper



2 Connect a tube to establish the air vent line.

Route the other tube end to a supply tank or a container.



3 **Determine the best mounting angle of the air vent body A.**

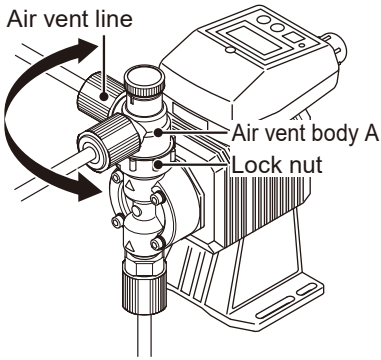
The air vent port can rotate 90 degrees.

a. Loosen the lock nut.

b. Turn the air vent body A to the optimal direction.

c. Hand-tighten the lock nut, holding the air vent body A.

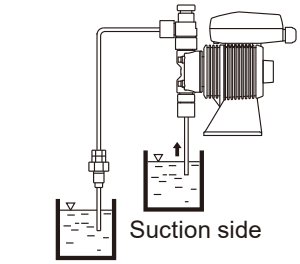
d. Use an adjustable wrench or spanner to turn the lock nut further 90 degrees.



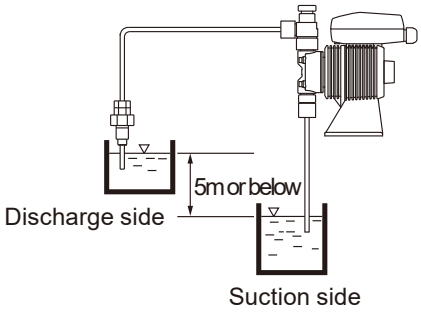
Check valve mounting

Install an attached/optional check valve to the pump for the prevention of a back flow, siphon and overfeeding. In the following cases be sure to install the check valve.

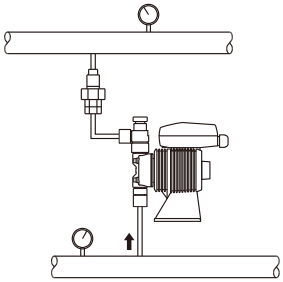
• A suction side liquid level is higher than a discharge side or an injection point at atmospheric pressure.



• A discharge side liquid level is higher than a suction side but the distance is 5m or below.



• A suction line pressure is higher than a discharge line pressure.

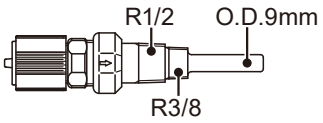


• A discharge pressure (including pipe resistance and discharge head) is below 0.13MPa.

1 Mount a check valve at the discharge tube end.

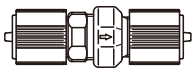
*The CAN check valve has the R1/2 and R3/8 thread connections as well as an O.D.9mm tube connection. Cut off an unused part and adjust the connection length as necessary.

CAN check valve

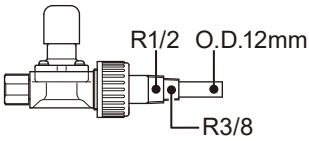


*The CBN check valve (both ends tube connections) and the BVC back pressure valve are optionally available. Contact us or your nearest distributor.

CBN check valve



BVC back pressure valve

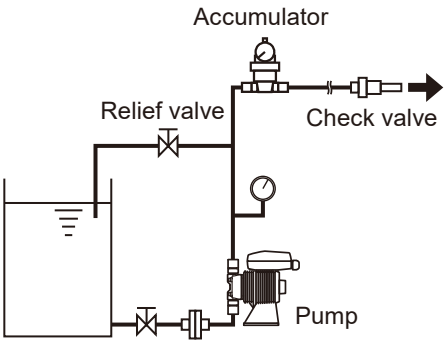


NOTE

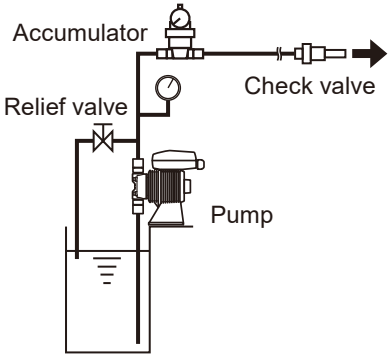
- Periodically clean or replace a check valve with new one for the prevention of crystal clogging, especially when using sodium hypochlorite.
- In the nature of the pump, the lower discharge pressure, the higher discharge capacity (and vice versa). If you want to observe the max discharge capacity at any low level of system (/discharge) pressure, use the check/back pressure valve to give the additional pressure of 0.17MPa±0.04 to the discharge line or reduce the pump speed/stroke length.

Tubing layout

Flooded suction application



Suction lift application



*Flooded suction installation is strongly recommended when handling liquids that generate gas bubbles (sodium hypochlorite or hydrazine solution).

Wiring

Wiring for a power voltage and earthing.

! Observe the following points during wiring work.

- Electrical work should be performed by a qualified electrician. Always observe local electric codes.
- Observe the rated voltage range, or the electrical circuit in the control unit may fail.
- Do not perform wiring work while electric power is ON. Otherwise, an electrical shock or a short circuit may result. Be sure to turn off the power before wiring work.
- Be careful for the power not to be turned on during work.

Necessary tools

- An adjustable wrench or spanner
- A Phillips screw driver
- A precision screw driver

Power voltage/Earthing

Check that the main power is turned off.

1 **Connect power cable to the rated power voltage (207-253VAC).**

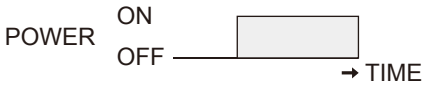
This product has two power wires and one earth wire, and is classified as class I.

*Make sure the earth plug is seated securely as well.

NOTE

- Do not share a power source with a high power device which may generate surge voltage. Otherwise an electronic circuit may fail. The noise caused by an inverter also affects the circuit.
- Energize the pump with a power voltage via a mechanical relay or switch. Do not fluctuate the voltage, or CPU may malfunction. See page 25 for the precautions for ON-OFF control by a mechanical relay.

Apply power sharply



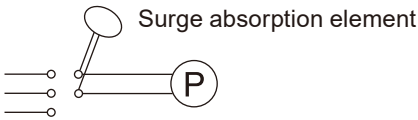
Do not apply gradually



Surge voltage

The electronic circuit in the control unit may fail due to surge voltage. Do not place the pump close to a high power device of 200V or more which may generate large surge voltage. Otherwise, take any of the following measures.

- Install a surge absorption element (ex. a varistor with capacity of 2000A or more) via power cable.



Recommended varistor
Panasonic ERZV14D431
See manufacturer's catalogues for detail.

- Install a noise cut transformer via power cable.



Noise cut transformer

Precautions for ON-OFF control by a mechanical relay

This control unit is equipped with a CPU. To ensure the CPU to work properly and won't run in a wrong way, do not turn on and off the power voltage of the pump to run it in the ON-OFF control. Otherwise, observe the following points:

- Ensure the minimum OFF time of 10 minutes.
- The contact capacity of a mechanical relay should be 5A or more. Or a contact point may break.
- If the contact capacity of a mechanical relay is 5A, the maximum allowable number of times the power is turned ON/OFF is 150,000. The contact capacity should be 10A or more when the actual number of times is over 150,000 or when sharing a power source with a large capacity equipment which may cause a surge voltage and damage a contact point.
- Use a solid state relay (SSR) as necessary (such as the OMRON G3F). See manufacturer's catalogues for detail.

Operation

This section describes pump operation and programming.
Run the pump after pipework and wiring is completed.

Before operation

First check tubing and wiring are correct. And then perform degassing and flow rate adjustment before starting operation.

Points to be checked

Before operation, check if:

- Liquid level in a supply tank is enough.
- Tubing is securely connected and is free from leakage and clogging.
- Discharge/suction valves are opened.
- A power voltage is in the allowable range.
- Electrical wiring is correct and is free from the risk of short circuit and electrical leakage.

Retightening of pump head fixing bolts

Important

The pump head fixing bolts may loosen when plastic parts creep due to temperature change in storage or in transit. This can lead to leakage. Be sure to retighten the bolts evenly to the specified tightening torque below in diagonal order before starting operation.

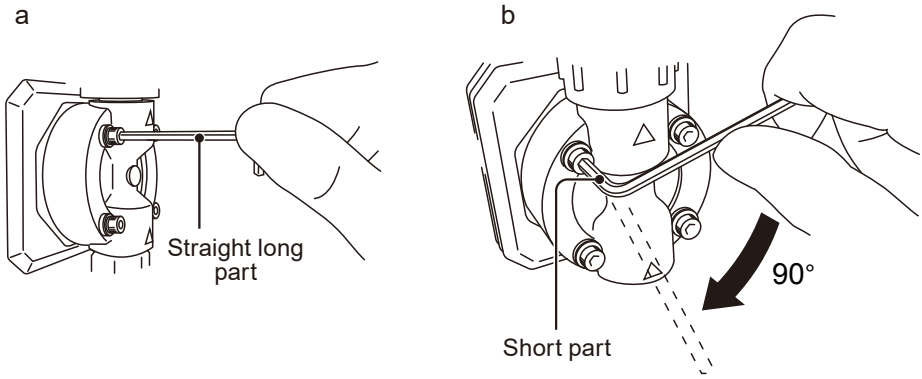
Tightening torque

Model code	Torque	Bolts
ES-B11	2.16 N•m	M4 hex. socket head bolt
ES-C21		

*Tighten fixing bolts once every three months.

■ **Use of hexagon wrench instead of a torque wrench**

Fasten the fixing bolts as tight as can be by the hand with the straight long part of a hexagon wrench (a) and further turn the bolts clockwise 90 degrees with the short part (b).



Degassing

The gas in the pump and tubing is the obstacle to liquid delivery and needs to be expelled before the pump is started. Especially:

- When the pump starts to run for the first time
- When a flow rate is too low
- After liquid is replaced in a supply tank
- After a long period of stoppage
- After maintenance and inspection are performed

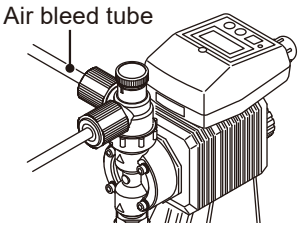
NOTE

- Both gas and chemical come out together through an air bleed tube. Make sure the end of the tube is located in a supply tank or a container.
- Some chemicals may damage skin and dry end parts. Wash/wipe chemicals off immediately if they got wet.

■ ES-B11/-C21 VC/VH M

Points to be checked

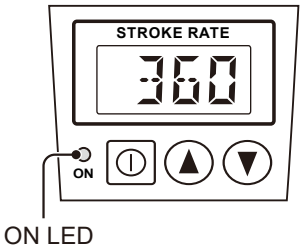
• An air bleed tube is connected to the pump.



1 **Turn on power.**

The ON LED and the display are turned ON.

*The pump waits in the MAN mode when turned on with the factory default setting.

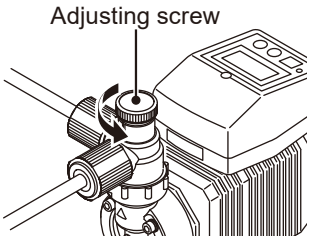


2 **Set a stroke rate to 360spm.**

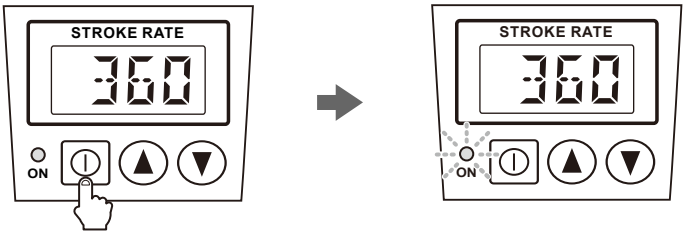
See page 31 the "Stroke rate adjustment" section for detail.

3 **Rotate the adjusting screw two revolutions anticlockwise to open the air vent port.**

*Do not rotate it three revolutions. The adjusting screw may come off with solution spray.



4 **Push the start/stop key and run the pump for more than ten minutes.**



5 **Push the start/stop key and stop the pump.**

6 **Rotate the adjusting screw clockwise to close the air vent port.**

7 **Check liquid is delivered to the discharge line.**

Degassing must be repeated until liquid is outputted from the pump outlet.

8 **Check connections for leakage.**

Degassing has now been completed.

Flow rate adjustment

The flow rate can be changed by a stroke rate and a stroke length adjustment.

The stroke rate represents the pump speed in spm (stroke per minute). The stroke rate adjustment is the main way to adjust the flow rate from the pump.

The stroke length represents the moving distance of the plunger. The widest moving distance is defined as 100% stroke length. The stroke length adjustment is used for determining the optimal flow volume per stroke (fine adjustment of the pump flow).

First adjust a flow rate by stroke rate adjustment. Use stroke length adjustment for the range where stroke rate adjustment can not reach. Note the optimal stroke length change with operating conditions and liquid characteristics.

1 **Change the stroke rate with the stroke length 100% to the specified level.**

See the "Stroke rate adjustment" section on page 31 and the "Stroke length adjustment" section page 33 for detail.

2 **Measure the flow rate.**

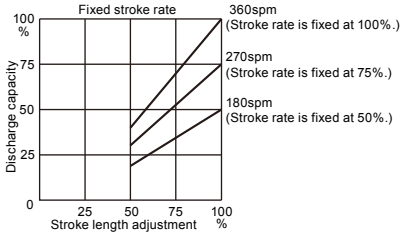
3 **If the flow rate is lower/higher than the specified level, increase/decrease the stroke rate and measure the pump flow again.**

4 **Change a stroke length for fine adjustment.**

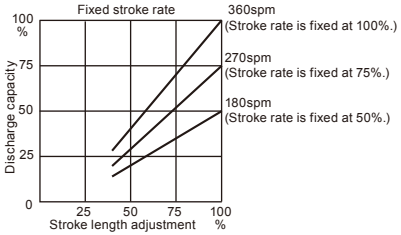
5 **Measure the pump flow again to see the specified level is obtained.**

Flow rate, stroke rate and stroke length

B type



C type



Precautions of flow rate adjustment

- **When back pressure is high**

  Set stroke length to 100% and adjust the pump flow by changing the stroke rate.

- **When each dose greatly affects a chemical reaction in neutralization or titration application**

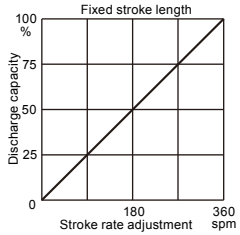
  Shorten the stroke length to reduce the flow rate per . And then adjust the pump flow by changing the stroke rate.

- **When handling liquids that generate gas bubbles (sodium hypochlorite or hydrazine solution).**

  Set the stroke length to 100% and adjust the pump flow by changing the stroke rate. Note air lock may occur when the stroke length is set too short.

■ Stroke rate adjustment

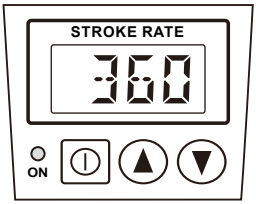
The stroke rate can be set by keypad operation from 1 to 360spm. The relation between the flow rate* and the stroke rate is shown as below.



*The flow rate on the nameplate falls on 100% discharge capacity and stroke length.

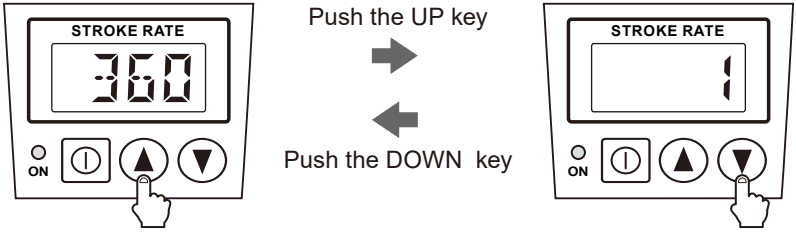
1 Turn on power and call up manual mode.

Enter manual mode to show a stroke rate (spm) on the screen.



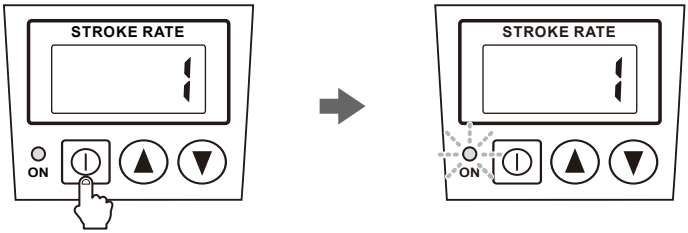
2 Use the UP or DOWN key to adjust a stroke rate.

- The stroke rate increases/decreases by 1spm every time the key is pushed.
- Press and hold either key for three seconds for quick change. Quick change stops at 1 or 360spm and then skips to 360 or 1spm when the key is released once and pushed again.



3 Push the start/stop key.

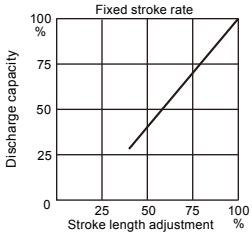
The ON LED blinks during operation.



■ Stroke length adjustment

The stroke length can be adjusted when the moving distance of the plunger is changed by the stroke length adjusting knob.

The stroke length adjustment range is 50-100% for the B type, 40-100% for the C type. The relation between the flow rate* and the stroke length is shown as below.



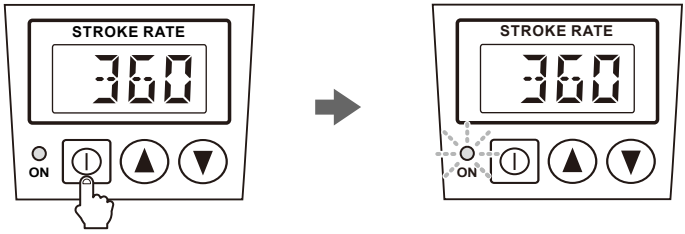
*The flow rate on the nameplate falls on 100% discharge capacity and stroke length.

NOTE

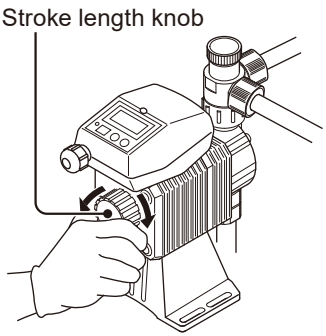
Do not rotate the stroke length adjusting knob when the pump is not running.

1 **Turn on power and push the start/stop key to run the pump.**

The ON LED blinks during operation.



2 **Rotate the stroke length knob to determine liquid volume per stroke.**



Before a long period of stoppage (one month or more)

Clean wet ends and the inside of tubing.

• Run the pump with clean water for about 30 minutes to rinse chemicals off from the pump head and piping.

Before unplugging the pump

• Always stop the pump by key operation and wait for three seconds before unplugging the pump. Otherwise, the last key operation may not be put in memory. In this case the pump unintentionally starts to run as powered on, discharging liquid.

When the pump does not transfer liquid at resuming operation.

• Clean the valve sets and remove foreign matters.

• If gas is in the pump head, expel gas and readjust a flow rate. See the "Degassing" section on page 27 and the "Flow rate adjustment" section on page 30 for detail.

Operation programming

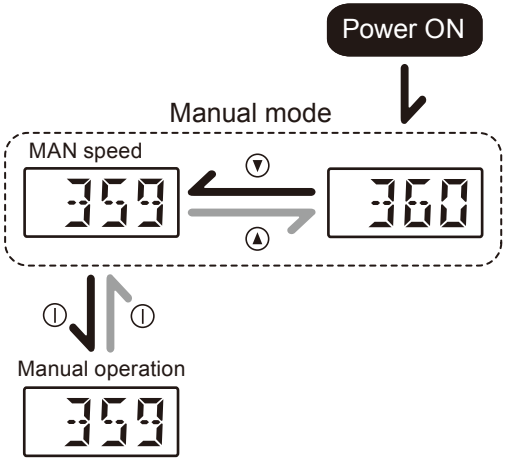
Operation at each mode is individually set and controlled by keypad operation. Select a proper mode to make optimal operation.

Default setting and Setting range

Parameters	Default setting	Setting range	Step
Stroke rate (MAN speed)	360	1-360	1[*1]

*1 The stroke rate increases/decreases by 1 spm every time the up or down key is pushed. Press and hold either key 3 seconds for quick change.

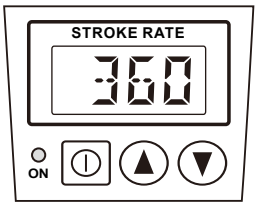
Programming flow



1 **Turn on power.**

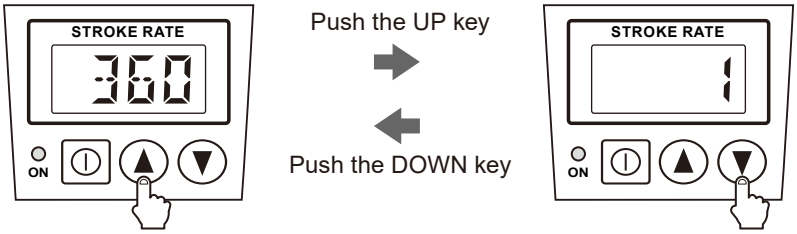
The ON LED and the display are turned ON.

*The pump waits in the MAN mode when turning on power with a default setting or calls up a previous mode at the last shutoff.



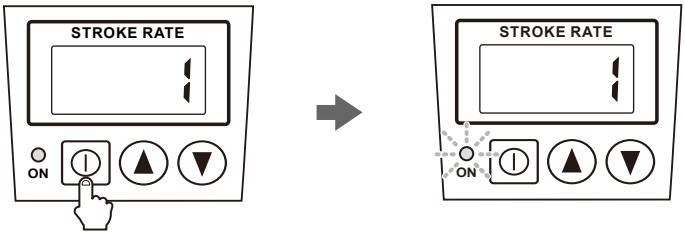
2 **Use the UP or DOWN key to adjust a stroke rate.**

- The stroke rate increases/decreases by 1spm every time the key is pushed.
- Press and hold either key for three seconds for quick change.



3 **Push the start/stop key.**

The ON LED blinks during operation.



Maintenance

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

Important

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

Before unplugging the pump

Always stop the pump by key operation. And wait for three seconds before unplugging the pump. Otherwise, the last key operation to stop the pump may not be put in memory. In this case the pump unintentionally starts to run as powered on, discharging liquid.

Troubleshooting

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

States	Possible causes	Solutions
The pump does not run . (LED does not light. Blank screen.)	Power voltage is too low.	• Observe the allowable voltage range of 207-253VAC
	The pump is not powered.	• Check the switch if it is installed. • Correct wiring • Replace a broken wire to new one.
	An electronic circuit in the control unit is failed.	• Replace the control unit.
Liquid can not be pumped up.	Air lock in the pump	• Expel air. See page 27.
	Stroke length is too short.	• Run the pump with full stroke length and then with adjusted length.
	Air ingress through a suction line.	• Correct tubing.
	A valve set is installed upside down.	• Reinstall the valve set.
	Valve gaskets are not installed.	• Install valve gaskets.
	Foreign matters are stuck in the pump head valves.	• Take apart, inspect and clean the valves. Replace as necessary.
	A ball valve is stuck on a valve seat.	• Take apart, inspect and clean the valve. Replace as necessary.
Flow rate fluctuates.	Air stays in the pump head.	• Expel air. See page 27.
	Overfeeding occurs.	• Mount a check valve. See page 21.
	Foreign matters are stuck in the pump head valves.	• Dismantle, inspect and clean the valves. Replace as necessary.
	Diaphragm is broken.	• Replace diaphragm.
	Pressure fluctuates at an injection point.	• Maintain a pressure constant at an injection point by optimizing tubing or by relocating the point.

Liquid leaks.	Loose fit of the fitting or the air vent body.	• Retighten them.
	Loose fit of the pump head.	• Retighten the pump head. See page 27.
	O rings or valve gaskets are not installed.	• Install O rings and valve gaskets in place.
	Diaphragm is broken.	• Replace the diaphragm.
	Excessive discharge pressure.	• Check that a discharge line is not closed. • Check if tubing is not clogged.

Inspection

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

Daily inspection

Check the following points. If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems. See the troubleshooting section as necessary.
When wear parts come to the life limit, replace them with new ones. Contact us or your nearest distributor for detail.

No.	States	Points to be checked	How to check
1	Pumping	• If liquid is pumped.	Flow meter or visual inspection
		• If the suction and discharge pressure are normal.	Check specifications.
		• If liquid has deteriorated, crystallized or precipitated.	Visual or audio inspection
2	Noise and vibration	• If abnormal noise or vibration occurs. They are signs of abnormal operation.	Visual or audio inspection
3	Air ingress from pump head joints and a suction line	• If leakage occurs. • If pumped liquid includes air bubbles, check lines for leakage and retighten as necessary.	Visual or audio inspection

Periodic inspection

Retighten the pump head mounting bolts evenly to the following torque in diagonal order.

*Mounting bolts may loosen in operation. How fast the bolts start to loosen is depending on operating conditions.

Tightening torque

Model code	Torque	Bolts
ES-B11	2.16 N•m	M4 hex. socket head bolt
ES-C21		

*A hexagon wrench can be used for a torque wrench. See page 27.

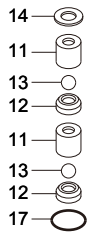
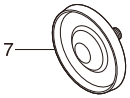
Wear part replacement

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 us or your nearest distributor for detail.

Precautions

- 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.
- Rinse wet ends thoroughly with tap water.
- Each time the pump head is dismantled, replace the diaphragm, O rings, valve gaskets and valve sets with new ones.

Wear part list

	Parts		# of parts	Estimated life
Pump	Valve set	VC/VH 	2 sets	8000 hours
	Diaphragm		1	
	O ring		See page 49.	

*Wear part duration varies with the pressure, temperature and characteristics of liquid.
*The estimated life is calculated based on the continuous operation with clean water at ambient temperature.

Before replacement

First release pressure from the pump head.

1 **Stop the pump operation.**

2 **Rotate the adjusting screw two revolutions anticlockwise to open the air vent port.**

NOTE

Do not rotate it three revolutions from the closed position. Or liquid may come out from the adjusting screw.

3 **Check the air vent line and the pump head are depressurized.**

Liquid pressure is released from the air vent line in the form of solution spray.

NOTE

If pressurized liquid is not expelled, run the pump with an opened air vent line until pressure is removed.

Valve set replacement

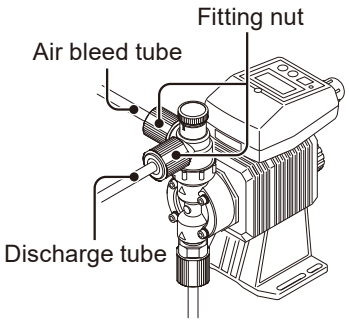
■ Discharge valve set disassembly/assembly

Necessary tools

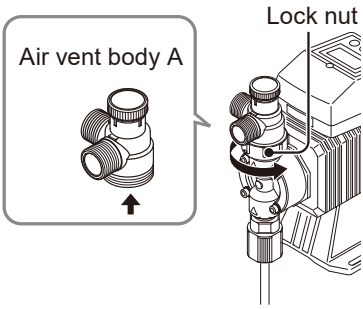
- An adjustable wrench or spanner
- A 21mm box wrench
- A pair of tweezers

*Unfix the pump base before disassembly.

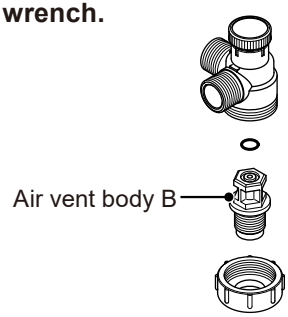
1 **Loosen the fitting nut to remove the discharge tube and the air bleed tube.**



2 **Turn the lock nut anticlockwise by an adjustable wrench and remove the air vent body A.**



3 **Remove the air vent body B by the 21mm box wrench.**



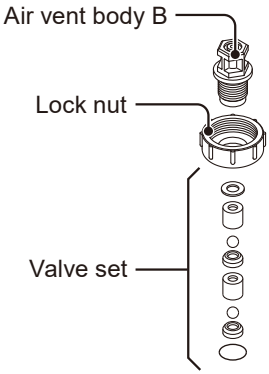
4 **Pull out the valve set by a pair of tweezers.**

5 **Build up the new valve set into the pump head and fasten the air vent body B via the lock nut.**

*Arrange the valve set in the correct parts order and direction. A leak or an insufficient flow may result.

*Be sure to fit O rings and gaskets in place.

*Keep the valve set clean.



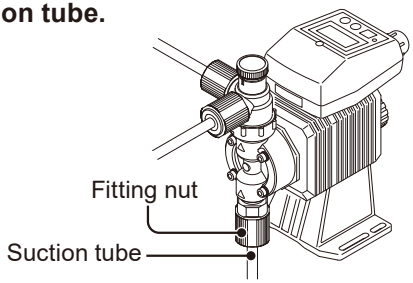
6 **Remount the air vent body A and connect tubes.**

■ Suction valve set disassembly/assembly

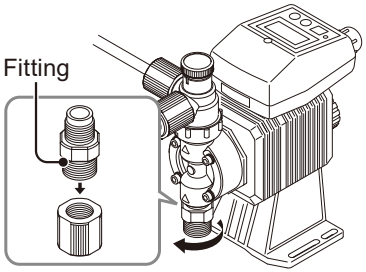
NOTE

Be careful not to drop the valve set.

1 **Remove the fitting nut and the suction tube.**



2 **Remove the fitting by an adjustable wrench or a spanner.**



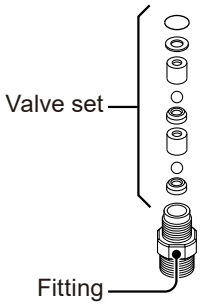
3 **Pull out the valve set by a pair of tweezers.**

4 **Build up the new valve set into the pump head and hand-tighten the fitting as far as it will go. Retighten it by a further 1/4 turn with an adjustable wrench or a spanner.**

*Arrange the valve set in the correct parts order and direction. A leak or an insufficient flow may result.

*Be sure to fit O rings and gaskets in place.

*Keep the valve set clean.



5 **Reconnect the suction tube.**

Diaphragm replacement

Necessary tools

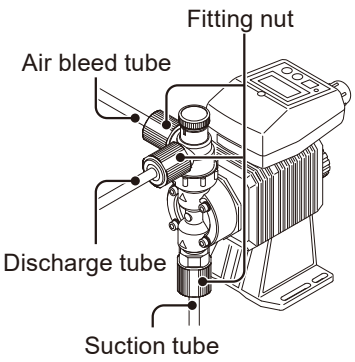
- An adjustable wrench or spanner
- A hexagon wrench
- A torque wrench

NOTE

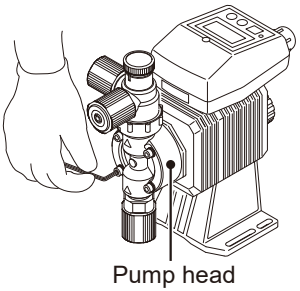
Pay attention not to loose diaphragm spacers. A few diaphragm spacers may be inserted between the retainer and plunger for the adjustment of a diaphragm location. Note that the number of diaphragm spacers provided varies at different pumps.

1 **Run the pump and set the stroke length to 0%. Then stop the pump.**

2 **Loosen the fitting nuts and remove the suction tube, discharge tube, and air bleed tube.**

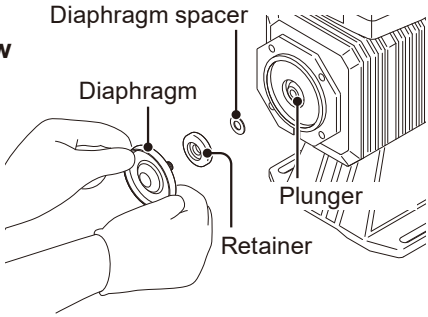


3 **Remove the pump head with a hexagon wrench.**



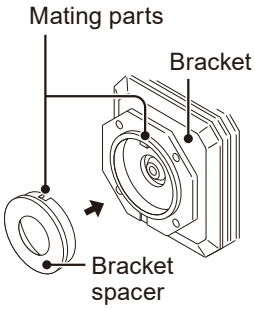
4 **Unscrew the diaphragm from the plunger (pump shaft).**

5 **Slide the retainer and diaphragm spacer(s) onto the screw of the new diaphragm.**



NOTE

- Fit the retainer with its round edge to the diaphragm.
- Do not remove the bracket spacer. If removed, replace as shown to the right.



6 **Screw the new diaphragm into the plunger as far as it will go.**

7 **Run the pump and set the stroke length to 100%.**

Stop the pump afterwards.

8 **Mount the pump head.**

Tighten the bolts diagonally and evenly by the specified torque at each model.

Tightening torque

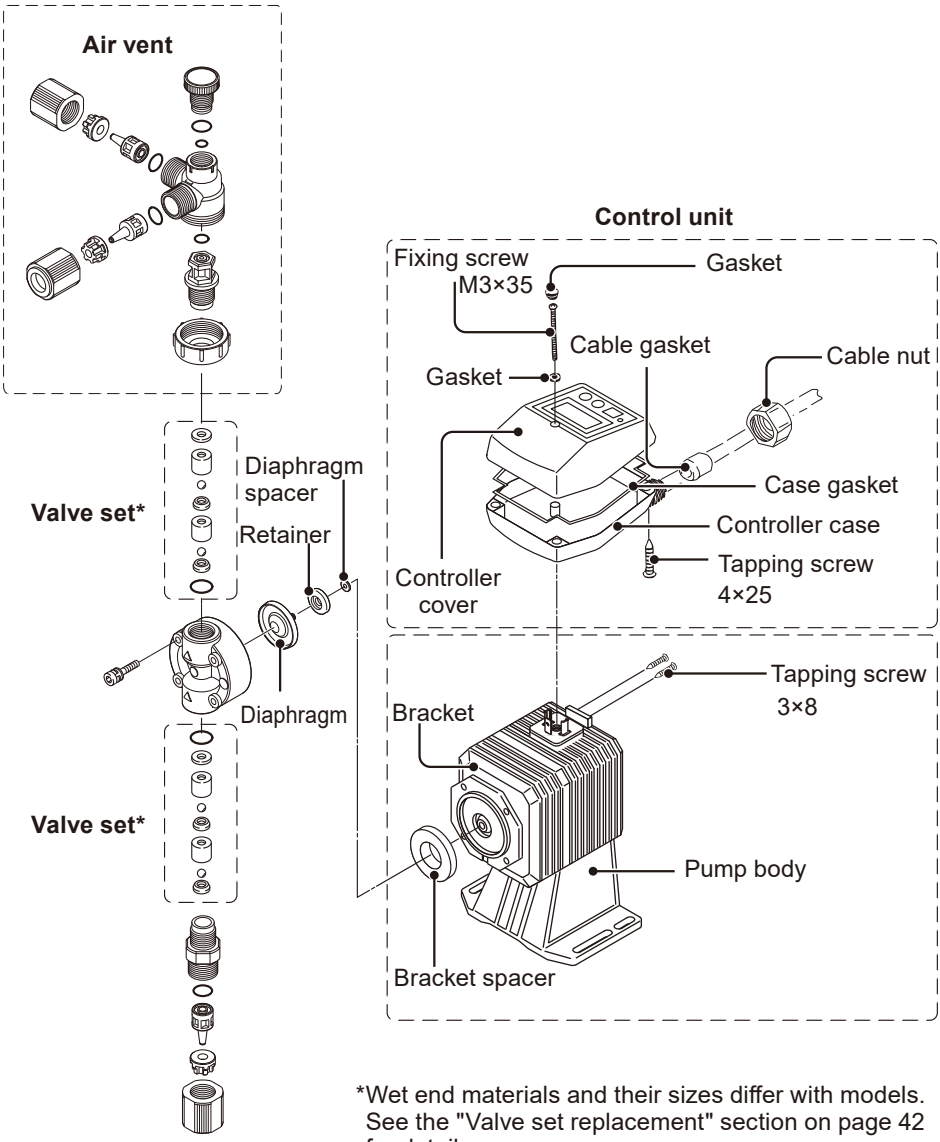
Model code	Torque	Bolts
ES-B11	2.16 N•m	M4 hex. socket head bolt
ES-C21		

*A hexagon wrench can be used for a torque wrench. See page 27.

Pump head, Drive unit & Control unit

Do not disassemble the pump beyond the description in this manual.

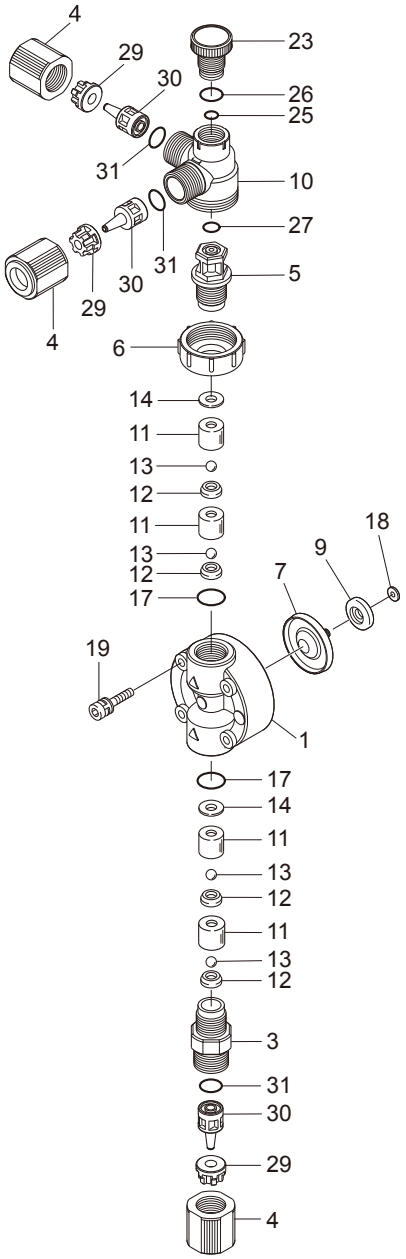
ES-B11/-C21 VC/VH M



*Wet end materials and their sizes differ with models. See the "Valve set replacement" section on page 42 for detail.

Pump head

■ ES-B11/-C21 VC/VH M



No.	Part names	# of parts
1	Pump head	1
3	Fitting	1
4	Fitting nut	3
5	Air vent body B	1
6	Lock nut	1
7	Diaphragm	1
9	Retainer	1
10	Air vent body A	1
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket	2
17	O ring	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4
23	Adjusting screw	1
25	O ring	1
26	O ring	1
27	O ring	1
29	Hose stopper	3
30	Hose adapter	3
31	O ring	3

*The number of diaphragm spacers varies with pump model.

Specifications

Information in this section is subject to change without notice.

■ Pump unit

VC/VH

Model code	Max. output capacity mL/min	Max. discharge pressure MPa	Stroke length mm (%)	Stroke rate spm	Tube size mm (I.D.×O.D.)	Average current A	Average power cons. W	Weight kg
ES-B11	38	1.0	0.5-1.0 (50-100)	1-360	ø4×ø6	0.5	16	1.8
ES-C21	130	0.7	0.5-1.25 (40-100)			0.6	22	2.9

*Maximum output capacity is rated with clean water at ambient temperature at maximum discharge pressure (also, stroke length 100%, at 360spm and rated voltage). Output may increase as pressure decreases.
*Allowable room temperature: 0-40°C
*Allowable ambient humidity: 35-90%RH (non-condensing in the controller)
*Allowable liquid temperature: 0-40°C for the pumps with VC/VH wet ends
*Allowable power voltage deviation: ±10% of the rated voltage
*Maximum altitude: 2000m
*Pollution degree: 2
*Maximum noise level: 70dB at 1m (A scale)

■ Control unit

Operation mode	Mode	Manual
Stroke rate	Setting range	1-360spm
	spm setting	UP and DOWN keys
Monitors	LCD	4-digit LCD
	LED	Green LED×1 (blinks during operation)
Buffer		Non-volatile memory
Power voltage*1		230VAC 50Hz

*1 Observe the allowable power voltage range of 207-253VAC. Or failure may result.

■ Power cable

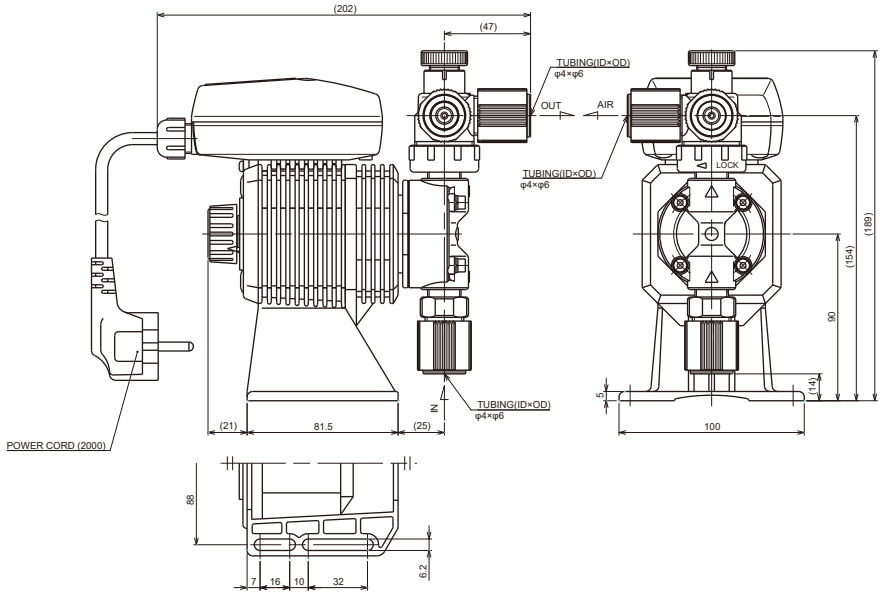
Conduction section area	0.75 [mm^2] Triplex cable
Length	2000 [mm]
Standard	H03VV-F
Terminal treatment	European plug

■ Pump colour

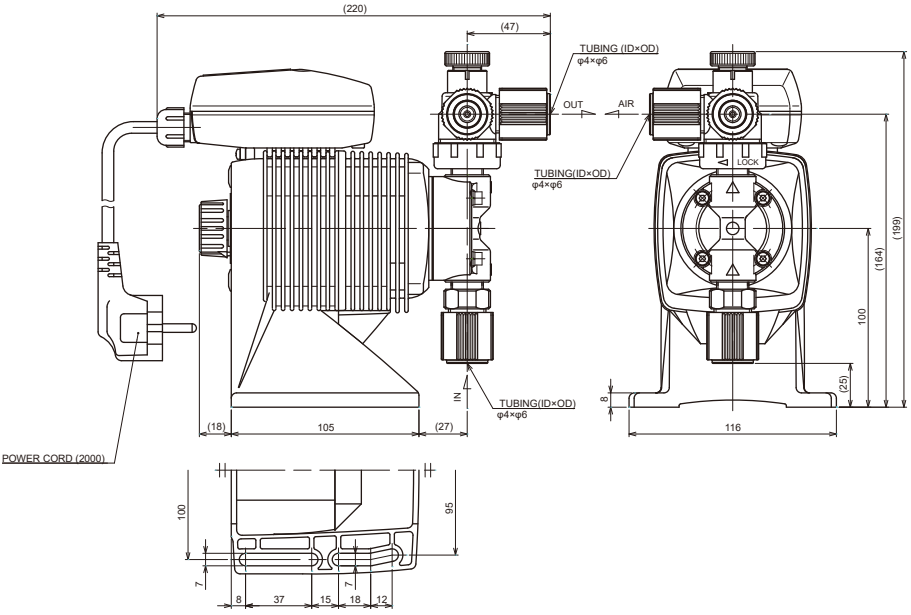
Blue	Munsell colour system 7.5PB 3/8
Red	Munsell colour system 5R 3/10

Outer dimensions

■ ES-B11 VC/VH M



■ ES-C21 VC/VH M



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

ELECTROMAGNETIC METERING PUMP

(MODEL NAME)

ES-B/-C-K6 SERIES

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)
EMC DIRECTIVE 2014/30/EU
RoHS DIRECTIVE 2011/65/EU

(STANDARDS)

EN ISO12100:2010 EN61000-6-2:2005 EN IEC63000:2018
EN809:1998+A1:2009 EN61000-6-3:2007+A1:2011

(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.

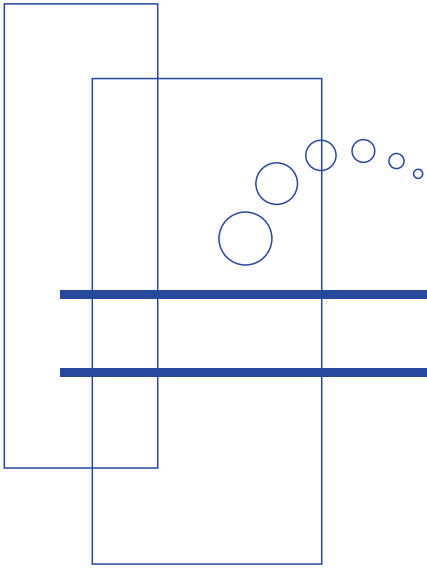
T. Sawada.

TSUTOMU SAWADA
DEPUTY SENIOR GENERAL MANAGER,
QUALITY ASSURANCE HEAD OFFICE

Tokyo, Sep. 13, 2021

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

DOCUMENT NO. IS-51K-567-2



IWAKI

https://www.iwakipumps.jp

IWAKI CO.,LTD. 6-6 Kanda-Sudacho 2-chome Chiyoda-ku Tokyo 101-8558 Japan
TEL: +81 3 3254 2935 FAX: +81 3 3252 8892

European Headquarter / IWAKI Europe GmbH
TEL: +49 2154 9254 0 FAX: +49 2154 9254 48

Germany / IWAKI Europe GmbH
TEL: +49 2154 9254 50 FAX: +49 2154 9254 55

The Netherlands / IWAKI Europe GmbH (Netherlands Branch)
TEL: +31 74 2420011 FAX: +49 2154 9254 48

Italy / IWAKI Europe GmbH (Italy Branch)
TEL: +39 0445 561219 FAX: +39 0445 569088

Spain / IWAKI Europe GmbH (Spain Branch)
TEL/FAX: +34 934 741 638

Poland / IWAKI Europe GmbH (East Europe Branch)
TEL: +48 12 347 0755 FAX: +48 12 347 0900

Denmark / IWAKI Nordic A/S
TEL: +45 48 242345

Finland / IWAKI Suomi Oy
TEL: +358 10 201 0490

Norway / IWAKI Norge AS
TEL: +47 23 38 49 00

Sweden / IWAKI Sverige AB
TEL: +46 8 511 72900

Belgium / IWAKI Belgium N.V.
TEL: +32 13 670200 FAX: +32 13 672030

France / IWAKI France S.A.
TEL: +33 1 69 63 33 70 FAX: +33 1 64 49 92 73

U.S.A. / IWAKI America Inc.
TEL: +1 508 429 1440 FAX: +1 508 429 1386

Brazil / IWAKI Do Brasil Comercio De Bombas Hidraulicas LTDA.
TEL/FAX: +55 19 3244 5900

China (Shanghai) / IWAKI Pumps (Shanghai) Co., Ltd.
TEL: +86 21 6272 7502 FAX: +86 21 6272 6929

China (Hong Kong) / IWAKI Pumps Co., Ltd.
TEL: +852 2607 1168 FAX: +852 2607 1000

China (Guangzhou) / GFTZ IWAKI Engineering & Trading Co., Ltd.
TEL: +86 20 84350603 FAX: +86 20 84359181

China (Shenzhen) / IWAKI Pumps (Shenzhen) Co., Ltd.
TEL: +86 0755 8656 3696

Singapore / IWAKI Singapore Pte Ltd.
TEL: +65 6316 2028 FAX: +65 6316 3221

Indonesia / IWAKI Singapore Pte Ltd. (Indonesia Office)
TEL: +62 21 6906606 FAX: +62 21 6906612

Malaysia / IWAKIm SDN. BHD.
TEL: +60 3 7803 8807 FAX: +60 3 7803 4800

Korea / IWAKI Korea Co., Ltd.
TEL: +82 2 6238 4800 FAX: +82 2 6238 4801

Taiwan / IWAKI Pumps Taiwan Co., Ltd.
TEL: +886 2 8227 6900 FAX: +886 2 8227 6818

Thailand / IWAKI (Thailand) Co., Ltd.
TEL: +66 2 322 2471 FAX: +66 2 322 2477

Australia / IWAKI Pumps Australia Pty Ltd.
TEL: +61 2 9899 2411 FAX: +61 2 9899 2421

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