IWAKI PUMPS

IWAKI
Electromagnetic Metering Pump

EH-E Type

Instruction Manual

⚠ Read this manual before use of product

Thank you for selecting the electromagnetic metering pump EH-E series. This instruction manual deals with “Safety Section” “Product outline” “Installation Section” “Operation Section” and “Maintenance Section”.
Please read through this manual carefully to ensure the optimum performance, safety and service of the EH-E series.

Contents

Important instructions

For the Safe and Correct Handling of the Pump

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

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

Types of Symbols

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

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

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

⚠ 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 the power supply**

  Working without disconnecting the power supply cause an electrical shock. Before engaging upon any working procedures involving the pump, make sure to turn the power supply switch off and to stop the pump and other related devices.


Electrical Shock

- **Terminate operation**

  When you detect or become aware of a dangerous sign or abnormal condition during operation, terminate the operation immediately and start from the beginning again.

- **For specified application only**

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


Prohibited

- **No remodeling**

  Never remodel a pump. Otherwise, a serious accident may result. Iwaki will not be responsible for any accident or damage of any kind which is caused by the user remodeling the pump without first obtaining permission or instructions from Iwaki.


No Remodeling

- **Wear protectors**

  If you touch or come in contact with any type of hazardous chemical liquid, including but not limited to chemicals, you may experience a serious injury. Wear protective gear (protective mask, gloves, etc.) during the pump operation.


Wear protective gear

- **Operating site must be free of water and humidity**

  The pump is not designed to be water-proof or dust-proof. The use of the pump in places where water splashes or humidity is high may result in an electrical shock or short circuit.


Prohibited

Safety instructions

⚠ CAUTION

- **Qualified operators only**
  The pump operator and pump operation supervisor must not allow any operators who have little or no knowledge of the pump to run and operate the pump. Pump operators must have a sound knowledge of the pump and its operation.


Prohibited

- **Specified power only**
  Do not operate the pump on voltage which is not specified on the nameplate. Failure to do so may result in damage or fire. Only the specified power level is to be applied.


Prohibited

- **Do not run the pump dry**
  Do not run the pump dry (without liquid inside the pump). Heat generated as a result of abrasion between elements inside the pump during operation without liquid may damage the inside of the pump.


Prohibited

- **Do not wet or dampen**
  If an electric part or wiring gets wet with the liquid spilled over accidentally, a fire or electrical shock may be caused. Install the system in a place free from liquid spillage or leakage.


Do not wet or dampen

- **Ventilate**
  Poisoning may result during an operation which involves, toxic or odorous liquid. Ventilate the operating site sufficiently.


Caution

- **Spill-out accident**
  Protective measures should be taken against any accidental spill-out or leakage of the operating liquid as a result of unexpected damage on the pump or the related piping.


Caution

- **Damaged pump**
  Never operate a damaged pump. A damaged pump may cause leakage or electrical shock.


Prohibited

- **Do not damage or change power cable**
  Do not scratch, damage, process, or pull the power cable forcibly. An extra load onto the cable, such as heating the cable or placing something heavy on the cable, may damage the cable and finally cause a fire or an electrical shock.


Caution

- Frequent stop and start of pump should be done by using STOP function (ON and OFF of STOP terminal). If you can not use STOP function and are forced to operate pump by turning OFF and ON of power source, ON and OFF of power source should be limited to six times an hour.

Safety instructions

⚠ CAUTION

● **Arrange grounding**

Do not operate the pump without connecting the grounding wire. Otherwise, an electrical shock may result. Make sure the grounding wire is connected with grounding terminal.

Grounding

● **Install an earth leakage breaker**

The operation of a pump without using an earth leakage breaker may cause an electrical shock. Please install a leakage breaker in the system.

Electrical Shock

● **Handling of power cable**

Use of a defective or damaged power cable may result in a fire or electrical shock. Handle the power cable carefully.

Electrical Shock

● **Follow the instruction manual**

Replace the consumable part by following the descriptions in the instruction manual. Do not disassemble any part of the pump if the disassembling procedure for the part in question is not included in the instruction manual.

● **Limited operating site and storage**

Do not install or store the pump in the following places :
Places where a flammable gas or material is used or stored.
Places where the ambient temperature is extremely high (40 °C or higher) or extremely low (0 °C or lower).

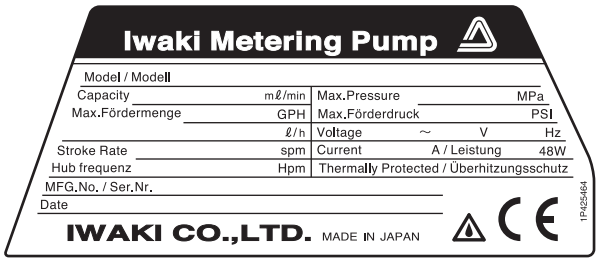
Prohibited

● **Disposal of used pump**

Disposal of used or damaged pumps must be done in accordance with the relevant local law and regulations. (Consult a licensed industrial waste products disposing company.)

Outline

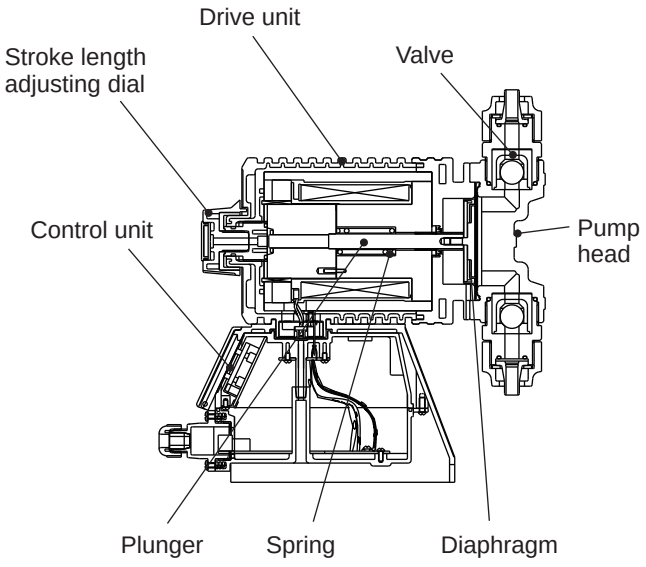
1. Unpacking



After unpacking the goods, check the following points to ascertain that the product is exactly as you ordered.
If you find anything wrong, please get in touch with your dealer.

(1) Do the model, voltage, etc., shown on the nameplate represent what you ordered?
(2) Has the goods been damaged in transit? Are the bolts and nuts loose?

2. Operating Principle



The EH Series electronic metering pump consists of a pump unit, a drive unit, and a control unit. The drive unit is an electromagnetic solenoid. When the solenoid coil is energized by the control unit the armature shaft moves forward due to the magnetic force of the solenoid. The shaft is attached to a PTFE faced diaphragm which is part of the pump unit. The diaphragm is forced into the pump head cavity decreasing volume and increasing pressure which forces liquid in the pump head out though the discharge check valves. When the solenoid coil is de-energized, a spring returns the armature to its starting position. This action pulls the diaphragm out of the head cavity increasing volume and decreasing pressure. Atmospheric pressure then pushes liquid from the supply tank through the suction check valves to refill the pump head.

3. Identification Code

• Pump identification

EH - E 31 PC - 23U P E 8 - □□

(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1) Series name EH Series

(2) Drive component E : 48 W

(3) Diaphragm effective diameter 31 : 30 mm 36 : 35 mm 46 : 45 mm 56 : 55 mm

(4) Material of liquid end

Codes	Pump head & Fittings	Valve balls	Valve seat & O-ring (Gasket)	Diaphragm	Gasket
VC	PVC	CE	FKM	PTFE Bonded to EPDM	PTFE
V6	PVC	SUS316	EPDM		
PC	GFRPP	CE	FKM		
VM	M-PVC	CE	FKM		
FC	PVDF	CE	PCTFE (PTFE)		
SH	SUS316	HC276	SUS316 (PTFE)		
HP6	GFRPP	SUS316	PCTFE (EPDM)		

PVC : Polyvinyl chloride (Transparent)
GFRPP : Glass fiber reinforced polypropylene
M-PVC : Polyvinyl chloride (Machined)
CE : Alumina ceramic
SUS316 : 316 Stainless steel
FKM : Fluoroelastomer
EPDM : Ethylene propylene diene methylene
PTFE : Polytetrafluoroethylene
PVDF : Polyvinylidenefluoride
HC276 : Hastelloy C276

(5) Voltage symbol

Codes	Voltage	Input voltage	Frequency
100	100VAC	90-110VAC	50/60Hz
11U	110/115AC	90-126VAC	50/60Hz
20J	200VAC	180-220VAC	50/60Hz
23U	230VAC	207-253VAC	50/60Hz
20E	220/230/240VAC	198-264VAC	50/60Hz

(6) Power code

P	with a plug
No symbol	without a plug

(7) Controller E : E type

(8) Connection

Codes	Applicable hose dia. (ID × OD)	Type
4	ø8 × ø13 (mm)	VC, V6, PC, VM
5	ø9 × ø12 (mm)	VC, V6, PC, VM
6	ø10 × ø12 (mm)	FC
8	ø3/8" × ø1/2" (inch)	VC, V6, PC, VM, FC
9	Rc 1/4"	SH
10	NPT 1/4"	SH
11	ø10 × ø16 (mm)	VC, V6, PC, VM
14	Rc 3/8"	SH
15	NPT 3/8"	SH
21	IN ø15 × ø22, OUT ø9 × ø12 (mm)	HP6
22	IN ø15 × ø22, OUT ø3/8" × ø1/2" (inch)	HP6

(9) Special configuration

01-99: Special material, special connection port diameter, etc.

• Controller identification

EHC - 100 P E - **
(1) (2) (3) (4) (5)

(1)	Controller name		EH		
(2)	Voltage codes	10 0	100VAC	90-126VAC	50/60Hz
		11 U	110/115VAC	90-126VAC	
		20 J	200VAC	180-220VAC	
		20 E	220/230/240VAC	198-264VAC	
		23 U	230VAC	207-253VAC	
(3)	Lead wire		P: with a plug		
			No code: without a plug		
(4)	Controller		E		
(5)	Special configuration		0-99 HV: High viscosity type		

Points to be noted in handling

1. Do not detach the control unit unless unavoidable.
2. Never use the control unit with pumps having different symbols for driving unit and power source voltage specified on the control unit. (Check the nameplate.)

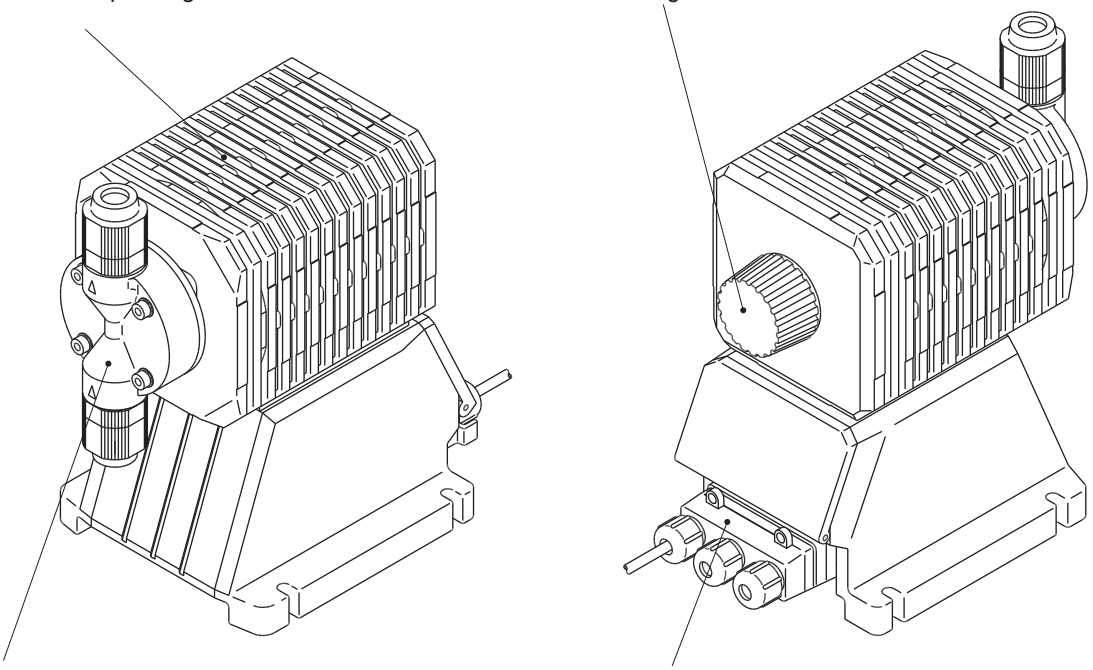
⚠CAUTION

Operation with a pump having different symbols for driving unit and power source voltage other than those specified may cause failure or trouble in the electronic circuit of the control unit or the driving unit of the pump.

4. Features

Driving unit
●Electromagnet and spring force makes diaphragm reciprocate responding to the command of control unit.

Stroke length adjusting knob
●To adjust discharge capacity per stroke in the range of 20 to 100%.



Pump body
●Reciprocating movement of diaphragm changes the volume of pump chamber to make pumping.

Control unit
●The control part to operate pump stop/start, adjustment of flow rate and stroke speed.

● Control unit
Pump operation is done electronically by control unit in which microcomputer is built-in.

● Easy operation
Pump operation and flow rate control is done by keys on control unit, which enables simple control of flow rate.

● Memory back-up function
If power is turned off, memory back-up function puts the set value in memory. When the power is turned on again, pump operates at the value which had been set before the power was turned off.

5. Specification

• Pump specification

Standard types

Model	Output capacity (ml/min)	Output per stroke (ml/stroke)	Maximum pressure (MPa)	Stroke frequency (spm)	Permissible stroke length % (mm)
31	340	0.19-0.94	1	0-360	20-100 (0.3-1.5mm)
36	520	0.29-1.44	0.7 (0.6)		
46	750	0.42-2.08	0.4		
56	1250	0.69-3.47	0.2		

High viscosity type

Model	Output capacity (ml/min)	Output per stroke (ml/stroke)	Maximum pressure (MPa)	Stroke frequency (spm)	Permissible stroke length % (mm)
36	300	0.25-1.25	0.7	0-240	20-100 (0.3-1.5mm)

NOTE 1. The performance data is based on clean water at 25 deg. C under rated voltage.
NOTE 2. Capacity is that at the max. pressure. (at max. stroke length and max. stroke frequency) Capacity exceeds the value when pump operates under low pressure.
NOTE 3. Operating ambient temperature : 0 to 40 deg. C
Relative humidity : 35 % to 85 % (Non condensing)
NOTE 4. Liquid temperature : 0 to 40 deg. C (PC/SH/FC/HP6 : 0 to 60 deg. C)
NOTE 5. Permissible voltage fluctuation : Within ±10 % of rating
NOTE 6. Ask us for liquid containing slurries or so.
NOTE 7. Value in ( ) of Maximum pressure is the value for type SH.
NOTE 8. Adjustment range of stroke length for EH-E46, 56SH is 50-100% (0.75-1.5mm).

• Control unit specification

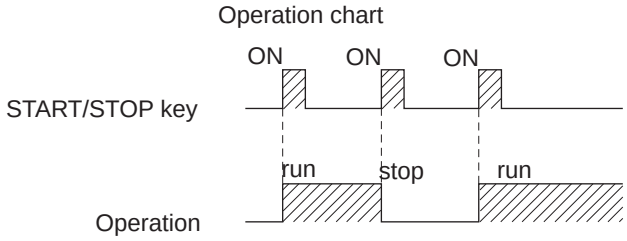
Mode	Mode	MAN (Manual) EXT (External)
	Changeover	Entering by keys (EXT, START/STOP)
Function	Parameters	EXT : Digital input pulse multiply 1 : n n = 1 - 999 Digital input pulse dividing n : 1 n = 999 - 1 Analog input SET point1 : Current 0 - 20 mA Stroke rate 0 - 360 spm SET point2 : Current 0 - 20 mA Stroke rate 0 - 360 spm MAN : Stroke rate 1 - 360 spm
	Keys	4 keys (START/STOP, EXT, ▲, ▼)
	Upper limited spm	360 spm
	Stop	By receiving stop signal from outside
Indication	Display	4 digit LCD Operating condition, set value etc.
	Stroke	Green LED (Blinks synchronous with stroke.)
Input	Stop signal	Potential free or open collector (NOTE 2)
	Pulse (NOTE1)	Potential free or open collector (NOTE 2)
Output	Power source for sensor	12VDC 10mA or below
Power source		100 AC : 90 - 127VAC 110/115AC : 90 - 127VAC 200 AC : 180 - 242VAC 230AC : 198 - 264 VAC

NOTE 1. Max. frequency of input pulse : 100Hz
NOTE 2. Max. applied voltage and amperage to open collector : 5V, 1.1 mA
NOTE 3. Max. spm of the high viscosity type : 240spm

6. Operating Function

• Manual operation

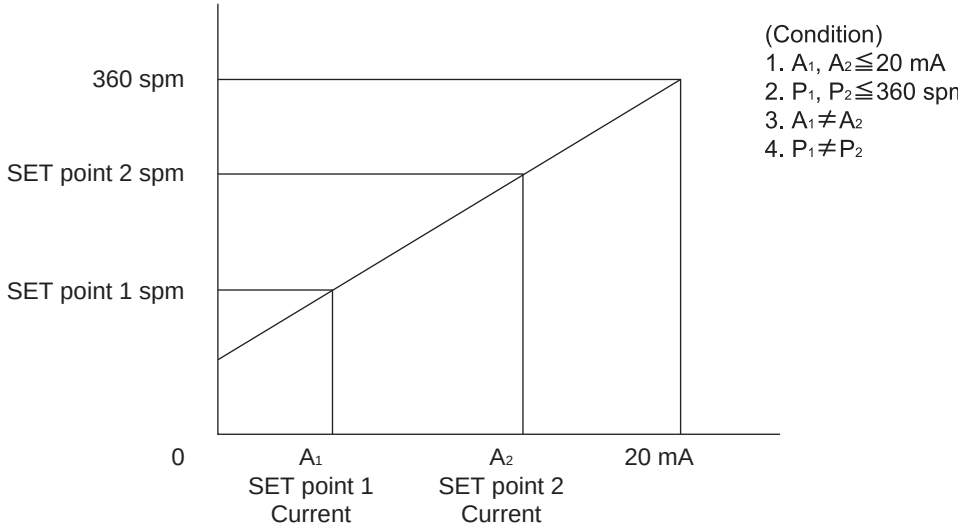
Stroke rate can be set from 0 to 360 spm with keys ▲ and ▼, and pump start and stop can be done with keys START/STOP. Both setting can be done while the pump stops or operates.



• Analog input operation (0 - 20 mA)

0 - 360 spm operation in proportion to 0 - 20 mA current input. Pump is fixed at 360 spm when came the input signal exceeding 360 spm.

Straight line is automatically made by setting two points. So, the pump may not come to 0 spm even if 0 mA current comes.



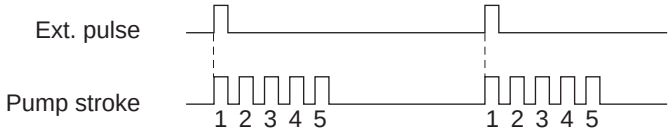
Straight line is drawn automatically by setting two points.

0 mA is not always 0 spm. It depends on set point. It is possible that 0 mA or 20 mA does not make 0 spm or 20 mA respectively because of the error of electronics parts. In this case adjust it by setting value.

• Digital input (pulse multiply) operation

Pump makes strokes from 1 to 999 responding to external pulse signal. Stroke rate is the spm set for manual operation. The pulses which came while operation are put in memory up to 255 pulses. (It is possible to make the pulses not to be put in memory.)

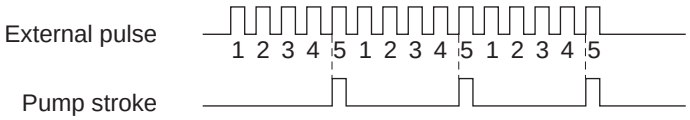
Digital input (multiplying) example (× 5)



• Digital input (pulse dividing) operation

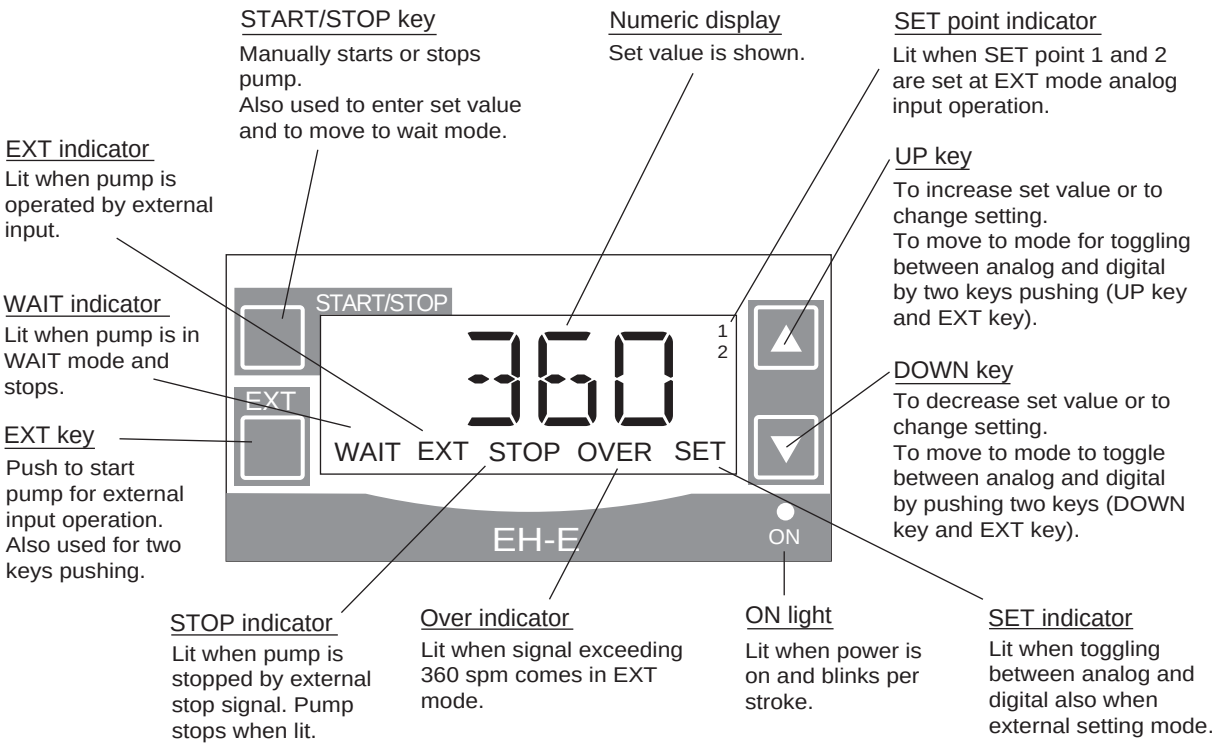
Pulse dividing operation by external pulse signals for 999 : 1 to 1 : 1. Stroke rate is the one set for manual operation. When the signals exceeding the set stroke rate came, excessive signals can be put in memory up to 255 pulses.

Digital input (Dividing) is set at 5 = /5



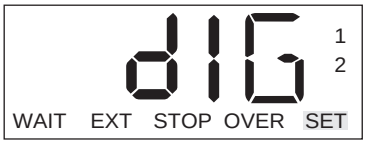
7. Display and Keys

• Controller display and panel

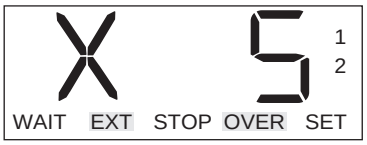
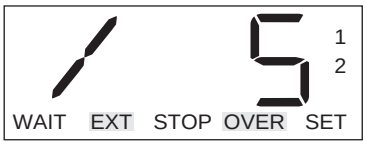


NOTE: Two keys pushing means to push simultaneously two keys of EXT key and UP or DOWN key.

• Basic display

Display examples	Meanings
	Running at manual operation mode. Value shows set spm.
	Waiting at WAIT mode. Displayed value is set value at manual operation mode.
	Running at EXT operation mode (Pulse multiply). Display shows running at 1 : 5 multiply.
	Running at EXT operation mode (Dividing). Display shows running at 5 : 1 dividing.
	Running at EXT operation mode (Analog input 0 - 20 mA). Display shows running at 120 spm speed responding to input current.
	In setting mode. (SET lights.)
	
	
	

• Alarm display

Display examples	Meanings
	Display for excess spm at EXT operation (analog input operation). (OVER lights.) In analog input operation, visible if external signal exceeding 360 spm operation comes. While visible, pump runs at fixed speed of 360 spm.
	Display for excess spm at EXT operation (Pulse multiply operation). (OVER lights.) In multiply operation, visible if next pulse comes when the pump is making the strokes. While visible, max. 255 pulses can be put in storage. You can set not to put them in storage.
	Display for excess spm at EXT operation (Pulse dividing operation). (OVER lights.) In dividing operation, visible if signal which exceeds max. preset number of strokes comes. While visible, the pump runs at fixed max. number of strokes. You can set so that excessive input pulses can be put in storage up to 255 pulses.

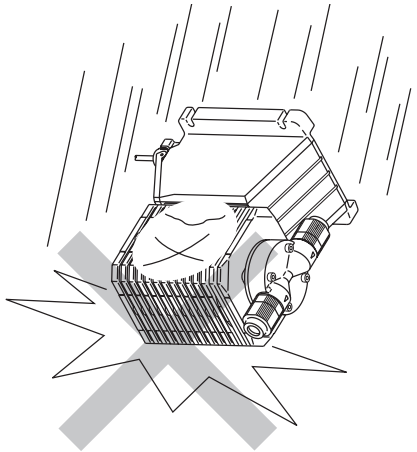
Installation

1. Notes on Operation

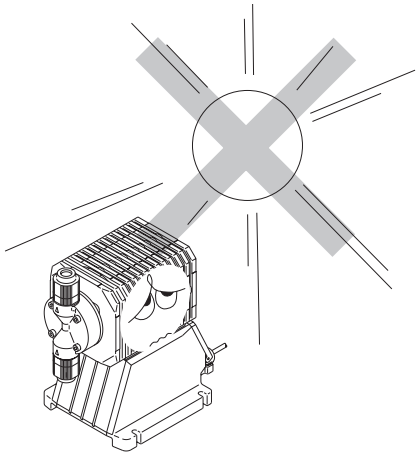
Operators and maintenance service staff must read the instruction manual thoroughly before using the products. Do not operate the pump system unless all of the contents in the manual are completely understood.

⚠ CAUTION

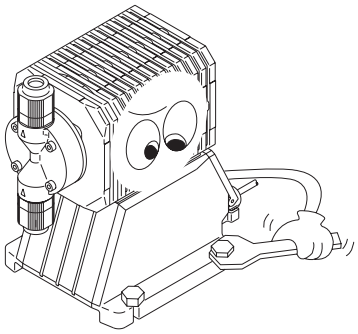
- **Turn off the power supply**
  Working without disconnecting the power supply may cause an electrical shock. Before engaging upon any working procedures involving the pump, make sure to turn the power supply switch off and to stop the pump and other related devices.
- **Terminate operation**
  When you detect or become aware of a dangerous sign or abnormal condition during operation, terminate the operation immediately and start it from the beginning again.
- **Specified power only**
  Do not operate the pump on voltage, which is not specified on the name plate.
  Failure to do so may result in damage or fire. Only the specified power level is to be applied.
- **Keep from heat or flame**
  Do not place any dangerous materials or flammable objects near the pump for the prevention of fire or accident.
- **Damaged pump**
  Never operate a damaged pump. A damaged pump may cause leakage or electrical shock.



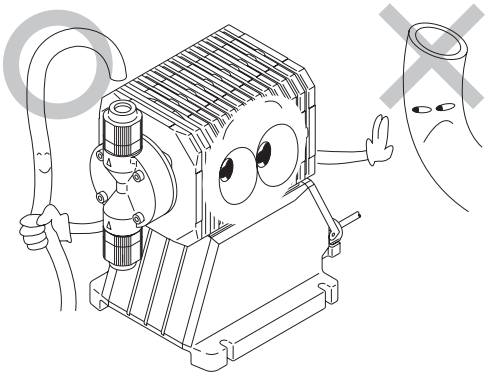
1. Dropping the pump or subjecting it to strong impacts may result in faulty performance. Handle the pump with care.



2. When installing the pump, avoid places exposed to direct sunlight or direct rain with an ambient temperature of above 40°C, or with a relative humidity or above 90 %. Though the pump has a simple waterproof and dust proof structure, a sheltered location is recommended.

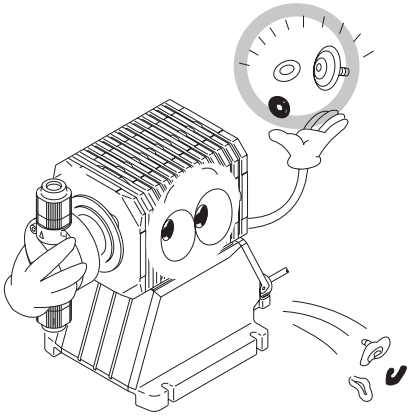


3. Install the pump at the place convenient for the maintenance/inspection works in the future.
   Securely fix the pump so that the pump can not vibrate horizontally.

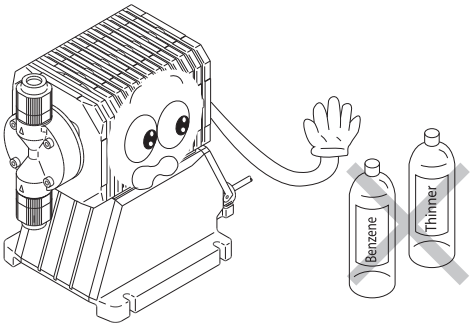


4. Use the tube corresponding to the pump suction and discharge port sizes. Securely connect the tube so that liquid can not leak or air can not be sucked in.

5. Make bleeding when you use the pump for the first time or when you replaced the chemical tank.
   Refer to item "Bleeding procedure" on page 28.



6. When you disassemble the pump head, replace diaphragm, O ring, valve gasket and valve unit by new ones.



7. Do not wipe the pump body with the cloth in which is soaked by solvent such as benzene, kerosene or thinner. Otherwise, the body may be discoloured. To clean pump body, use dry cloth or the cloth in which are soaked by water or neutral detergent.

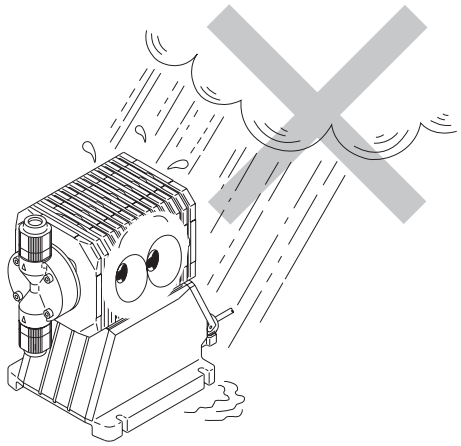
⚠CAUTION

Liquid splash on driving unit and control unit may cause failure or accident. Pay attention the liquid not to be splashed.

2. Installation

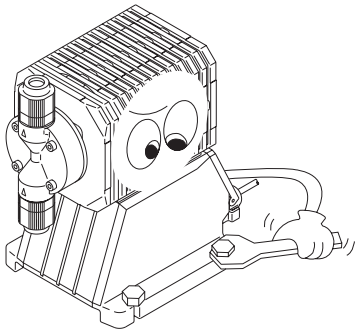
⚠CAUTION

When you feel danger or abnormality during installation or mounting works, stop works immediately to check its reason.



1) Install pump at place of ambient temperature of 40 deg. C or below and humidity of 40% RH or below (No dew condensation should be in the control unit.) where is easy and convenient for maintenance and inspection works.
   Cover the pump when installing it out of doors for protection against direct sunlight and wind & rain.

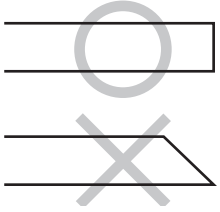
2) Install pump as close to a suction tank as possible in the manner of flooded suction (Pump is located below the suction tank.).



3) Mount pump securely with M6 bolts at horizontal and flat place where no liquid splashes on it. Pump mounted on the slant may cause reduced discharge capacity or no liquid discharged.

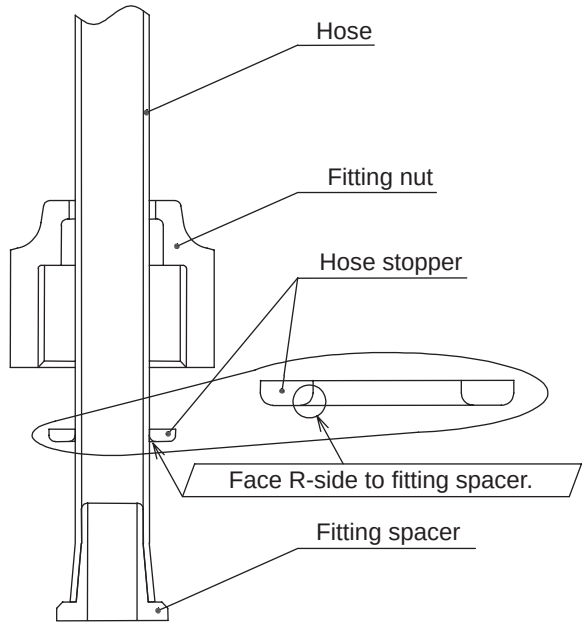
4) If pump is used to handle liquid which apt to generate bubbles (sodium hypochlorite and hydrazine solution or so), install pump at cool and dark place without being exposed to direct sunlight. Employ flooded suction. (Install pump below liquid level of suction side.)

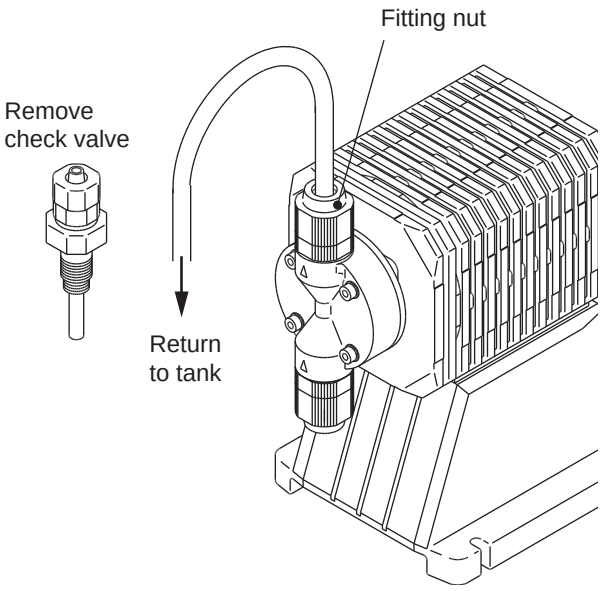
Side view of hose

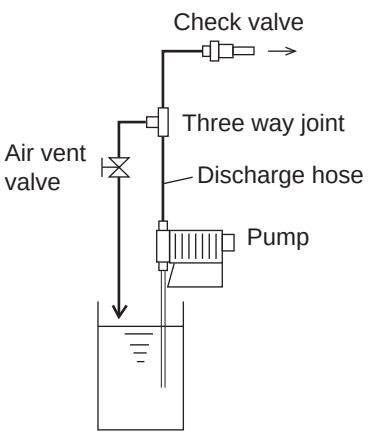


5) Cut hose end at right angle as shown on figures at left.

3. Tubing







1. Tubing for types VC, V6, PC, VM, FC
   Use PVC braided hose or so which corresponds to connection bore of pump.
   Hose is fixed by hose stopper. Put fitting nut and hose stopper on hose and insert hose end into fitting spacer and then push the hose stopper to the bottom of fitting spacer and tighten fitting nut. Make sure that the R-side of the hose stopper is facing to the fitting spacer.
   NOTE: Especially for type FC, make sure to face the R-side of the stopper to the fitting spacer. Otherwise, hose may be damaged.
   Insufficient or wrong mounted hose stopper may cause liquid leakage, failed priming or damaged hose.
   Fitting nut is made of plastics. Pay attention not to tighten it excessively. Excessive tightening may break nut.

⚠CAUTION

- Use specified size of tube. Otherwise tube may come off.
- Insert the fitting spacer into tube as deep as possible. Otherwise liquid may leaks or tube may come off.
- Pay attention not to lose O ring (gasket for FC). If O ring (gasket for FC) is not mounted, it may cause liquid leakage or failed self-priming.

2. Tubing for SH type
   Connections are Rc1/4 or NPT1/4 (EH-E31, 36SH) and Rc3/8 or NPT3/8 (EH-E46, 56SH). Apply seal tape to connected pipe and securely tighten it so that liquid can not leak nor air be sucked in.
3. Tubing for bleeding
   When you do bleeding, return the discharge side tube to the suction side tank. Remove the check valve if it is mounted. Refer to item "Bleeding" of "Operation" section.

⚠CAUTION

The EH-E pump is not equipped with built-in air-vent valve. Mount the air-vent valve referring to the illustration on left.
Built-in type air-vent valve is available as an option for types VC, V6 and PC.

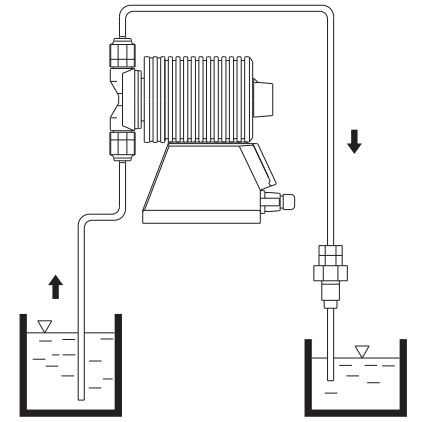


Fig. A

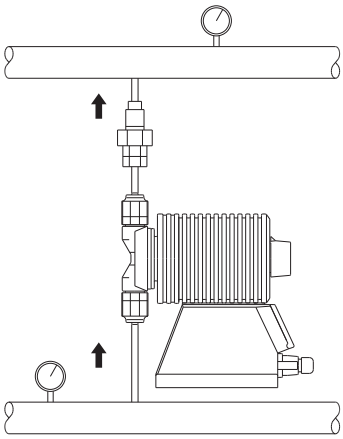


Fig. B

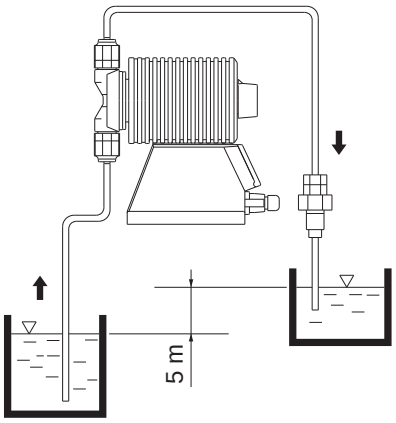


Fig. C

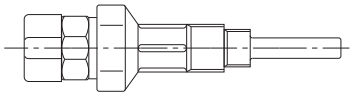
4. Mounting check valve
   In case the pump is installed as mentioned below, make sure to install the check valve to avoid over-feeding.

   1) In case the suction side liquid level is higher than that of discharge side. (Fig. A)

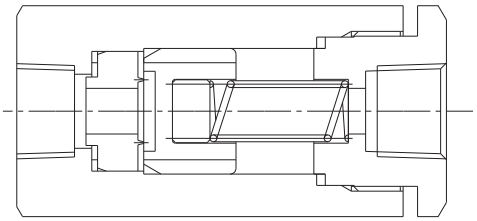
   2) In case the suction side pressure is higher than the discharge side one. (Fig. B)

   3) In case the discharge side liquid level is higher than the suction side one but the height difference between the two levels is 5 meters or less. (Fig. C)

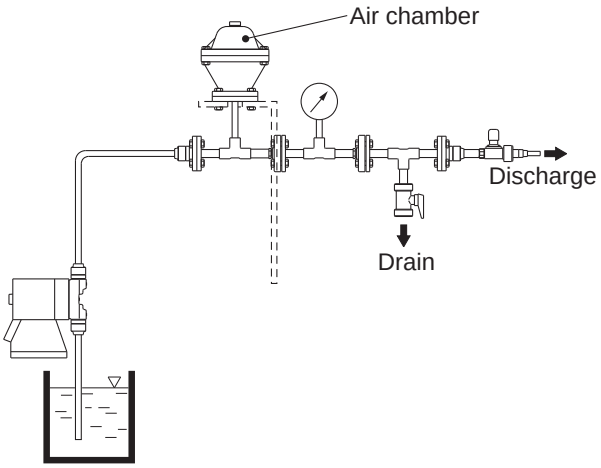
   4) In case the pressure loaded to the pump (due to pipe resistance, discharge head etc.) is less than 0.13 MPa.



CA type check valve



CS type check valve



Precautions when mounting check valve

1) Install the check valve at the end of discharge tubing. It should be separated the pump by 1 meter or more.

2) CA type check valve can be connected to either tube or threaded pipe of R1/2 and R3/8.

3) Stainless steel check valve CS type has the connection of RC1/4 or NPT1/4 for pump models EH-E31 and 36SH, and RC3/8 or NPT3/8 for pump models EH-E46 and 56SH.
For the connection of pipe, apply seal tape to avoid liquid leakage.

5. Other precautions for tubing

1) Use the specified size of tube. Otherwise required pump performance and flow rate may not be obtained.

2) Suction side tube should be as short as possible. (Max. length is 1 meter.)

3) Self-priming ability of this pump is 1 meter or less when the valves are dry.
Install the pump of which the pump head to be 1 meter or less than the liquid level. The HP6 type is not designed for self-priming.

4) In case are handled gaseous liquids such as sodium hypochlorite or hydrogen peroxide etc., flooded suction is recommended for suction side. Flooded suction is effective to avoid gas generation or air pocket in the piping.

6. Install of accumulator or air chamber
To avoid the vibration caused by the pulsation of pump discharge side, install an accumulator or an air chamber in the piping.

⚠CAUTION

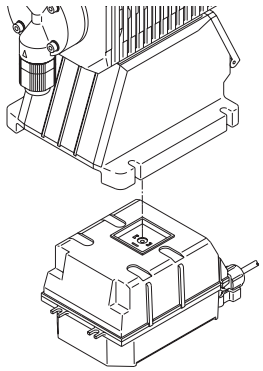
Vibration of pipe causes the rupture of pipe.

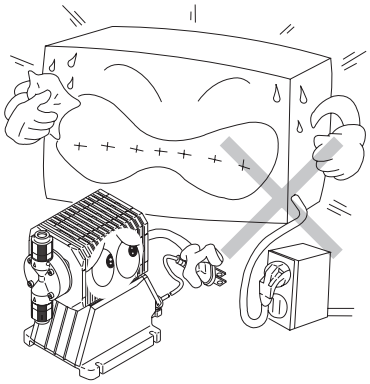
4. Electrical Wiring

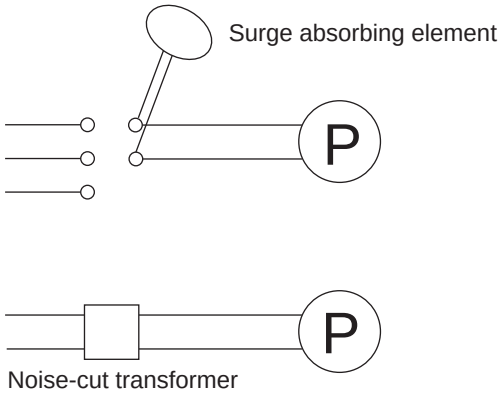
1. Precautions on wiring

⚠CAUTION

- Only qualified operator/service staff should be in charge of the related electrical arrangement and control of the power source. Failure to observe this instruction may result in injury to person or damage to assets.
- Frequent stop and start of pump should be done by using STOP function (ON and OFF of STOP terminal). If you can not use STOP function and are forced to operate pump by turning OFF and ON of power source, ON and OFF of power source should be limited to six times an hour.







⚠Precaution for handling control unit

The control unit can be detached but do not detach it when unnecessary.
Never combine the control unit with the driving unit which are different power voltages. Otherwise the electronic circuit or driving unit may be failed or damaged.

⚠CAUTION

Never use in common the power source of the pump and that of high power electrical equipment which generates surge voltage. The surge voltage may cause the damage and failure of controller.

- Surge voltage
  The electronic circuit of the control unit may be affected by excessively high surge voltage. So, do not operate the pump near high-power electrical equipment of 220V or above that generates high surge voltage.
  Under unavoidable circumstances, take either of the following measures.
  (1) Use a surge absorbing element (such as a varistor with surge resistance of 2000A or more) at the pump power supply connection.
  (2) Use a noise-cut transformer.

2. Wiring

Power cord and external signal cord are connected according to the procedure as bellow.

⚠CAUTION

- Never do the wiring when pump is operating. Otherwise you will get an electric shock or the pump will be failed due to the short-circuit.
- Wait one minute or more after the power is switched off to start the wiring works because the internal circuit will be electrified just after it is switched off.
- Use the cord of which outer diameter is 7, 8 mm. If smaller cord is used, enough tightness can not be obtained
- Wiring of external and stop signals
  Do not combine cables for EXT and STOP signals with power cable. Do not use coaxial cable (5-wires cable or so) for wiring power cable, EXT and STOP signals cable all together. Otherwise noise may be generated in EXT and STOP cables because of induction effect from power cord, which may result in pump failure or failed operation.

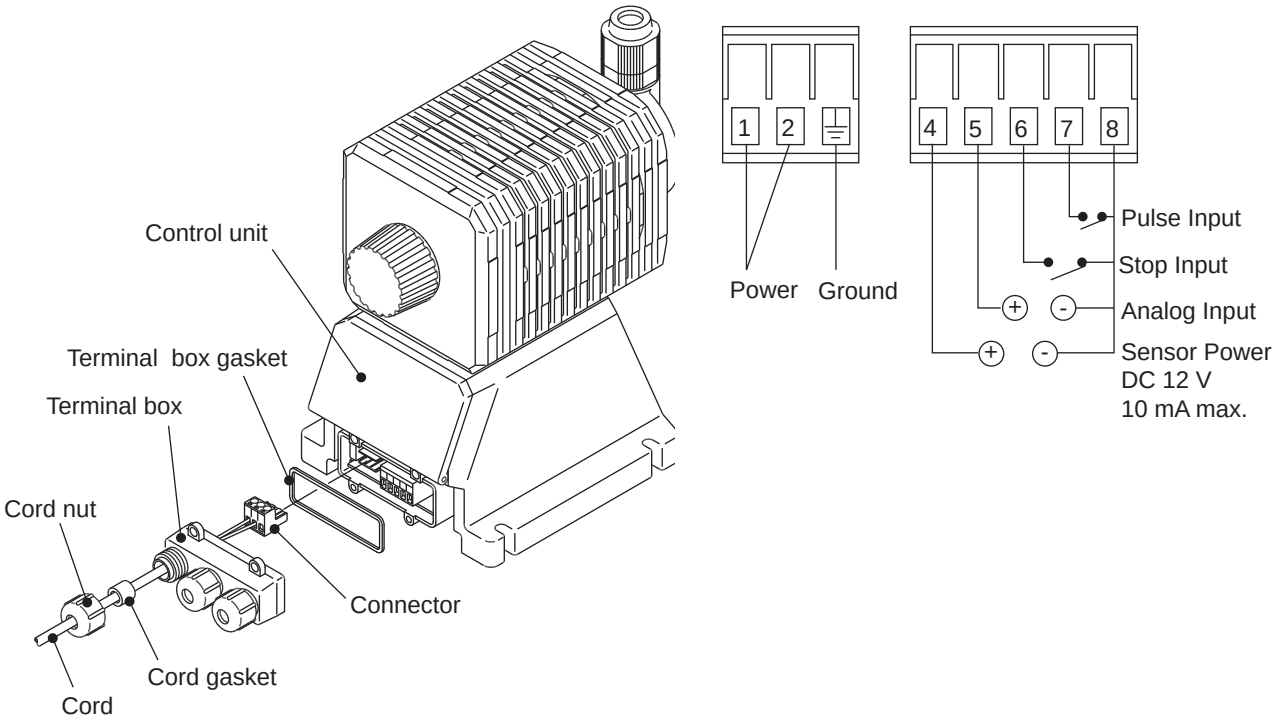
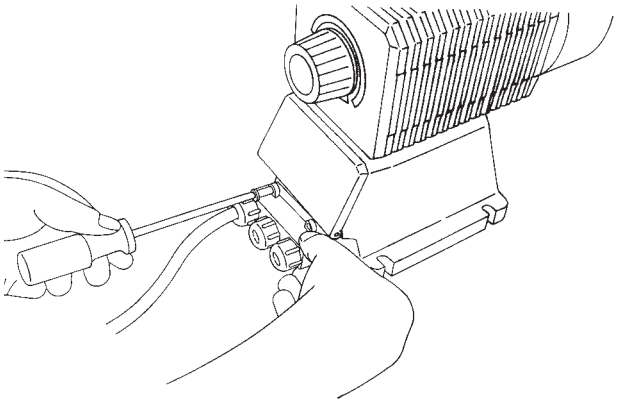


Fig. 5



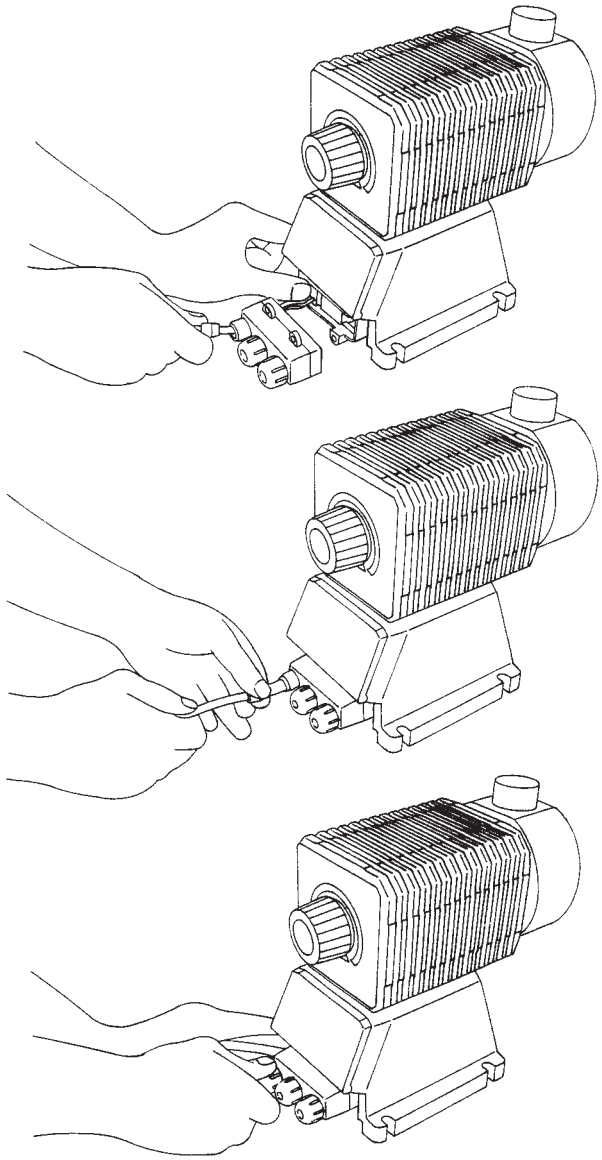
1) Remove four screws with screw driver to take off terminal box.

2) Connector is press-fit to PCB connector. Remove connector from PCB connector.

3) Remove other cord nut which is not used for wiring and take off blind cap and cord gasket from it and put cord nut and cord gasket on wired cord in that order and then insert it through terminal box.

4) Connect wire to connector. Strip wire jacket by approx. 5mm from its end and insert it into each terminal and tighten connector screws (Tightening torque : 0.4 N•m)

5) When wiring is completed, insert connector into the original position.



⚠CAUTION

Check if connector is securely mounted. Wrongly or insufficiently mounted connector may cause failed operation.

6) Mount terminal box on case in the manner the connection label comes upside and fix it with attached four screws. Tightening torque is 0.5 N•m.

⚠CAUTION

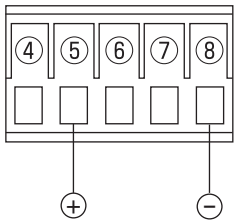
If terminal box is mounted by other screws than attached ones, it may cause failed sealing.

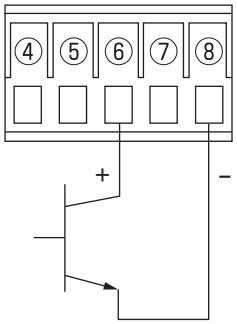
7) Adjust the tension of cord inside terminal box and insert cord gasket into terminal box.

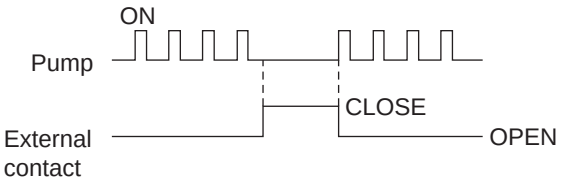
8) Tighten cord nut.

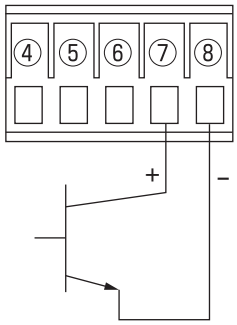
⚠CAUTION

Use the cord of outer diameter of 7.8 mm. Smaller diameter cord may cause wrong sealing resulting in failed pump.









● Wiring for analog input operation

Analog input operation means the pump operation by input current signal of 0 to 20 mA to change the stroke rate in proportion to 0 to 360 spm.

For the wiring, connect the wires to the terminals ⑤ and ⑧ and fix them by screws. Tightening torque is 0.4 N•m or less. ⑤ is plus and ⑧ is minus. (Inside resistance : 250 Ohm)

⚠CAUTION

Pay attention to polarity. Wrong connection leads to unintentional operation. If signals are entered with wrong connection for a long time, the pump may break down.

● Wiring for stop function

Stop function means the method to provisionally stop the pump operation by external potential free contact signal or open collector signal.

For the wiring, connect the wires to ⑥ and ⑧ of the connector.

• When used with open collector

Pay attention to the polarity. ⑥ is plus and ⑧ is minus. (Max. chargeable voltage is 5 V, current 1.1 mA)

• When used with mechanical contact such as relay or so. Use the electronic purpose one of which the minimum applicable load of 1 mA or below.

⚠CAUTION

Frequent stop and start of pump should be done by using STOP function (ON and OFF of STOP terminal). If you can not use STOP function and are forced to operate pump by turning OFF and ON of power source, ON and OFF of power source should be limited to six times an hour.

● Wiring for pulse input function

Pulse input function means the pulse multiply or dividing operation by external potential free contact signal or open collector input.

For the wiring, connect the wires to ⑦ and ⑧ with screw driver. Tightening torque is approx. 0.4 N•m.

• When used with open collector

Pay attention to the polarity. ⑦ is plus and ⑧ is minus. (Max. chargeable voltage is 5 V, current 1.1 mA)

When mechanical contact such as relay or so is used, use the one designed for electronic purpose of which the minimum applicable load of 1 mA or below.

Operation

1. Preparation for Operation

⚠CAUTION

- Do not operate the pump with discharge-side valve completely closed.
  Operating the pump with discharge-side valve fully closed may lead to liquid leakage or pipe rupture.
- Do not run pump dry.
  Dry operation of the pump over a long time (longer than 30 minutes) causes the pump to overheat and the pump unit (pump head, valve guide etc.) to become deformed or the pump head attachment to become loose, which may result in liquid leakage trouble.
- Keep the pump head firmly assembled.
  If mounting bolts on the pump head are loosened, liquid leakage may result.
  * Fasten the 4 or 6 hex. socket bolts tightly before starting the initial pump operation. (The bolts may be loosened during storage or transportation of the pump, depending upon the condition.)
  * Fastening torque: 2.55 N·m.
    Tighten all the bolts fully by applying an equal amount of torque in a diagonal order among the bolts.
- Frequent stop and start of pump should be done by using STOP function (ON and OFF of STOP terminal). If you can not use STOP function and are forced to operate pump by turning OFF and ON of power source, ON and OFF of power source should be limited to six times an hour.

1-1. Bleeding

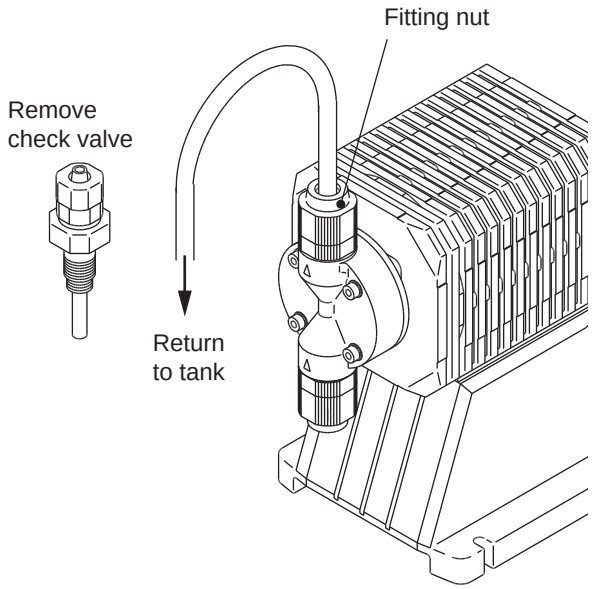
Bleeding is a process to eliminate the air which remains in the suction tube or pump head.
Make sure to carry the bleeding prior to the initial operation of the pump or when the liquid in the tank was replaced or the pump rested for a long time.

Starting and stopping pump operation

1) Switch on the power and ON lamp (green) lights and goes to WAIT mode after the version number was displayed. (When the pump is switched on for the first time.)
   The word WAIT is lit during WAIT mode.

START/STOP key

2) Push START/STOP key one time. The word WAIT disappears and pump starts operation. Every time START/STOP key is pushed, operation and stopping is repeated.



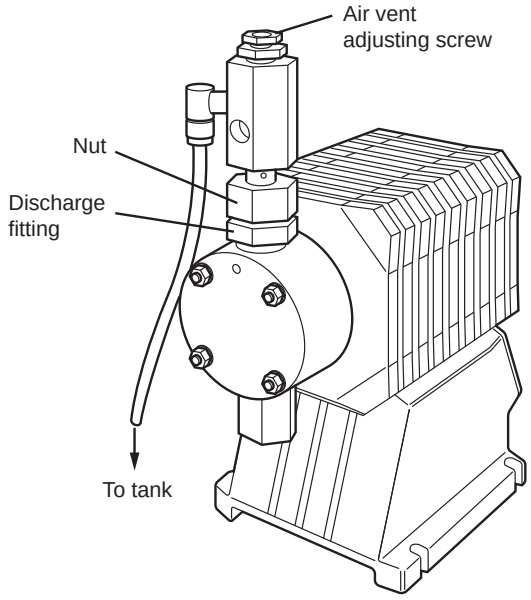
Bleeding for types VC, V6, PC and FC

1) Return the discharge side hose to the tank and start the pump. Remove the check valve if it is mounted.

2) Run the pump for 10 minutes for bleeding.

3) When the air is removed and pump head is completely filled with liquid, return the discharge tube to the normal piping.

4) Check if no liquid leaks from any part.



Bleeding for SH (stainless steel head) type

Before the bleeding is done, tighten the nut and discharge fitting.

Tightening torque : E31, 36SH···5N•m
E46, 56SH···7N•m

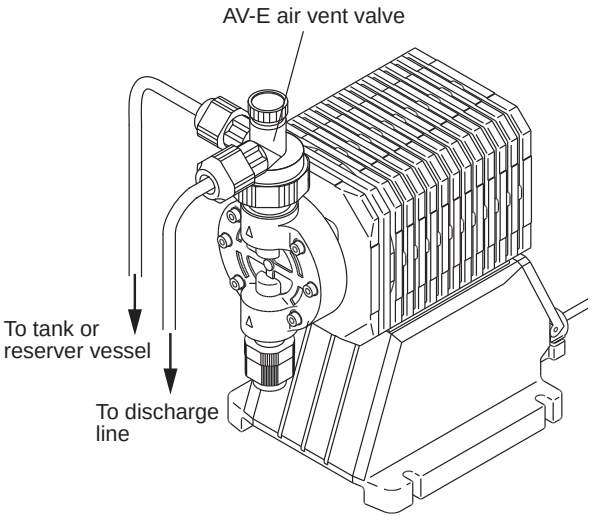
1) Connect hose to bleeding hose connection part return the hose to the suction tank.
Bleeding hose should be open without any load.
Pay attention that the air and liquid come out together when bleeding is done.

2) Turn an adjusting screw counter clockwise. (by half to one turn)

3) Run the pump for ten minutes for bleeding.

4) Close the adjusting screw by turning it clockwise.

5) Check if no liquid leaks from any part.



Bleeding for types VC, V6 and PC with AV-E air vent valve (Option)

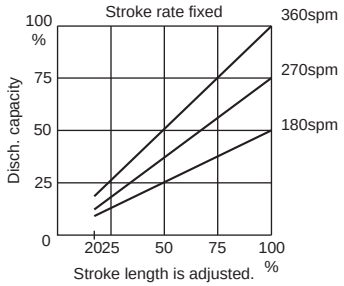
1-2. Adjustment of Discharge Capacity

Adjustment of the discharge capacity can be done by adjusting the stroke length and by adjusting the stroke rate but basically it is done by adjusting the stroke rate. Stroke length adjustment is an auxiliary way when the stroke rate adjustment is not enough.

Pay attention to the following for the correct adjustment.

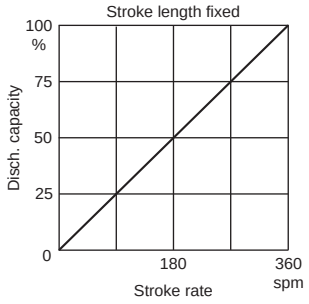
1) For the gaseous liquid such as sodium hypochlorite and hydrazine solution, set the stroke length at 100 % or near. Discharge flow may be reduced if the stroke length is short.
2) When the back pressure is high at discharge side, set the stroke length at 100 % or near to adjust discharge capacity by stroke rate.
   In case the reaction is greatly influenced by discharge capacity per pump shot in the application of neutralization or titration, adjust discharge capacity by stroke speed with shortened stroke length to minimize discharge capacity per shot.

1. Procedure to adjust the discharge capacity
   Appropriate stroke length and stroke rate are decided considering the pump operating condition and liquid characteristics or so. Following ways are recommended for proper calibration.
   (1) Set the stroke length at 100 % to roughly adjust the discharge capacity by adjusting the stroke rate.
   (2) Measure the discharge capacity.
   (3) If the measured capacity is below the wanted value, increase the stroke rate and measure again the discharge capacity.
   (4) Adjust the stroke length to do the fine adjustment of the capacity.
   (5) Measure again the discharge capacity to confirm the wanted capacity is discharged.



2. Adjustment of stroke rate

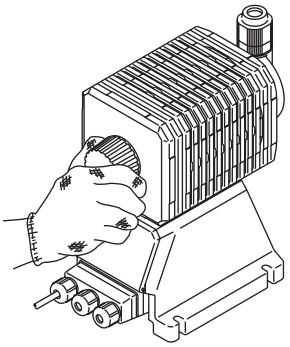
Stroke rate is adjusted by keys operation on the control unit. Stroke rate is adjusted from 1 to 360 spm.

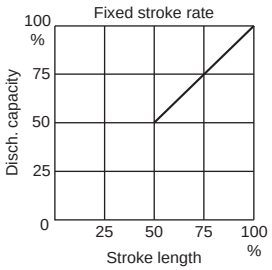


3. Adjustment of stroke length

(1) Power on the pump to start and adjust the discharge capacity by turning the stroke length adjustment knob.

(2) Figure below shows the relation between the stroke length and discharge capacity.
Stroke length can be adjusted from 0 to 100 % but actually set the length between 50 and 100 %.





⚠CAUTION

Do not turn the stroke length adjusting knob while pump stops.

● Full operation

Start pump for full operation after bleeding and discharge adjustment are finished.
Operation is done by manually or by any function of control unit.

● Manual operation

Starting pump : Turn on power to light ON lamp (green) to come to WAIT mode.
Push START/STOP key (for the first time to turn on power) for WAIT lamp to go out and start pump.

Stop pump : Push START/STOP key to light WAIT lamp to stop pump. Every time to push START/STOP key, pump starts and stops.

● EXT operation

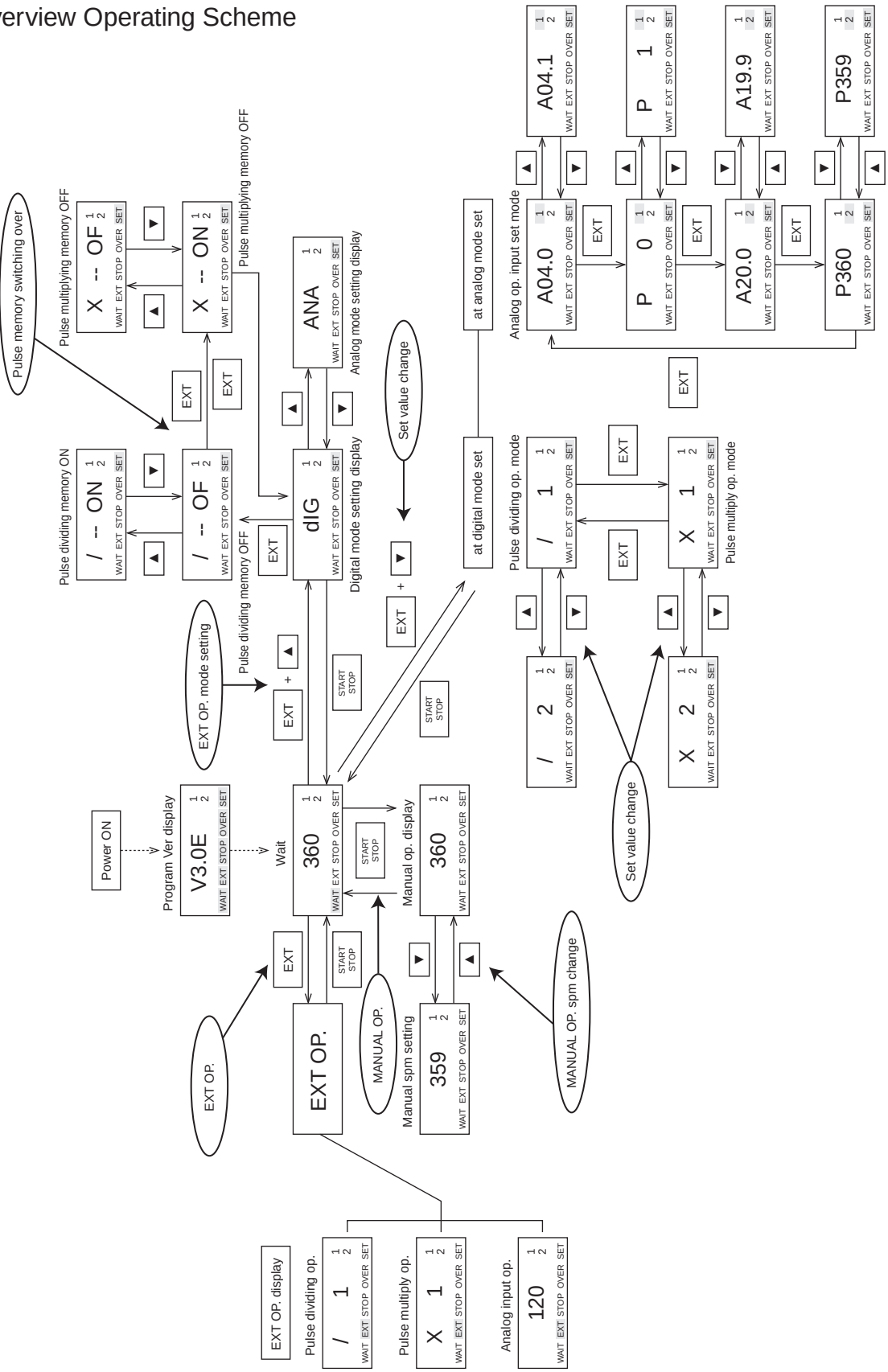
Refer to next section of "Operation".

● When the pump is stopped for a long period (more than 1 month)

When the pump is stopped for a long period, clean the wet-end of pump and tubing by operating the pump with clean water for 30 minutes before stopping the pump.
When the pump is started after stopping, if it does not suck up and discharge the liquid, clean the valve set and remove foreign matters adhered. Do bleeding and adjust the discharge capacity.

2. Operation

2-1. Overview Operating Scheme



Notes to Overview Operating Scheme

1) ------> means automatic movement. After the program Ver is displayed, it automatically moves to the status at which the power was off last time. (When the pump is powered for the first time, it comes to WAIT mode.)
2) For the pump start by manual operation, push START/STOP key at WAIT mode. To stop the pump, push START/STOP key again.
3) EXT operation starts by pushing EXT key at WAIT mode and stops by pushing START/STOP key.
4) For the switching over between analog and digital operation, push EXT and ▲ keys simultaneously.
   Parameter is changed by ▲ and ▼ keys and the set value is fixed by START/STOP key.
5) To move to pulse memory switching mode, push EXT key while dIG is selected at analog/digital switching mode. (If ANA is selected, you can not come to this mode.)
   Figures are changed by ▲ and ▼ keys and switching between multiply and dividing is done by EXT key.
   Push START/STOP key to return to WAIT mode.
6) To go to EXT setting mode, push EXT and ▲ key simultaneously at waiting mode.
   Parameter is changed by pushing ▲ and ▼ keys when you are in analog operation, and when you are in digital operation, by pushing ▲ and ▼ keys to change parameter and push EXT key to toggle between dividing and multiplying operation.

Default parameter value

Mode	Parameter	Default value	Setting range	Step
Manual	spm	360	1 - 360	1
A/D toggle	Digital/Analog	dIG	dIG, ANA	
Pulse memory toggle	Dividing	/OF	ON, OF	
	Multiply	× ON	OF, ON	
EXT operation	Dividing	/1	1 - 999	1
	Multiply	× 1	1 - 999	1
	Analog	Set point 1 Amp.: 4.0	0.0 - 20.0	0.1
		Set point 1 spm : 0	0 - 360	1
		Set point 2 Amp.: 20.0	0.0 - 20.0	0.1
		Set point 2 spm : 360	0 - 360	1

2-2. Setting and Operation of Controller

■ Manual operation

(1) Power ON

When the power is on, a green lamp lights up and the wording "V3.0E" appears, then the stroke rate for manual operation is displayed and comes to WAIT mode. (In case the pump is powered on for the first time.) If it does not come to WAIT mode, push once START/STOP key to come to WAIT mode.

(2) Stroke rate can be changed by pushing ▲ or ▼ key at wait mode or during operation. Push ▲ key to increase stroke rate and ▼ key to decrease. If you push the key in a short time, the spm figures changes slowly by one spm and if you continue to push over three seconds, they change quickly. The pump is shipped set at 360 spm.

When the spm value is changed, the value is not put in memory unless you push START/STOP key or EXT key, or until three or more seconds have passed.

(3) Push START/STOP key to start the pump.

WAIT word disappears and ON lamp blinks.

(4) Stop the pump.

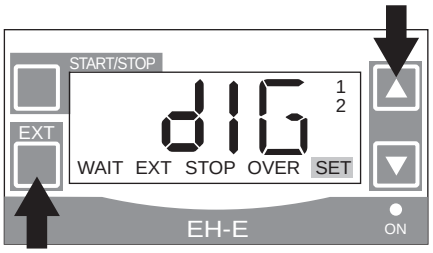
When START/STOP key is pushed once, the pump stops and WAIT word appears to come to WAIT mode.

■ Automatic operation

1. Analog signal operation

(1) Power ON

When the power is on, a green lamp lights up and the wording "V3.0E" appears, then the stroke rate for manual operation is displayed and comes to WAIT mode. (In case the pump is powered on for the first time.) If it does not come to WAIT mode, push once START/STOP key to come to WAIT mode.



(2) Change over at EXT operation mode

Push EXT key and ▲ key simultaneously.

Display shows "dIG" and SET lights. (If ANA is displayed, go to next item (3)).

The display changes to ANA if ▼ key is pushed. (Every time ▼ key is pushed, the display changes ANA to dIG.) When the pump is shipped from the factory, it is set at dIG.

(3) Push START/STOP key to confirm the analog mode and move to WAIT mode.

(4) Value input at analog mode

Push EXT key and ▼ key simultaneously.

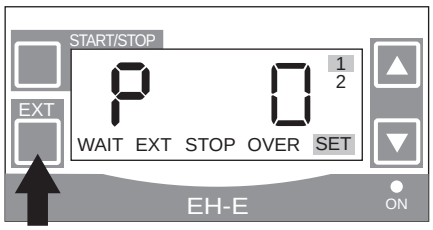
Display shows the initial set value A04.0 and SET and 1 light.

(5) Setting of input amperage at SET point 1.

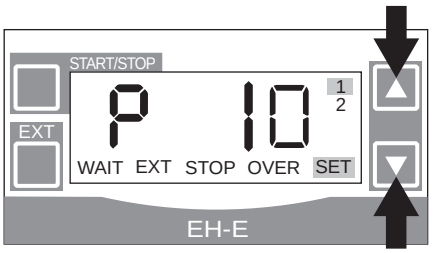
Set the input amperage at SET point 1 by ▲ and ▼ keys. The value increases with ▲ key pushed and decreases with ▼ key pushed. Amperage changes slowly by 0.1 mA when the key is pushed briefly, and changes quickly if pushed 3 seconds or more.

Setting range is 0.0 - 20.0 mA.

When the pump is shipped, it is set at 4.0 mA.



(6) Push EXT key to confirm the value at SET point 1 and move to the setting of stroke rate for the current value of SET point 1. The words PO is displayed and SET and 1 light.

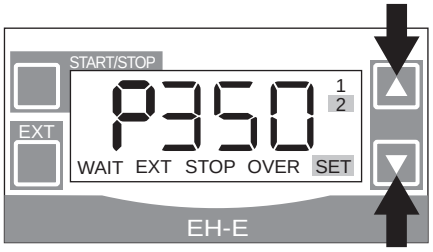


(7) Setting of stroke rate for the current value at SET point 1
Set the stroke rate for the current value at SET point 1 by ▲ and ▼ keys. Setting range is 0 - 360 spm. The pump is set at 0 spm when it is shipped from the factory.

(8) Push EXT key to confirm the set current value at SET point 1 and move to the setting of the input current value at SET point 2.
Display shows A20.0 and SET and 2 light.

(9) Setting of current value at SET point 2
Push ▲ and ▼ keys to set the current value at SET point 2. Do not set the value which is set at SET point 1.
Set range is 0.00 - 20.00 mA.
The pump is set at 20.00 mA when it is shipped from factory.

(10) Push EXT key to confirm the set current value at point 2 and move to the setting of stroke rate vs current value of SET point 2. Display shows P360 and SET and 2 light.



(11) Setting of stroke rate for the current value of SET point 2
Push ▲ and ▼ keys to set the stroke rate for the current value at SET point 2. Do not set the value which is set for SET point 1.
Set range is 0 - 360 spm.
The pump is set at 360 spm when it is shipped.

(12) Push START/STOP key to confirm the set value and move to WAIT mode.

(13) Push EXT key to start the pump.
Pump operates according to the set current value. WAIT disappears and ON lamp blinks.
Display shows the stroke rate at which the pump operates and EXT word lights. Stroke rate changes corresponding to input current.
To stop the pump, push START/STOP key and WAIT word lights.
To start the pump next time, push EXT key.

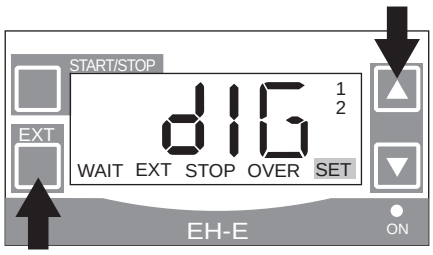
Alarm indication

At the analog input operation, if the current exceeding 360 spm comes, the word OVER lights. While the OVER is lighting, the pump operates at 360 spm.

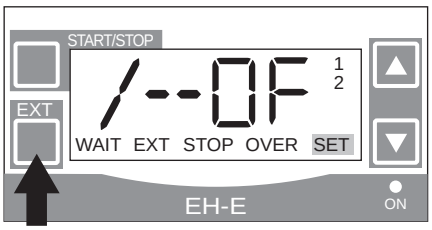
When analog input being set, if the same value (current or stroke rate) is put for SET point 1 and 2, ERR 1 is displayed for three seconds and then returns to set display.

2. Pulse multiply operation

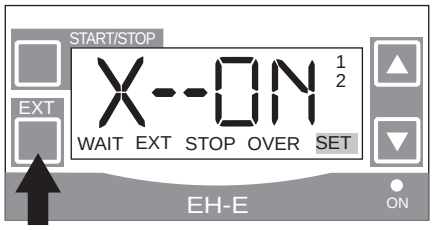
(1) Power ON
Power on and green lamp lights, display shows "V3.0E" and then shows stroke rate of manual operation and goes to WAIT mode.
(In case the pump is powered for the first time)
The word WAIT is lit at WAIT mode. If it does not show WAIT, push START/STOP key once to change to WAIT mode.



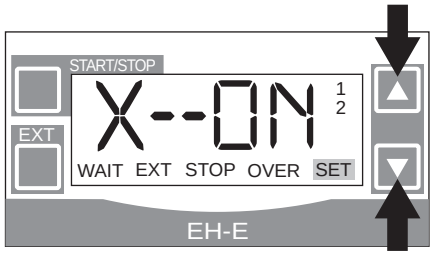
(2) Move to EXT operation mode.
Push ▲ key and EXT key simultaneously.
The word dIG is displayed and SET lights.
(If the word ANA is displayed, push ▼ key to change to dIG. Every time you push ▼ key, the words ANA and dIG switch over.) When the pump is shipped from the factory, it is set at dIG.



(3) Move to pulse memory (The function to put in memory the pulses (max. 255 pulses) which come while the pump does the multiply operation.)
Push EXT key and /-- OF or / -- ON is displayed and SET lights. (If X -- ON or X -- OF is displayed, go to next (4). When the pump is shipped from the factory, it is set at / -- OF.



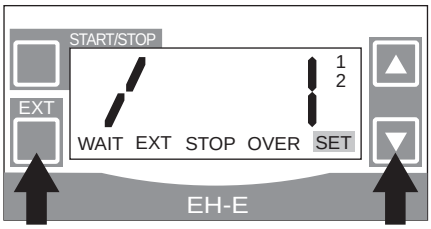
Push EXT key and the display changes to X -- ON or X --OF. (Every time you push EXT key, / -- OF or / -- ON, X -- ON or X -- OF switches.) When the pump is shipped from the factory, it is set at X -- ON.



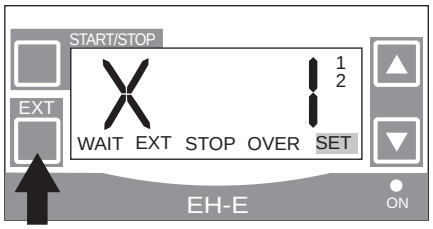
(4) Setting of pulse memory ON, OFF
Push ▲ key and ▼ key to set ON and OFF of pulse memory. Display X -- ON is memory ON and X -- OF is memory OFF status.
When the pump is shipped from the factory, it is set at X -- ON.

(5) Push EXT key to confirm ON, OFF of pulse memory and return to EXT operation mode.
The display shows dIG and SET lights.

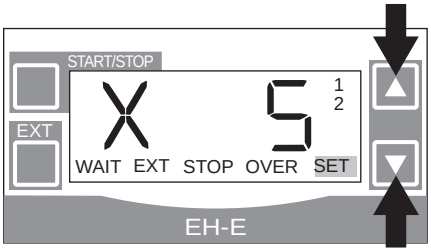
(6) Push START/STOP key to confirm the digital mode and move to wait mode.



(7) Switching of operation mode
Push EXT key and ▼ key simultaneously and / 1 (Dividing operation mode) is displayed and SET lights. (If X 1 is displayed, go to next (8).

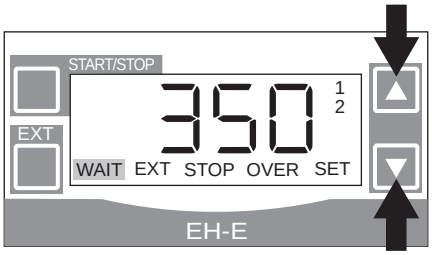


If you push EXT key, the display changes to X 1 (Multiplying operation). Every time EXT key is pushed, X 1 and / 1 are switched over.

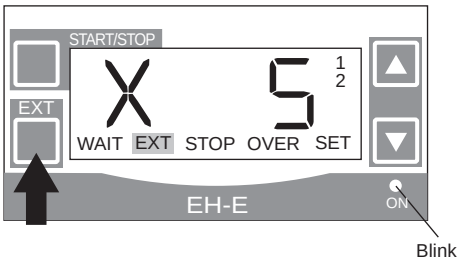


(8) Setting of stroke number to be counted
Set the stroke number with ▲ key and ▼ key. ▲ key increases the number and ▼ key decreases the number. The number changes slowly one by one if key is pushed in a short time and changes rapidly if pushed more than 3 seconds. Set range is 1 to 999. The pump is set at 1 when it is shipped from the factory.

(9) Push START/STOP key to confirm the operation mode and stroke number.



(10) Setting of stroke rate
Stroke rate at multiply operation is the one which is set for manual operation mode. At WAIT mode, push ▲ key and ▼ key to set the stroke rate. Refer to the item of Manual Operation for details.
The pump is set at 360 spm when it is shipped from the factory.



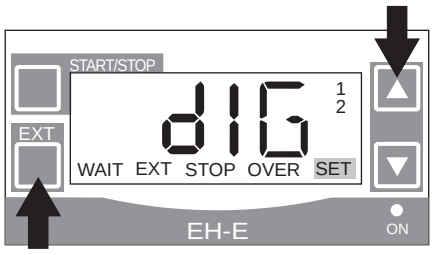
(11) Push EXT key to operate the pump.
Pump starts to operate, WAIT goes out and ON lamp blinks when a pulse comes.
The pump automatically stops after it operated for the stroke number which is set at above item (8). During the operation, the display shows pre-set stroke number and EXT lights. Push START/STOP key to stop the pump and go to WAIT mode. To start the pump again, push EXT key.

Alarm indication

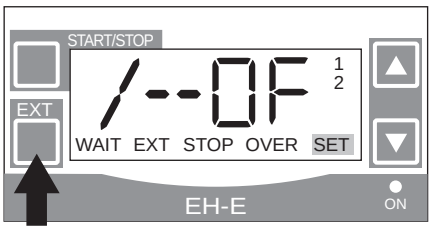
If next pulse comes during the multiplying operation, OVER lights. If the pulse memory is set to ON, max. 255 times pulse is put in memory and the pump continues operation.

3. Pulse dividing operation

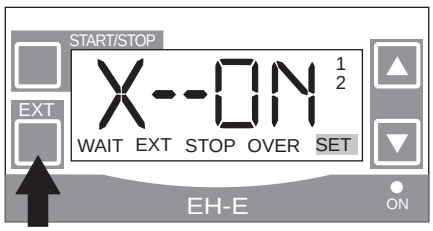
(1) Power ON
Power on and green lamp lights, display shows "V3.0E" and then shows stroke rate of manual operation and goes to WAIT mode.
(In case the pump is powered for the first time)
The word WAIT is lit at WAIT mode. If it does not show WAIT, push START/STOP key once to change to WAIT mode.



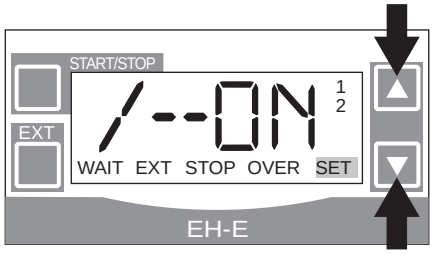
(2) Move to EXT operation mode.
Push ▲ key and EXT key simultaneously.
The word dIG is displayed and SET lights.
(If the word ANA is displayed, push ▼ key to change to dIG. Every time you push ▼ key, the words ANA and dIG switch over.) When the pump is shipped from the factory, it is set at dIG.



(3) Move to pulse memory (The function to memorize the pulses (max. 255 pulses) which come while the pump does the multiply operation.)
Push EXT key and / -- OF or / -- ON is displayed and SET lights.



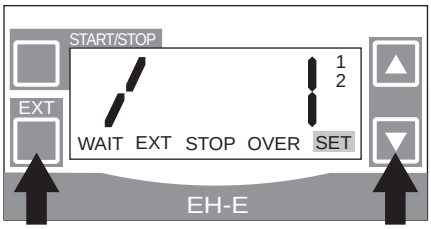
If X -- ON or X -- OF is displayed, push EXT key and the display changes to / -- ON or / -- OF. (Every time you push EXT key, / -- OF or / -- ON, X -- ON or X -- OF switches.) When the pump is shipped from the factory, it is set at X -- OF.



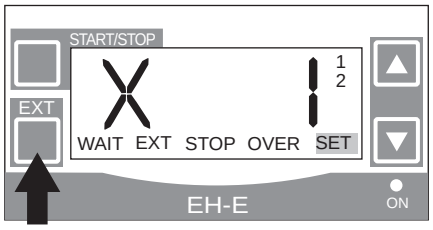
(4) Setting of pulse memory ON, OFF
Push ▲ key and ▼ key to set ON and OFF of pulse memory. Display X -- ON shows the pulse memory ON and X -- OF shows memory OFF status.
When the pump is shipped from the factory, it is set at / -- OF.

(5) Push EXT key to confirm ON, OFF of pulse memory.
The display shows dIG and SET lights.

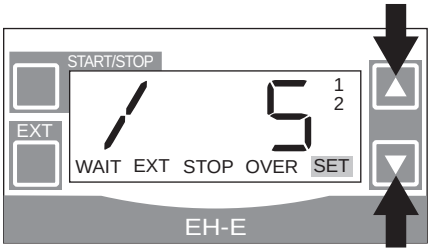
(6) Push START/STOP key to confirm the digital mode and move to wait mode.



(7) Switching of operation mode
Push EXT key and ▼ key simultaneously, and / 1 (Pulse dividing operation mode) is displayed and SET lights.

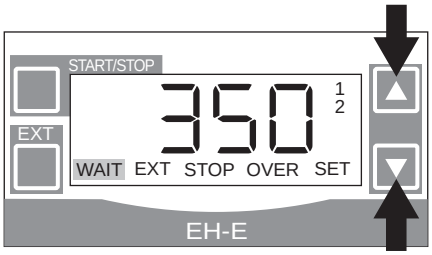


If X1 (multiplying mode) is displayed, push EXT key to change to / 1.
(Every time EXT key is pushed, the display changes from X1 to / 1.)



(8) Setting of dividing ratio
Set the dividing ratio with ▲ key and ▼ key.
▲ key increases the number and ▼ key decreases the number. The number changes slowly one by one if key is pushed in a short time and changes rapidly if pushed more than 3 seconds. Set range is 1 to 999. The pump is set at 1 when it is shipped from the factory.

(9) Push START/STOP key to confirm the operation mode and dividing ratio.



(10) Setting of upper stroke rate
Stroke rate at pulse dividing operation is the one which is set for manual operation mode. At WAIT mode, push ▲ key and ▼ key to set the stroke rate. Refer to the item of Manual Operation for details.
The pump is set at 360 spm when it is shipped from the factory.

NOTE) In case pulse memory is set for OFF
Pump operation may become unstable if dividing operation stroke rate according to input pulse exceeds the set value of upper limit stroke rate. Set the upper limit stroke rate at the value more than the stroke rate at dividing operation according to input pulse.

(11) Push EXT key to start the pump. WAIT disappears and ON lamp blinks.
Dividing ratio is displayed and EXT lights.
Stop the pump, push START/STOP key to come to WAIT mode.
When the pump is started next time, push EXT key.

Alarm indication

If pulses which exceeds upper stroke rate come in dividing operation, OVER lights.
If the pulse memory is set at ON, max. 255 inputs are put in memory and the pump continue to run for this pulses.

Maintenance

1. Troubleshooting

⚠WARNING

- **Wear protector**
  You may be injured if you touch chemical liquid. When you work on pump, be sure to wear protector such as protective mask, safety gloves or so.


Wear protective gear

- **Turn off power**
  You may be electrically shocked if you do the works without turning off power of pump. Before you start working, be sure to turn off power to stop pump or equipment.


Power off

Problem	Possible Cause	Corrective Action
Pump does not start.	Faulty wiring or disconnected	Correct wiring
	Power voltage went down.	Check power source.
	Electronic control unit is damaged.	Replace control unit
Pump does not prime. Discharge is not sufficient.	Pump stroke length is too short.	Operate pump with stroke length set at 100 % until primed. Then set stroke length as needed to obtain desired output.
	Air sucked in suction tubing	Correct tubing.
	Valve gasket is not mounted.	Install valve gasket
	Valve set assembly direction is wrong.	Reassemble valve set
	Pump is air locked.	Do air elimination.
	Suction or discharge valve is clogged by foreign matters.	Disassemble, inspect, clean
	Ball stuck to valve seat	Disassemble, inspect, clean
Discharge capacity fluctuates.	Suction or discharge valve is clogged by foreign matters.	Disassemble, inspect, clean
	Air is trapped in pump.	Do air elimination.
	Overfeeding	Install check valve or back pressure valve at discharge side.
	Diaphragm is damaged.	Replace diaphragm
	Worn check valves	Replace valve cartridges
Liquid leaks.	Fitting or coupling nut is loose.	Tighten
	Pump head is loose.	Tighten pump head bolts Torque: 2.55 N•m
	Diaphragm is damaged.	Replace diaphragm
	O-ring or valve gasket is not mounted.	Install O-ring or valve gasket

* It is recommended pump head bolts are tightened regularly at tightening torque of 2.55 N•m.
* When you find pump head bolts are loosened, liquid may goes inside driving unit. In this case remove a diaphragm and check to see if liquid does not get into driving unit.

2. Maintenance and Inspection

2-1. Daily inspection

Pay attention to following items during pump operation and if you find any abnormality, stop pump immediately to take countermeasures referring to Troubleshooting on page 45. When the time comes to replace the wear parts, replace it by new one.

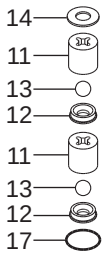
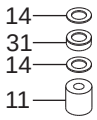
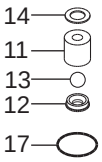
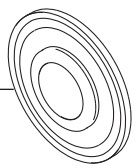
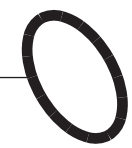
No.	Check item	Description	Check method
1	If pump discharges liquid normally.	● Check if liquid is discharged. ● Check if suction or discharge pressure is normal. ● Check if liquid characteristics are not changed, crystallized nor adhered.	● Flow meter or visual. ● Refer to figures on nameplate. ● Visual or auditory
2	Abnormal noise or vibration.	● Pump may generate abnormal sound or vibration when it runs abnormally.	● Visual or auditory
3	If no liquid leaks through piping or any pump parts or if no air is not sucked in pump.	● Tighten the parts where leakage happens. ● Air is sucked in if you see many bubbles in discharged liquid.	● Visual inspection

⚠ Check pump head tightening bolts periodically and tighten them when necessary.

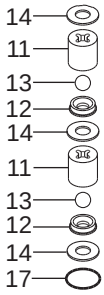
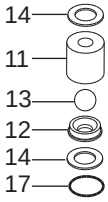
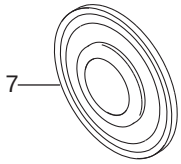
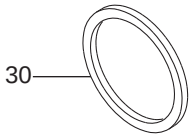
2-2. Wear parts

When pump is to be operated for a long period, the parts should be replaced appropriately, above all the wear parts shown below are recommended to be stocked always.

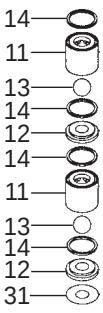
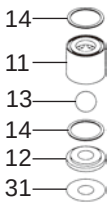
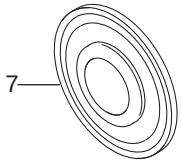
VC, V6, PC and VM types

Parts				Q'ty	Time to replace	Remarks
	EH-E31 • E36	EH-E46	E56			
Valve set				2 set	Approx. 8000 hrs	
Diaphragm				1		
O ring				*		*Refer to "Exploded views" for quantity required.

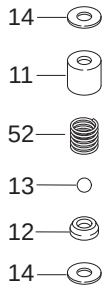
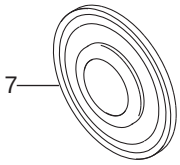
FC type

Parts			Q'ty	Time to replace	Remarks
Valve set	EH-E31 • E36	EH-E46 • E56	2 set	Approx 8000 hrs	
					
Diaphragm			1		
Gasket			*		*Refer to "Exploded views" for quantity required.

SH type

Parts			Q'ty	Time to replace	Remarks
Valve set	EH-E31 • E36	EH-E46 • E56	2 set	Approx 8000 hrs	
					
Diaphragm			1		

HP6 type

Parts		Q'ty	Time to replace	Remarks
Valve set	EH-E36 	2 set	Approx 8000 hrs	
Diaphragm		1		
Gasket		*		*Refer to "Exploded views" for quantity required.

3. Disassembly and Assembly

⚠WARNING

- **Inspection and maintenance**
  Inspection, maintenance, disassembly and assembly of pump must be done within the procedure and extent described in this instruction manual. Never disassemble the parts beyond the extent described in this manual (Do not disassemble electromagnetic driving part and electronic circuit board). The product is not guaranteed if it is disassembled or modified beyond the extent described in this manual. IWAKI is not responsible to the damage and accident caused by the disassembly and modification beyond the extent.
- **Wear protector**
  You may be injured if you touch chemical liquid directly or chemical liquid splashes on you. Wear protective cloth, mask or safety gloves or so when you do works on pump and piping.


Wear protective gear

- **Turn off power**
  You may be electrically shocked if you do the works with the power turned on. When the works are done, be sure to turn off power to stop pump or system.


Power off

- Before piping is removed or pump is disassembled, be sure to depressurize pump and discharge piping. Chemical liquid gushes out and dangerous if pump or piping is disassembled without depressurizing.
- When pump is disassembled, pay attention to residual liquid.

3-1. Disassembly and assembly of pump head

When pump head is disassembled, turn off power of pump and remove piping after pump and piping are depressurized to atmospheric pressure and disassemble pump head referring to exploded views on pages 53 to 56.

● How to depressurize

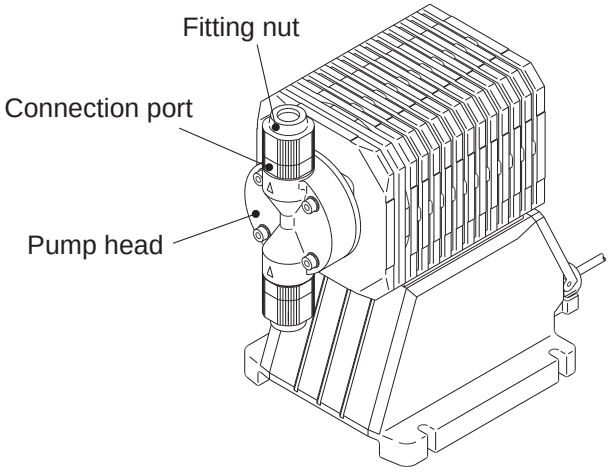
EH-E pump has no air vent valve except SH type. Install an air vent valve at discharge side to open it to release pressure. (Refer to item "Tubing" on page 20.

SH type has an air vent valve and can release pressure by following procedure.

(Take the same procedure to release air for types VC, V6 and PC which equip air vent valve as option.)

1. Stop pump.
2. Turn an air vent adjusting screw to left by two turns to fully open air vent port.
3. Confirm that liquid came out from air vent port and pressure was released.

NOTE : When the liquid does not come out, it is possible the pressure is not released. In this case continue to run pump until you confirm the liquid came out from air vent port and the pressure was released.



3-2. Replacement of valve set

<Disassembly>

1. Loosen fitting nut to remove hose paying attention to liquid coming out.
2. Loosen connection port by wrench to remove it and take valve set out of pump head.

⚠WARNING

- **Liquid may injure your hand, fingers or pump component. Wipe off quickly the liquid** adhered to your hand or pump component.

<Assembly>

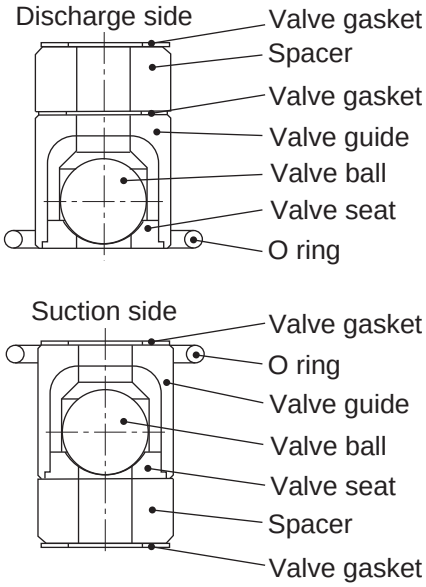
Assemble valve set in reverse order to disassembly paying attention to the following.

- Arrange and insert valve set in correct order and direction.
- Wrongly ordered and directed valve set causes failed pumping such as leakage and reduced flow rate or so.
- Do not forget to put O ring.

1. Assembly of discharge side valve set
   Put valve set in pump head, screw connection port in pump head by hand and then tighten it with wrench by approx. 1/4 turns.
2. Assembly of suction side valve set
   Put valve set in connection port, screw connection port in pump head by hand and then tighten it with wrench by approx. 1/4 turns.

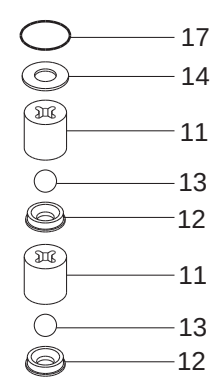
NOTE: Pay attention to up and down direction of spacer of EH-E46 (types VC, V6 and PC). Put chamfered side downward for suction side valve and upward for discharge side valve. Refer to figures on left.

EH-E46(VC, V6, PC)Valve set



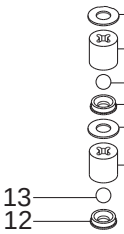
Exploded views of valve set

VC, V6, PC, VM types



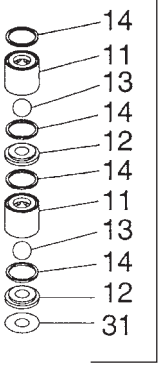
31 · 36
Same for disch. and suc.

FC type

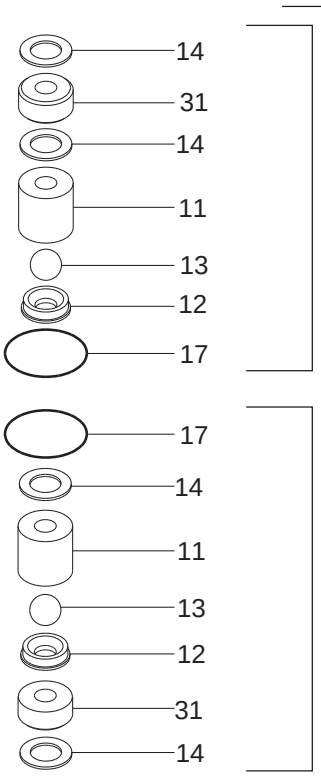


31 · 36
Same for disch. and suc.

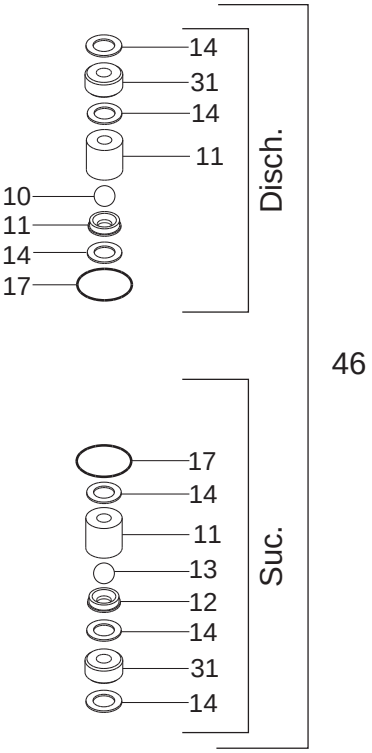
SH type



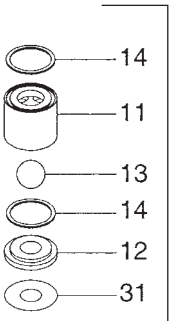
31 · 36
Same for disch. and suc.



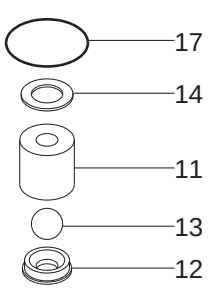
46



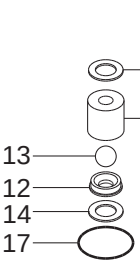
46



46 · 56
Same for disch. and suc.

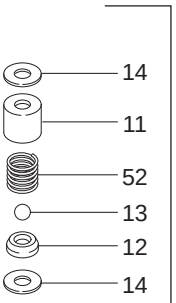


56
Same for disch. and suc.

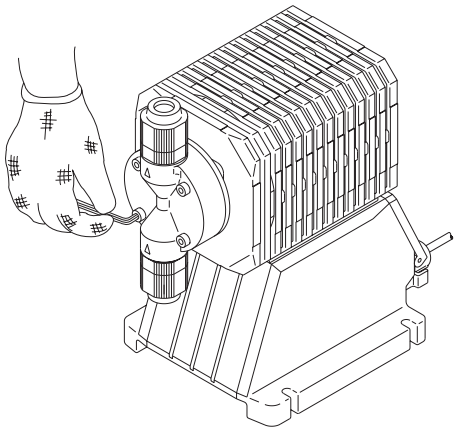


56
Same for disch. and suc.

HP6 type



Same for disch. and suc.



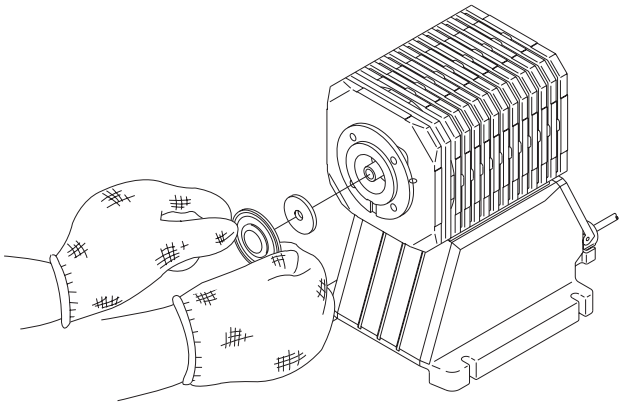
3-3. Replacement of diaphragm

<Disassembly>

1. Set stroke adjusting knob at zero.
2. Remove four or six hex. socket head bolts with hex. wrench and take pump head off.
3. Hold periphery of diaphragm and turn it counter clockwise to remove it from plunger pin. (Diaphragm is screwed in plunger pin.)

⚠WARNING

- Do not lose diaphragm spacer. Zero to several diaphragm spacers are put between retainer and plunger pin for the purpose of adjusting the position of diaphragm. Number of spacer depends on each pump and there is the pump which has no spacer.



<Assembly>

Assemble pump in the reverse order to disassembly paying attention to following.

1. Confirm that a stroke length adjusting knob is set at 0%.
2. Put a retainer and diaphragm spacer on the threaded part of new diaphragm and screw it in plunger pin. Put the recessed side of retainer on stepped part of diaphragm. Pay attention for the retainer not to drop.
3. Start pump and adjust stroke length at 50% and then stop pump and turn off power.
4. Mount pump head on pump body with hex. socket head bolts. (Tightening torque : 2.55 N•m)

4. Optional Accessories

Specification of check valve and back pressure valve

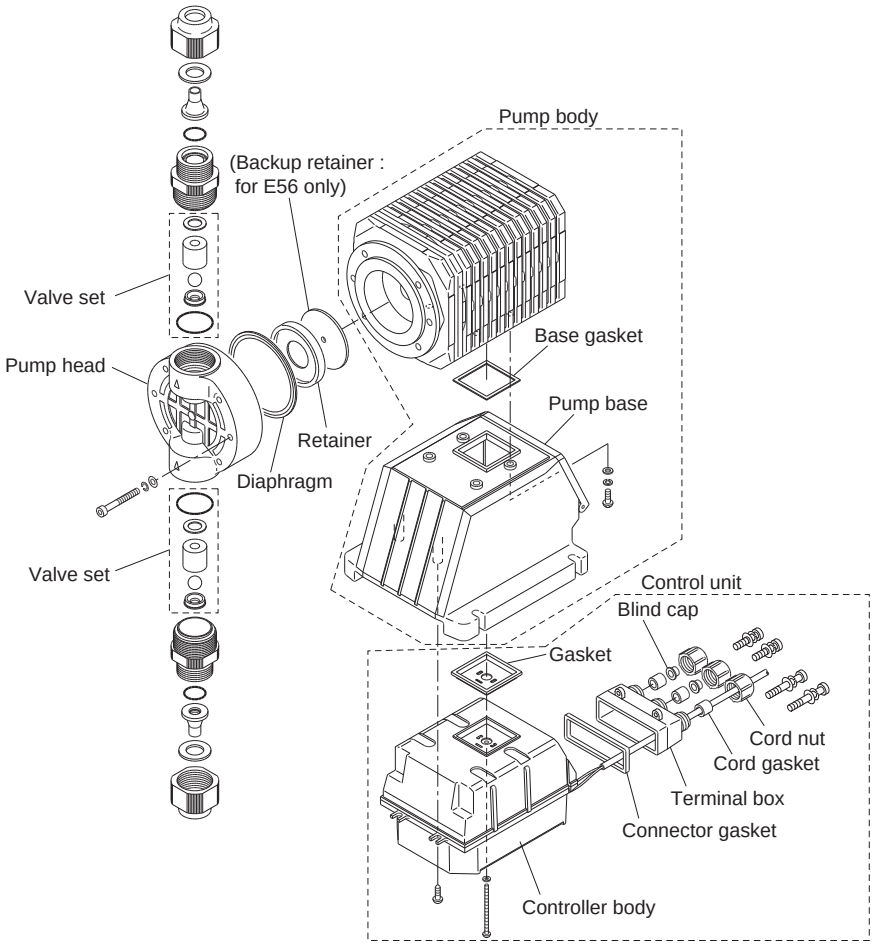
Model	Set pressure MPa	Wet-end material	Applicable pump model	Pump wet-end code
CA-2VC	0.17±0.04	PVC	EH-E31, E36	VC
CA-2VE				V6
CA-2V		GFRPP		PC
CA-2E				
CA-3VH	0.17±0.04	PVC	EH-E46	VC
CA-3VEH				V6
CA-3VH		GFRPP		PC
CA-3VCL	0.05±0.04	PVC	EH-E56	VC VM
CA-3VEL				V6
CA-3VL		GFRPP		PC
CS-1S	0.2±0.03	SUS316	EH-E31, E36	SH
CS-2S	0.2±0.03	SUS316	EH-E46	SH
CS-2SL	0.1±0.02	SUS316	EH-E56	SH
BVC-1TV	0.2±0.02	PVDF	EH-E31, E36	FC
	0.1±0.02		EH-E46, E56	FC

5. Exploded Views and Dimension Drawing

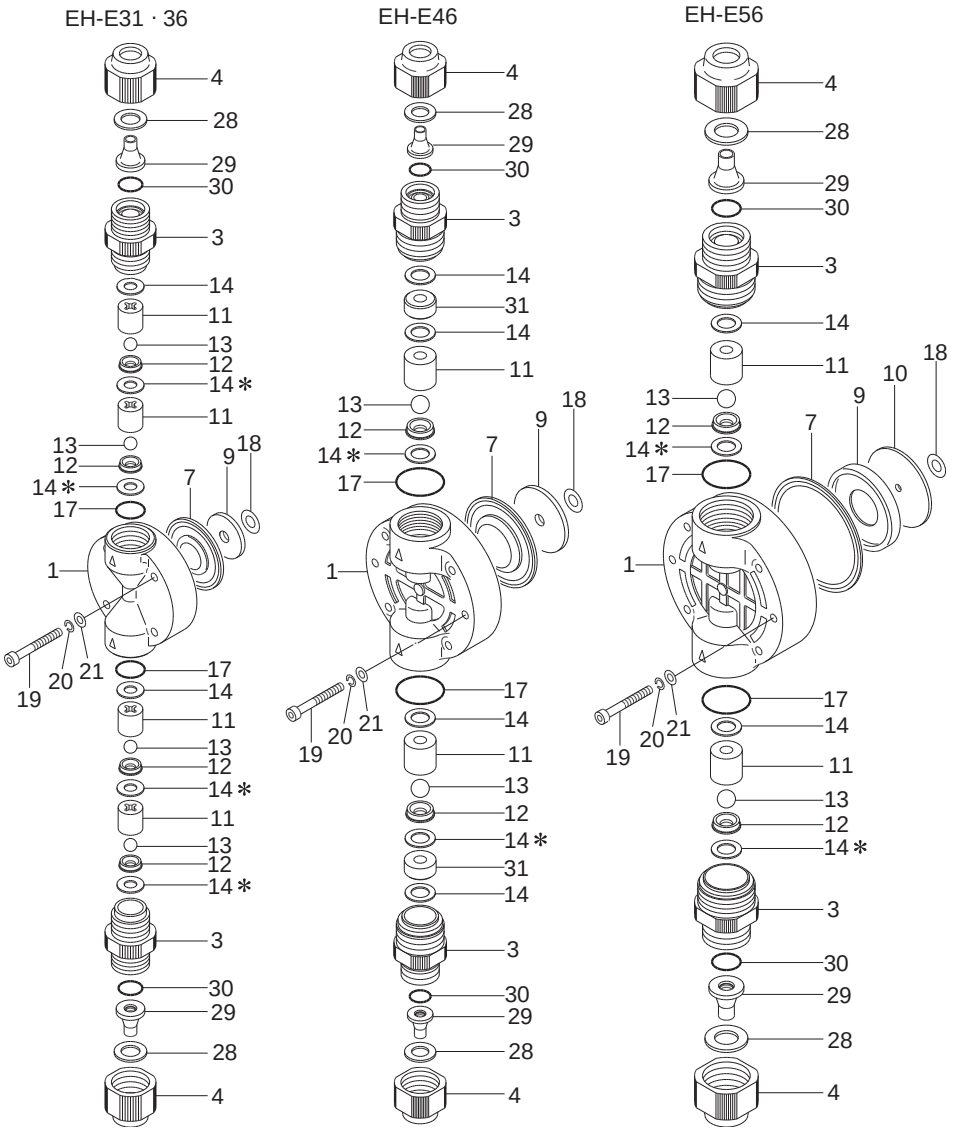
Exploded view of whole pump

The view shows completely exploded components for your easy understanding.

Do not disassemble pump beyond the extent shown in the item “Disassembly and assembly”.



Exploded view of pump head (VC, V6, PC, VM, FC types)



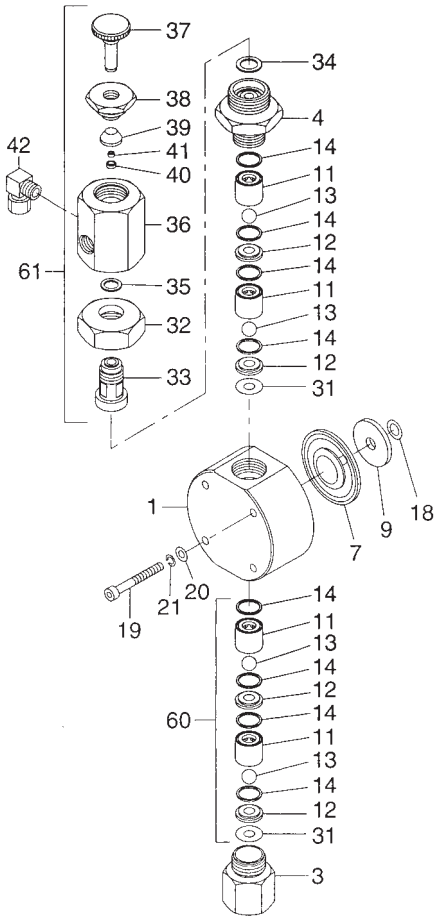
No.	Parts	Q'ty
1	Pump head	1
3	Connecting port	2
4	Fitting nut	2
7	Diaphragm	1
9	Retainer	1
10	Backup retainer	1(NOTE 2)
11	Valve guide	4(NOTE 3)
12	Valve seat	4(NOTE 3)
13	Valve	4(NOTE 3)
14	Valve gasket	NOTE 4

No.	Parts	Q'ty
17	O ring (FC type : Gasket)	2
18	Diaphragm spacer	(NOTE 5)
19	Hex. socket head cap bolt	4(NOTE 6)
20	Spring washer	4(NOTE 6)
21	Plate washer	4(NOTE 6)
28	Hose stopper	2
29	Connecting port spacer	2
30	O ring (FC type : Gasket)	2
31	Spacer	2(NOTE 7)

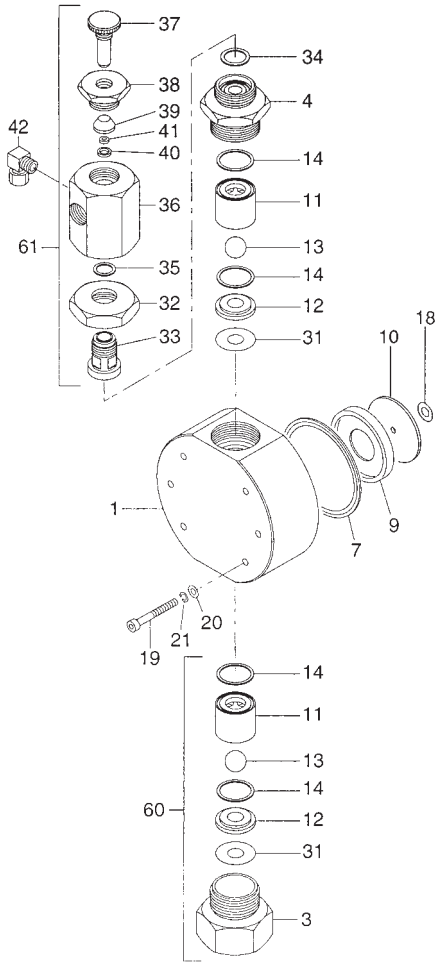
NOTE 1: Valve gasket 14 marked by (*) on above views is used only for FC type.
2: Only for E56.
3: 2 pcs for E46 and E56.
4: 2 pcs for VC,V6, PC, VM types of E31, E36, E56.
4 pcs for VC, V6, PC, VM types of E46 and FC type of E56
6 pcs for FC type of E31, E36, E46
5: Number of diaphragm spacer depends on shipped pump (from zero to several pieces).
6: 6 pcs for E46 and E56
7: Only for E46.

Exploded view of pump head (SH type)

EH-E31 · 36



EH-E46 · 56



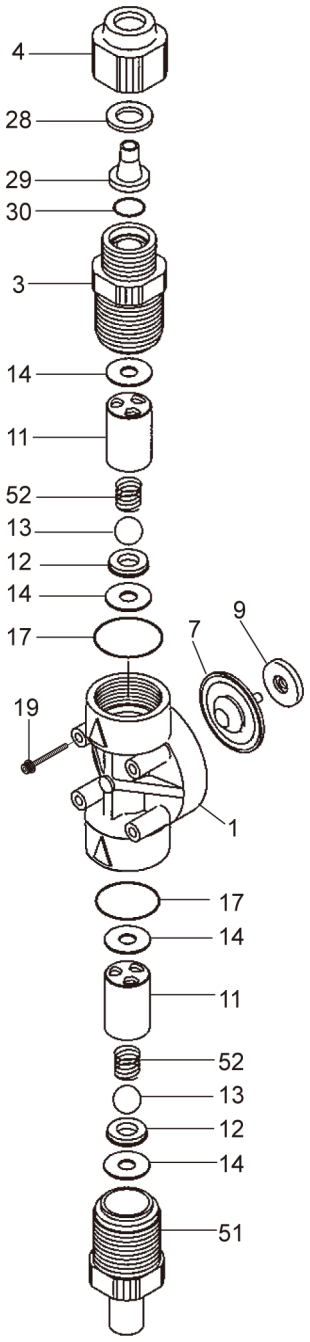
No.	Parts	Q'ty
1	Pump head	1
3	Connecting port IN	1
4	Connecting port OUT	1
7	Diaphragm	1
9	Retainer	1
10	Backup retainer	1(NOTE 1)
11	Valve guide	4(NOTE 2)
12	Valve seat	4(NOTE 2)
13	Valve	4(NOTE 2)
14	Valve gasket	6(NOTE 3)
18	Diaphragm spacer	(NOTE 4)
19	Hex. socket head bolt	4(NOTE 5)
20	Plate washer	4(NOTE 5)

No.	Parts	Q'ty
21	Spring washer	4(NOTE 5)
31	Gasket	2
32	Lock nut	1
33	Joint	1
34	Gasket	1
35	Gasket	1
36	Air vent body	1
37	Air vent adjusting valve	1
38	Seal nut	1
39	Seal gasket	1
40	Seal ring	1
41	Gasket	1
42	Hose joint	1

NOTE 1: Only for E56.
2: 2 pcs for E46, E56
3: 4 pcs for E46, E56
4: Number of diaphragm spacer depends on shipped pump (from zero to several pieces).
5: 6 pcs for E46, E56

Exploded view of pump head (HP6 types)

EH-E36

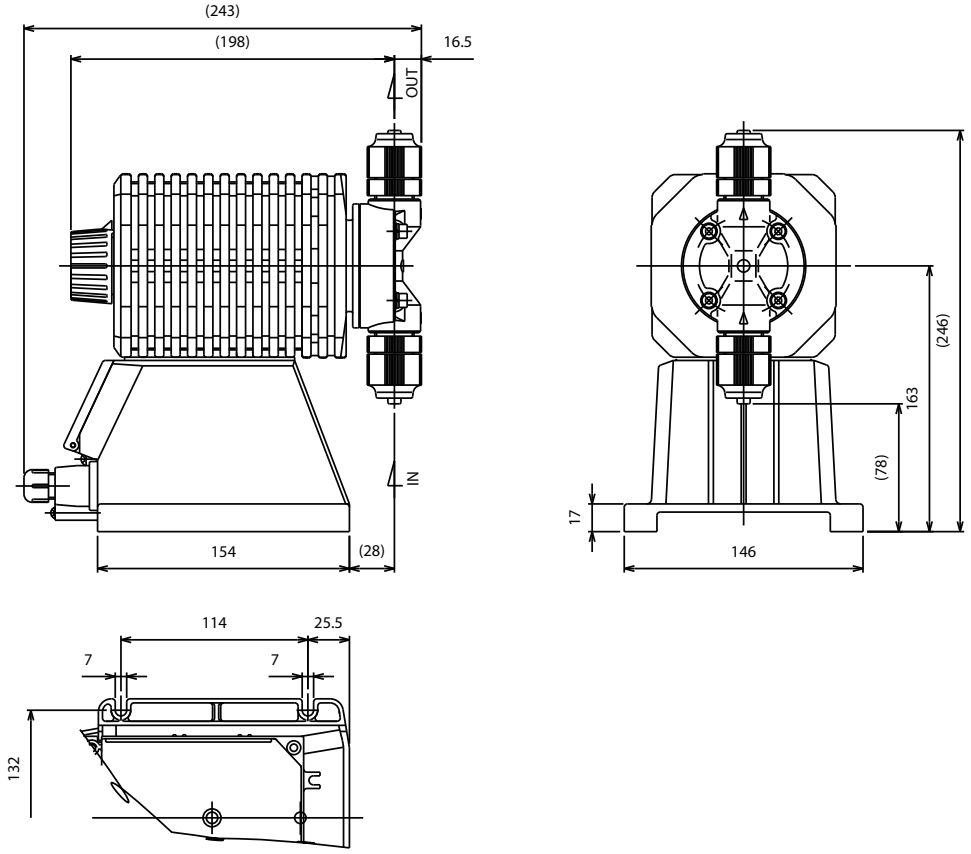


No.	Part names	# of parts
1	Pump head	1
3	Fitting	1
4	Fitting nut	1
7	Diaphragm	1
9	Retainer	1
11	Valve guide	2
12	Valve seat	2
13	Valve	2
14	Valve gasket	4
17	O ring	2
19	Hex. socket head bolt [PW•SW]	4
28	Hose stopper	1
29	Fitting spacer	1
30	O ring	1
51	Inlet	1
52	Valve spring	2

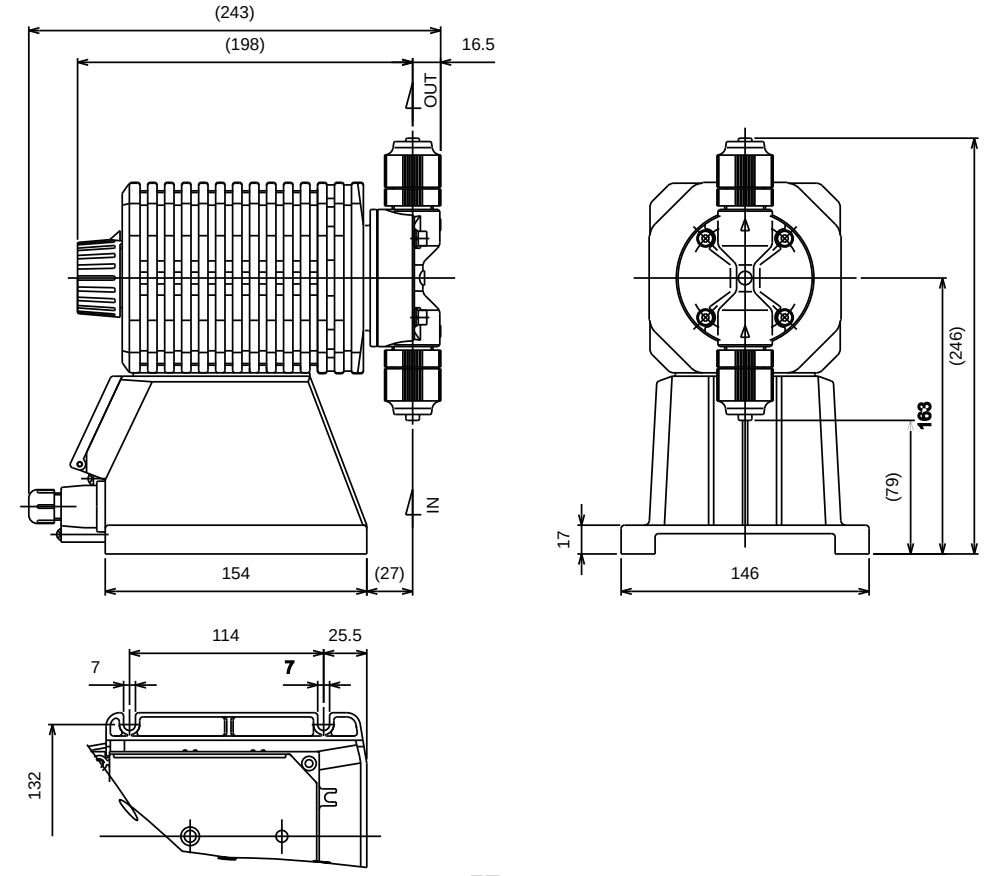
*The number of diaphragm spacers varies with pump model.

■ Outline dimension (VC, V6, PC, VM, FC)

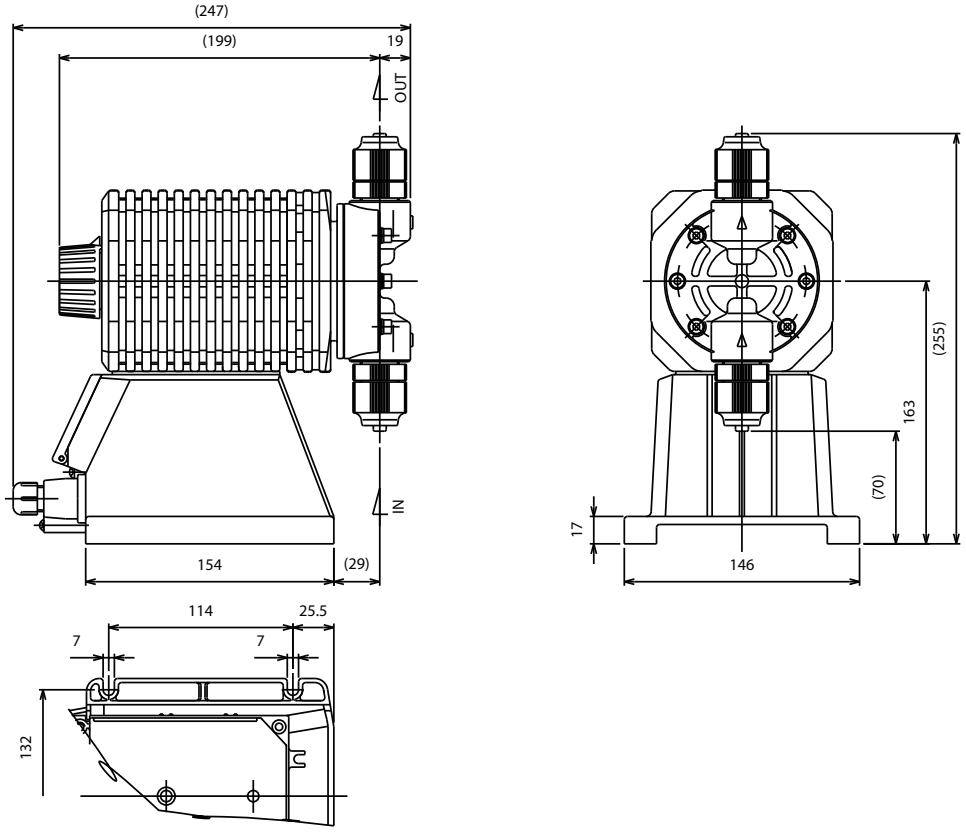
● EH-E31



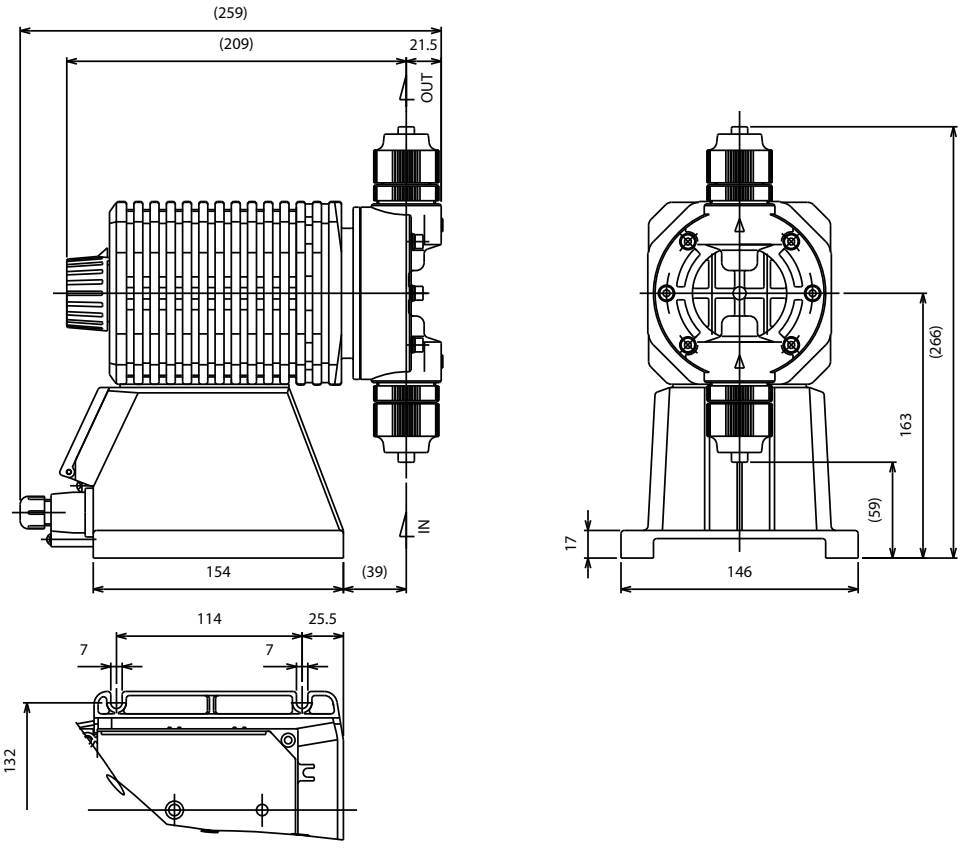
● EH-E36



● EH-E46

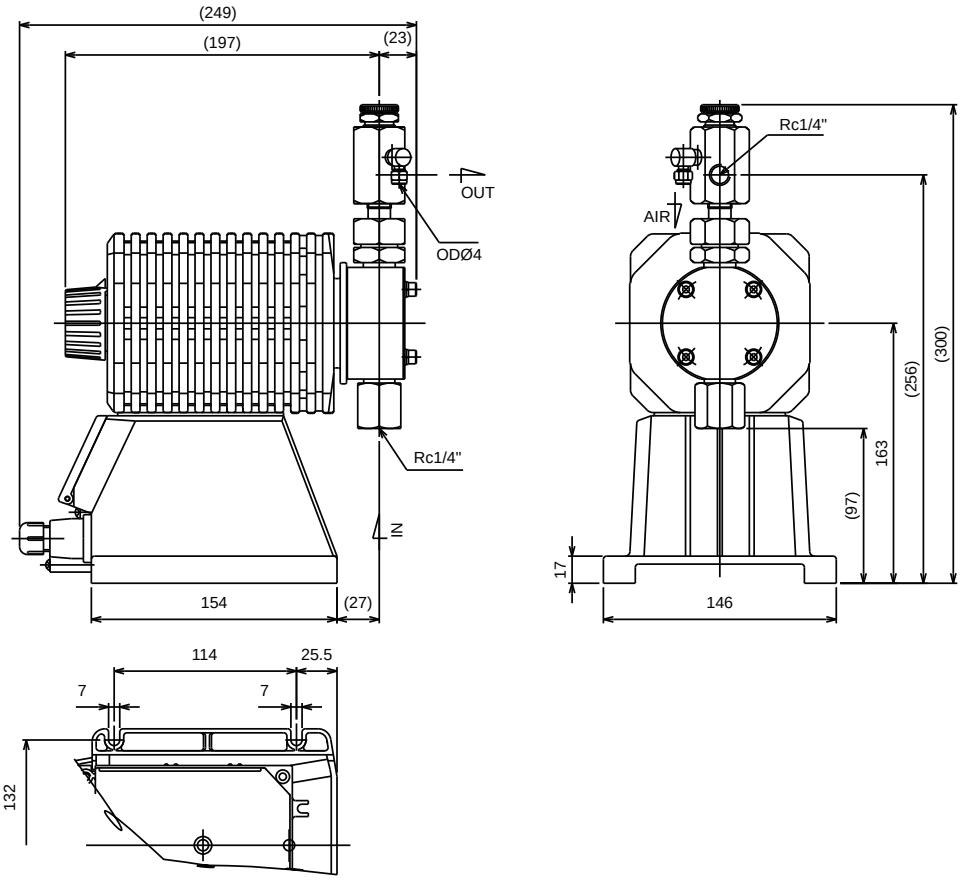

(247)
(199)
19
OUT
IN
154
(29)
114
25.5
7
7
132
(255)
163
(70)
17
146

● EH-E56

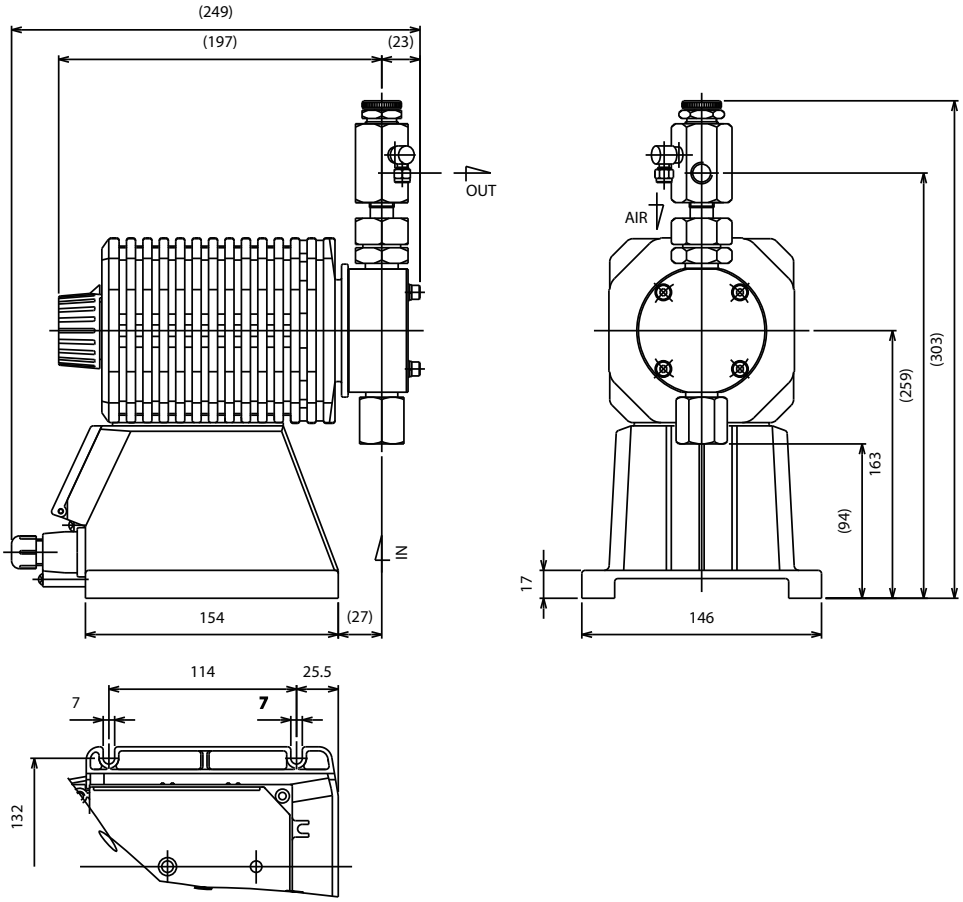

(259)
(209)
21.5
OUT
IN
154
(39)
114
25.5
7
7
132
(266)
163
(59)
17
146

■ Outline dimension (SH)

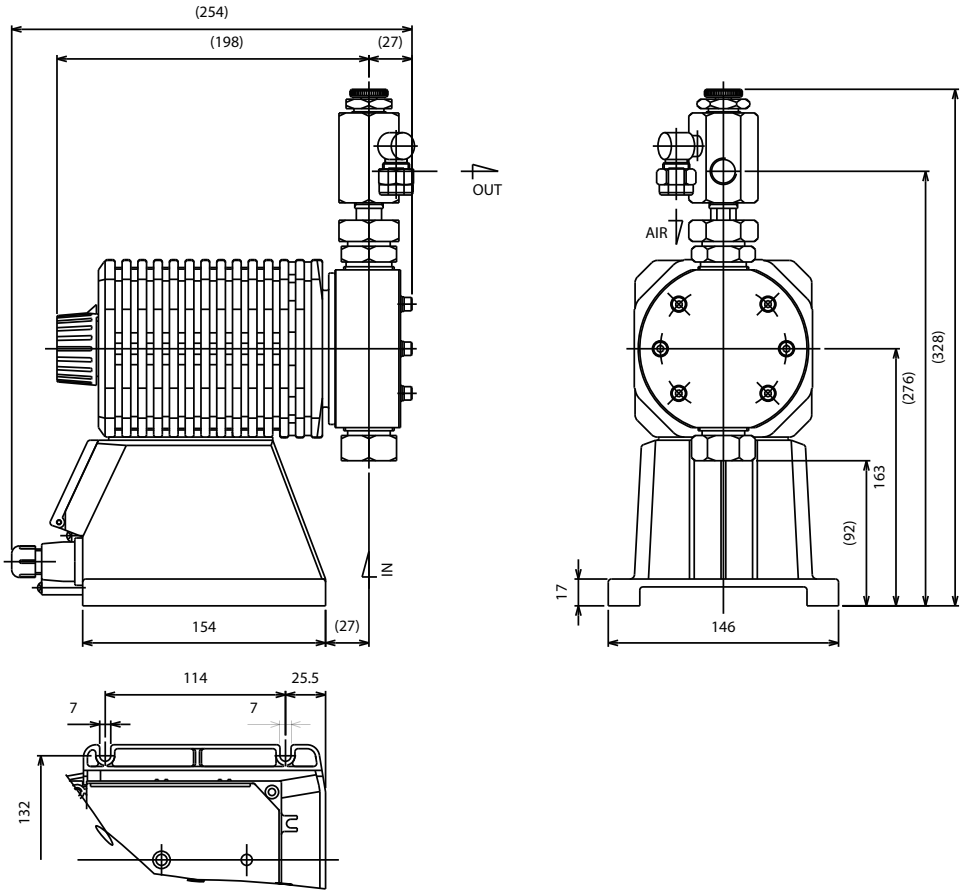
● EH-E31SH



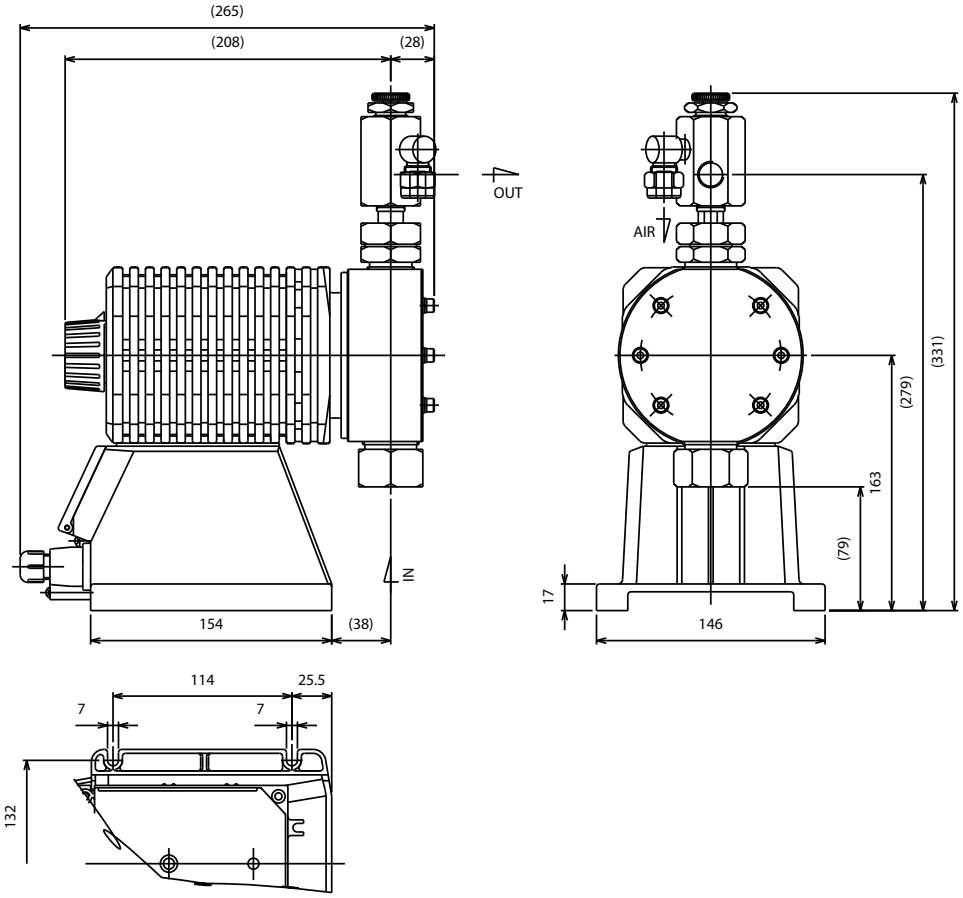
● EH-E36SH



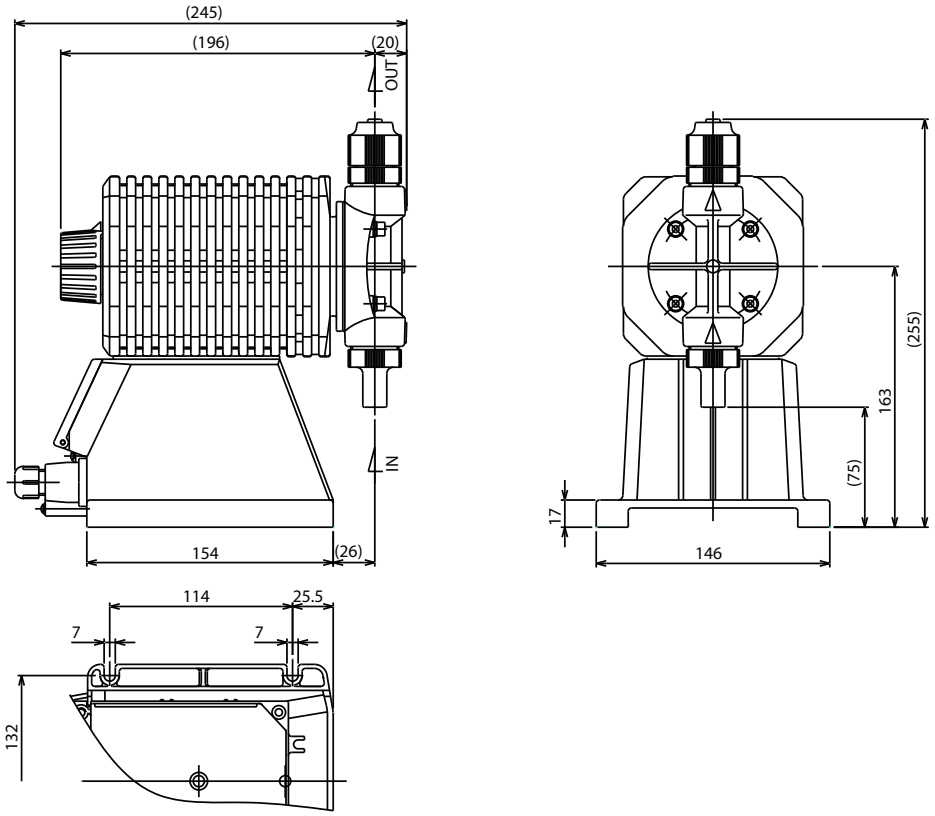
● EH-E46SH

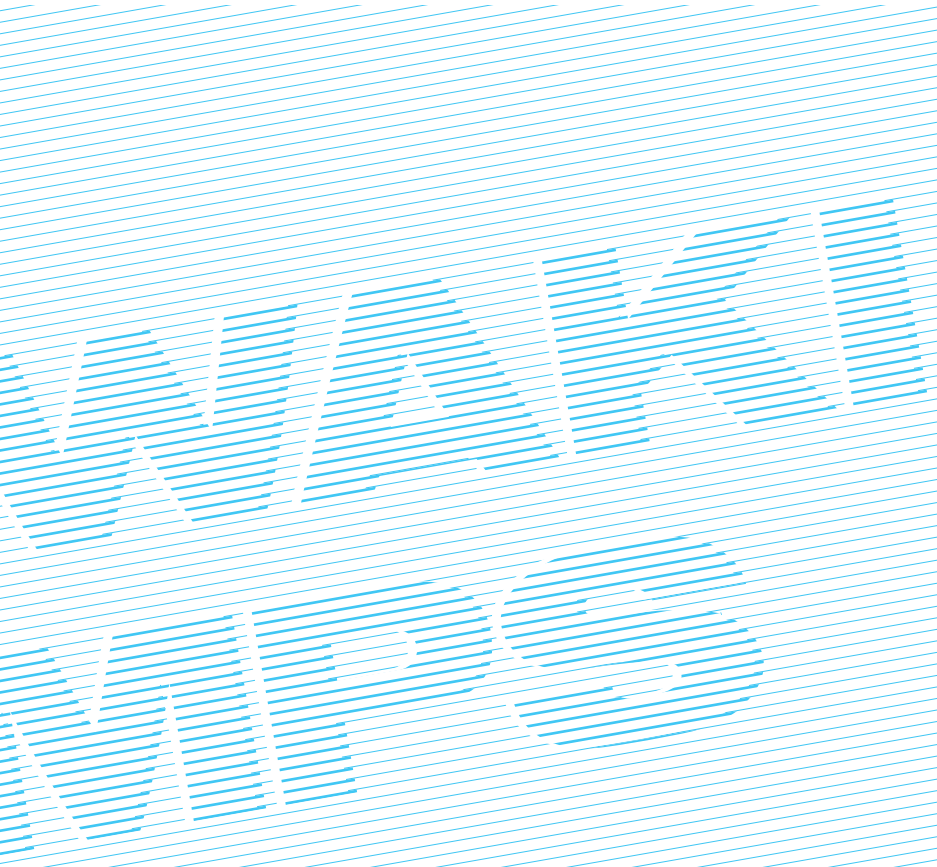


● EH-E56SH



● EH-E36HP6





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