

IWAKI
Electromagnetic Metering Pump
ES-B/C Type (Asia)
Instruction Manual

 Read this manual before use of product

Thank you for selecting the IWAKI's electromagnetic metering pump ES series. This instruction manual deals with "*Safety Instructions*", "*Outline*", "*Installation*", "*Operation*" and "*Maintenance*" sections.

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

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

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 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 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.



Prohibited

- **Do not modify the pump**

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



No Remodeling

- **Wear protective clothing**

Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work.



Wear protective gear

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

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



Prohibited

CAUTION

- **Qualified personnel only**

This product should be handled or operated by qualified personnel with a full understanding. Any person not familiar with the product should not take part in the operation or maintenance of the pump.



Prohibited

- **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

Safety instructions

CAUTION

- **Do not run pump dry**

Do not run pump dry (operation without priming water or with a suction valve closed). Internal parts are excessively worn by friction heat and fatal pump damage results.



Prohibited

- **Keep electric parts and wiring dry**

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



Do not wet or dampen

- **Ventilation**

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



Caution

- **Spill precautions**

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



Caution

- **Do not use a damaged pump**

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



Prohibited

- **Do not damage the power cable**

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



Caution

- **Install a GFCI (earth leakage breaker)**

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



Electrical Shock

- **Damaged power cable**

Do not use any damaged power cable for the prevention of a fire or electrical shock.



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.



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

- Where ambient temperature can exceed 0-40 °C.
- In a flammable atmosphere.



Prohibited

- **Disposal of a used product**

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



Outline

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Outline

1. Safety and Caution Notes

Avoid areas where ambient temperature exceeds 40 °C or falls below 0 °C, or where the pump or tubing would be exposed to direct sunlight.

Disconnect the pump from electrical power source before performing any maintenance.

When working on or around a metering pump, always wear proper protective clothing and equipment as recommended by the supplier of the liquid being pumped.

Depressurize the discharge tubing before disconnecting the tubing or performing any maintenance on the pump.

2. Principle of Operation

The ES series electromagnetic metering pump consists of a pump unit, a driving 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 through 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.

Outline

3. Specifications

Capacity/Pressure Rating

Model	B11	B16	B21	B31	C16	C21	C31	C36
Max. capacity L/H	2.28	3.9	5.7	12.0	4.8	7.8	16.2	24.0
Max. capacity mL/min	38	65	95	200	80	130	270	400
Max. discharge pressure MPa	1.0	0.7	0.4	0.2	1.0	0.7	0.35	0.2
Stroke rate	0 - 353 spm							
Stroke length	1.00 mm (Fixed stroke length)				1.25 mm (Fixed stroke length)			
Power supply	207 - 253VAC, 50Hz single phase							
Average power consumption	16W				22W			
Connection tubing ID×OD	4×9 or 6×8mm		8×13 mm or 9×12mm		4×9 or 6×8mm		8×13 mm or 9×12mm	

- Max. capacity is measured with clean water under the Max. discharge pressure. Actual discharge capacity may increase if the discharge pressure is low.
- Operating conditions
 Ambient temperature: 0 - 40 °C
 Relative humidity : 35 - 90 % non-condensing

Wet End Materials

Wet End Part	VH	VC
Pump head	PVC	
Diaphragm	PTFE (bonded to EPDM)	
Valve ball	Hastelloy C276	Alumina Ceramic
Valve seat	EPDM	FKM
Valve guide	PVC	PVC
Gasket	PTFE	PTFE
O ring	EPDM	FKM

PTFE: Polyterafluoroethylene

EPDM: Ethylene propylene diene monomer

FKM: Fluoroelastmer

Installation

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Installation

1. Unpacking

Open the shipping carton and inspect contents for damage. If any items are missing or damaged, contact your local distributor to arrange for replacement.

2. Location

Choose a location for the pump which is clean, dry, close to an electrical outlet, and allows convenient access to frequency control and tubing connections. Avoid areas where ambient temperature exceeds 40 °C or falls below 0 °C, or where the pump or tubing would be exposed to direct sunlight.

Flooded suction (mounting the pump below the level of liquid in the supply tank) is strongly recommended, especially when pumping liquids that readily generate gas bubbles (See Figure 1). Sodium hypochlorite and hydrogen peroxide are common examples of such liquids.

If flooded suction mounting is not possible, a shelf adjacent to (but not directly above) the supply tank often works well (See Figure 2).

The supply tank or cover can also be used if it provisions for mounting a pump (See Figure 3).

In any cases, the total suction lift should not exceed 1.0m.

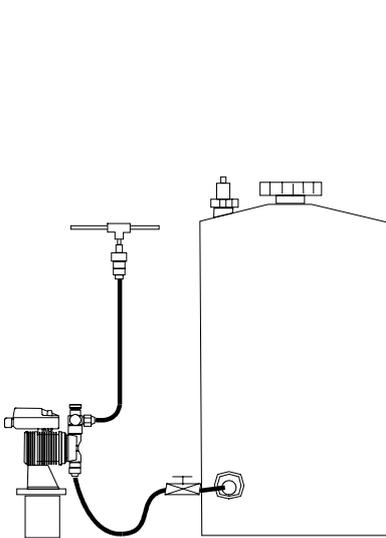


Figure 1
Flooded Suction

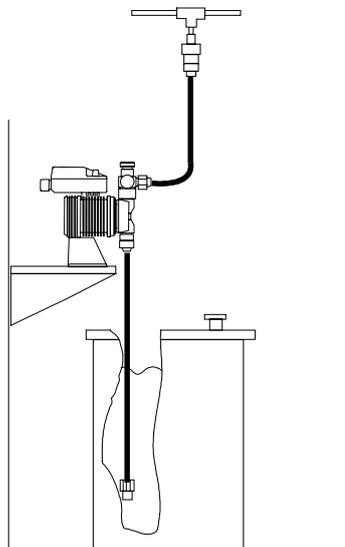


Figure 2
Shelf Mount

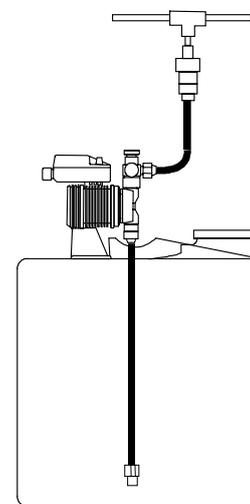


Figure 3
Tank Mount

Installation

3. Supply Tubing

The supply tubing run should be as short as possible. For flooded suction mounting, install a shut-off valve with an appropriate tubing connector at the tank outlet. Cut a length of tubing from the coil supplied and install between the shut-off valve and the pump inlet fitting. For suction lift applications, install a foot valve on one end of suction tubing and cut the tubing to a length such that the foot valve hangs vertically about 25mm above the bottom of the tank. Avoid any loops in the tubing run that could form a vapour trap. Running the tubing through a length of PVC pipe will help to keep tubing straight.

4. Discharge Tubing

The discharge tubing run is less critical and can be any length required to reach the application point. Avoid sharp bends or kinks in the tubing and protect the tubing from sharp edges that could chafe or cut it. Install a check valve (optionally available) at the injection point and connect the discharge tubing to the check valve.

 CAUTION
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Any check valve using Hastelloy or other metal springs in wet end is not usable for chemicals (such as HCL) which corrode the Hastelloy or other metal springs. Ask IWAKI for a special check valve for this application.

5. Electrical

Connect the pump power cord to a GROUNDED outlet supplying proper voltage. Avoid branch circuits that also supply power to heavy machinery or other equipment that could generate electrical interference. Be sure to equip the power cord with a noise filter. The DENSEI-LAMBDA MBS1205-22 is recommended. Refer to manufacturer's instruction for the noise filter before use.

Operation

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Operation

CAUTION

- Do not operate the pump with a completely closed discharge-side valve. Operating the pump with the discharge-side valve fully closed may lead to liquid leakage or pipe rupture. In addition, more than 30 minutes of closed-discharge operation causes abnormal heat in the pump. This can lead to failure such as leakage when the pump head, valve case or so is deformed or the pump head is loosened. Make sure not to operate the pump with the discharge-side valve closed.
- Do not run the pump dry. A pump, which has been run dry, may experience liquid leakage during its liquid feeding operation. Make it a rule to run the pump after supplying liquid inside the pump.
 - * 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 the installation bolts on the pump head are loosened, liquid leakage may result.
 - * Fasten the 4 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 of each.)
 - * Fastening torque: 2.16 N•m (B11/B16/B21/C16/C21)
2.55 N•m (B31/C31/C36)Tighten all the bolts fully by applying an equal amount of torque in a diagonal order among the bolts.

1. Priming

Install the pump as described above. With the pump turned on, set frequency at 100%. If the pump is equipped with an air vent valve, open the knob 1/2 turn. Liquid should move through the suction tubing and into the pump head. When liquid starts running through the vent tubing, close the air vent knob and continue with output adjustment described below. If the pump has no air vent valve, disconnect the discharge tubing from the injection valve. When liquid enters the discharge tubing at the pump head, set frequency to 0% to stop the pump and reconnect the discharge tubing to the injection valve.

2. Adjustment

If less than full output is required, set the frequency to the approximate percentage of maximum desired.

Operation

3. Calibration

If exact output calibration is required, first prime and adjust the pump as above. Then connect a calibration column to the suction side of the pump. Turn the pump on for one minute and read the amount of liquid pumped from the column. Adjust the frequency up or down as necessary and check the output again. When the desired output is reached, disconnect the calibration column and reconnect the suction tubing (See Figure 4).

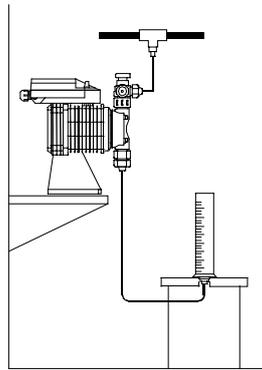


Figure 4
Calibration

Maintenance

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Maintenance

⚠ CAUTION

- Before working on the pump, disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid for the pump head and valves.

1. Diaphragm Replacement

Remove the power cord from the electrical outlet and disconnect the suction tubing, discharge tubing, and air vent tubing. Remove the four head bolts with a 4mm or 5mm hex wrench. Unscrew the diaphragm and remove its retainer (small disk behind the diaphragm). Install the new retainer and diaphragm on the shaft. Turn the diaphragm clockwise until it bottoms on the shaft. Replace the pump head and tighten the head bolts to a torque of 2.16/2.55 N•m.

2.16 N•m (B11/B16/B21/C16/C21)

2.55 N•m (B31/C31/C36)

2. Valve Replacement

Remove the suction and discharge tubing. Remove the suction fitting, the valve ass'y (consists of 2 × valve ball, 2 × valve seat, 2 × valve guide, 1 × gasket & 1 × O ring). Install the new valve ass'y. Be sure both valve seats are in the same orientation. Refer to Figure 5, below. Tighten the suction fitting. Similarly remove and replace the discharge valve ass'y.

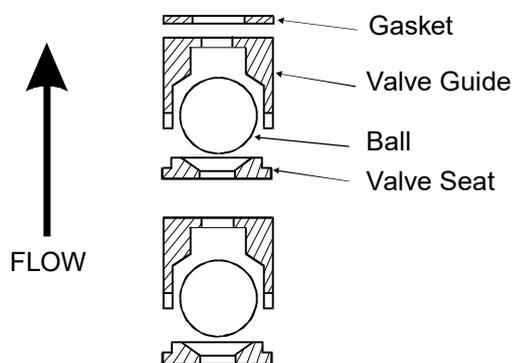


Figure 5

Valve Ass'y Orientation

3. Tubing

Check ends of tubing for splits, cracks or thin spots. Examine the full length of tubing for damage due to chafing, abrasion, stress cracks, excessive temperature or exposure to ultraviolet light (direct sunlight or mercury vapour lamps). If any signs of deterioration exist, replace the entire length of tubing. It is a good idea to replace discharge tubing on a regular preventive schedule every 12 months.

Maintenance

4. Troubleshooting

 **CAUTION**

- Before working on the pump disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid from the pump head and valves.

Problem	Possible Cause	Corrective Action
Pump does not start	<ul style="list-style-type: none"> - Faulty wiring - Improper voltage - Electronic control unit is damaged. 	<ul style="list-style-type: none"> - Correct wiring - Connect to proper voltage source - Replace control unit
Pump does not prime	<ul style="list-style-type: none"> - Air in suction tubing - Valve gasket is not installed - Valve ass'y direction is wrong - Pump is air locked - Suction or discharge valve is clogged with foreign matter - Adhesion of valve onto valve seat 	<ul style="list-style-type: none"> - Reroute suction tubing to eliminate air trap - Install valve gasket - Reassemble valve ass'y - Open air vent valve - Disassemble, inspect, clean - Disassemble, inspect, clean
Output fluctuates	<ul style="list-style-type: none"> - Suction or discharge valve is clogged with foreign matter - Air is trapped in pump - Overfeeding - Diaphragm is damaged 	<ul style="list-style-type: none"> - Disassemble, inspect, clean - Open air vent valve - Install injection valve or back pressure valve - Replace diaphragm
Liquid leaks	<ul style="list-style-type: none"> - Fitting or coupling nut is loose - Pump head is loose - Diaphragm is damaged - O ring or valve gasket missing 	<ul style="list-style-type: none"> - Tighten it - Tighten pump head bolts - Torque: 2.16 N•m (B11/B16/B21/C16/C21) 2.55 N•m (B31/C31/C36) - Replace diaphragm - Instal O ring or valve gasket

- !** Check if the pump head mounting bolts are not loosened every 3 months. Tighten them diagonally on the following tightening torques as necessary. The mounting bolts may loosen during operation (An extent of looseness depends on operating condition.).

Tightening torque of the pump head mounting screw

Model	Torque	Parts name
ES-B11/-B16/-B21	2.16 N•m	M4 hex. socket head bolts
ES-B31	2.55 N•m	M4 hex. socket head bolts
ES-C16/-C21	2.16 N•m	M4 hex. socket head bolts
ES-C31	2.55 N•m	M4 hex. socket head bolts
ES-C36	2.55 N•m	M5 hex. socket head bolts

Maintenance

5. Model Code

ES-B 16 VC-230 N 3
a b c d e f g

a. Series name

ES: With manual stroke speed control (without stroke length adjustment)

b. Drive unit (Average power consumption)

B: 16W C: 22W

c. Diaphragm effective diameter

11: 10 mm 16: 15 mm 21: 20 mm 31: 30 mm 36: 35 mm

d. Wet end materials

See the table of Wet End Materials presented page 6.

VH: Hastelloy ball valves

VC: Ceramic ball valves

e. Power-supply voltage

230: 207-253 VAC

f. Control unit type

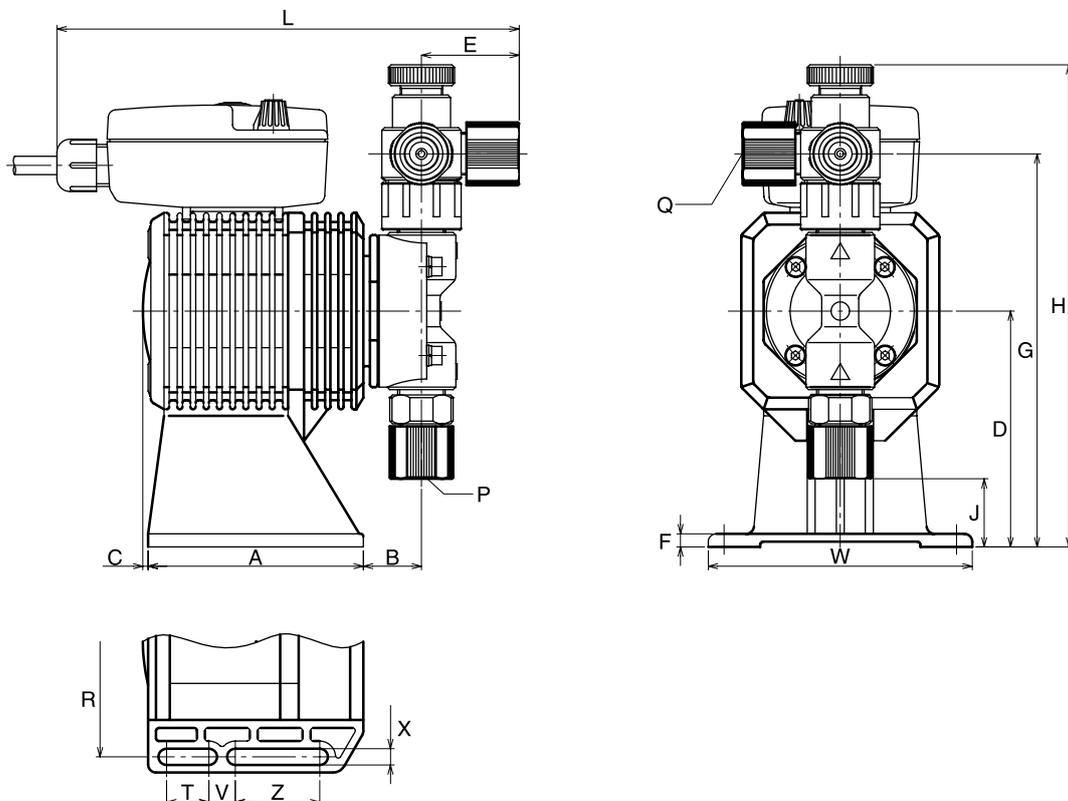
N: Manual stroke speed control

g. Connection Tubing inside diameter (ID) × Outside diameter (OD)

1: $\varnothing 4 \times \varnothing 9$ mm 3: $\varnothing 6 \times \varnothing 8$ mm	ES-B11/-B16/-B21/-C16/-C21
4: $\varnothing 8 \times \varnothing 13$ mm 5: $\varnothing 9 \times \varnothing 12$ mm	ES-B31/-C31/-C36

Maintenance

6. Dimensions (ES-B type)



Dimensions in mm

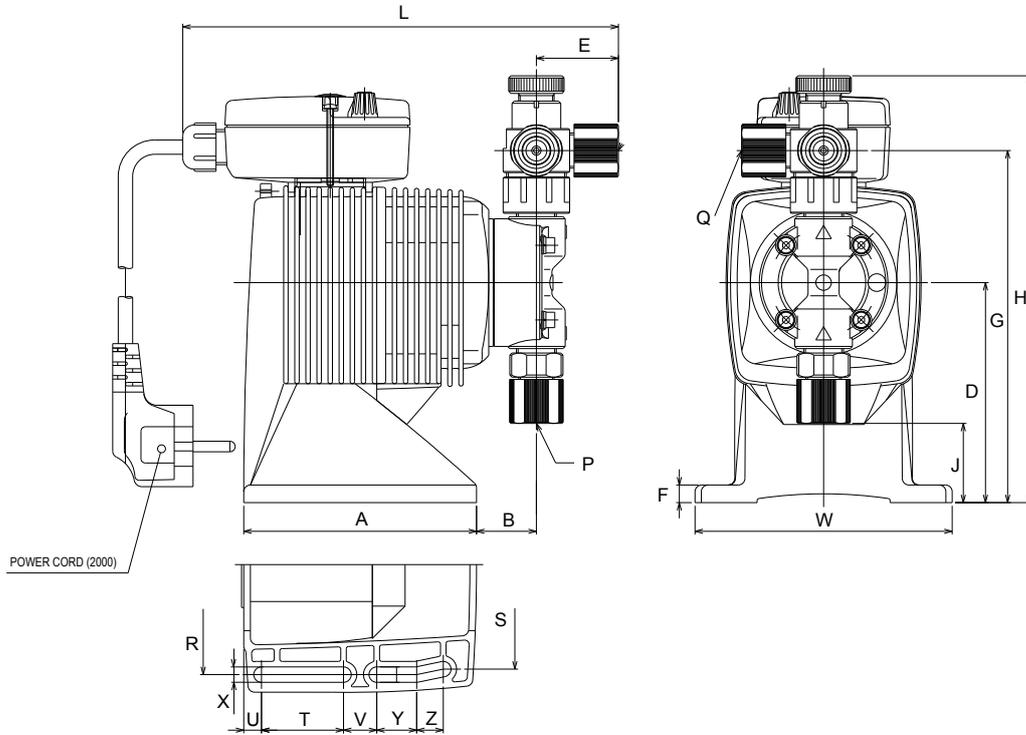
Model	A	B	C	D	E	F	G	H	J	L	P&Q Tubing	W
ES-B11											ø4×ø9	
ES-B16	81.5	22	2	90	37	5	150	184	28	175	or	100
ES-B21											ø6×ø8	
ES-B31	81.5	26	2	90	16	5	-	172	8	158	ø8×ø13 or ø9×ø12	100

Mounting hole Dimensions in mm

Model	R	T	V	Z	X
ES all variations	88	16	10	32	6.2

Maintenance

(ES-C type)



Dimensions in mm

Model	A	B	D	E	F	G	H	J	L	P&Q Tubing	W
ES-C16 ES-C21	105	27	100	37	8	160	194	36	196.5	Ø4×Ø9 or Ø6×Ø8	116
ES-C31	105	29	100	16	8	182	186.5	18	177.5	Ø8×Ø13	116
ES-C36	105	28.5	100	16	8	181.5	186.5	18.5	177	or Ø9×Ø12	116

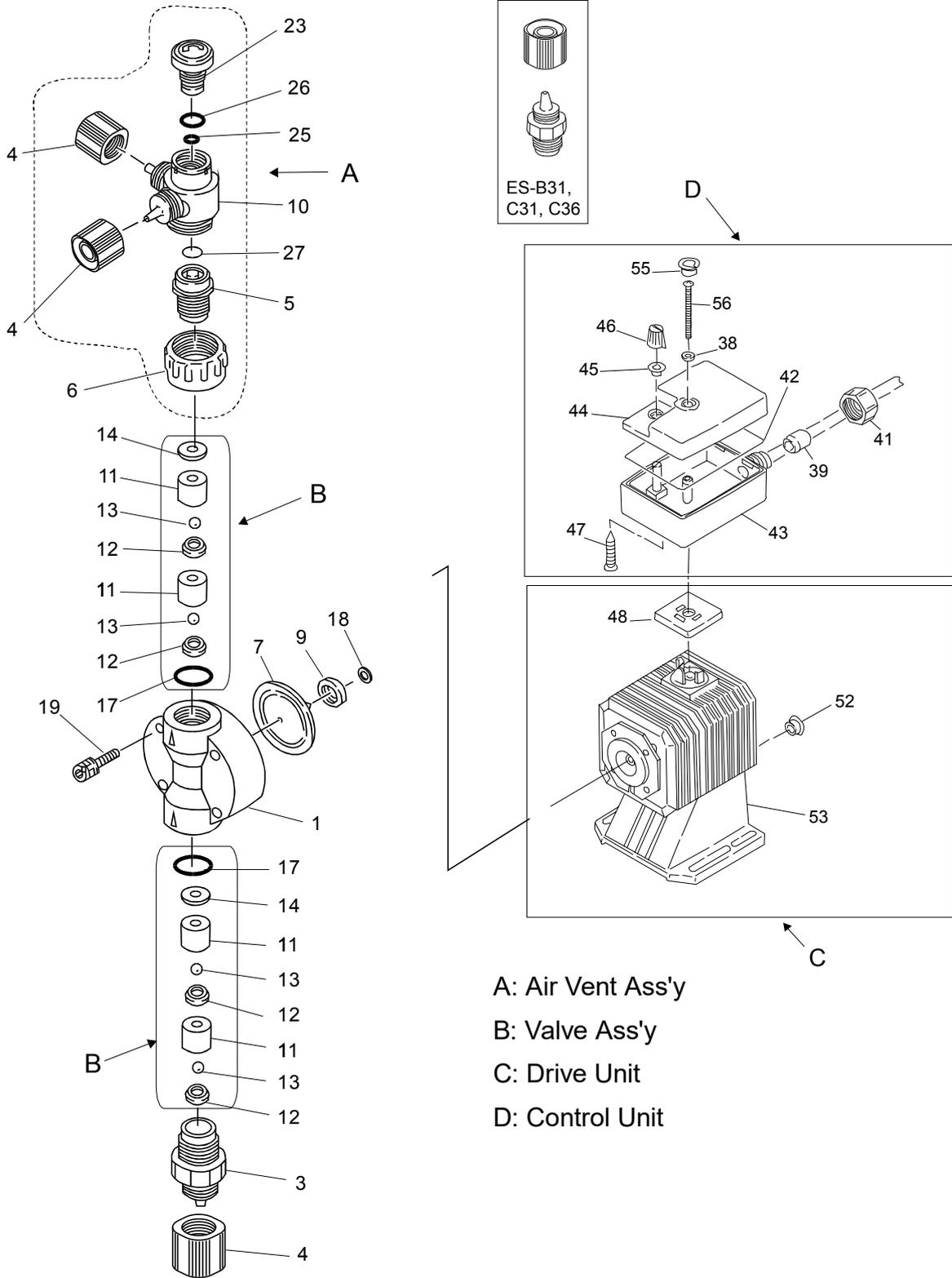
Mounting hole Dimensions in mm

Model	R	X	U	T	V	Y	Z	S
ES all variations	100	7	8	37	15	18	12	95

Maintenance

7. Exploded View

Models with thermoplastic wet end materials and air vent valve



- A: Air Vent Ass'y
- B: Valve Ass'y
- C: Drive Unit
- D: Control Unit

Notice: Actual fitting nut (4) may differ from illustrated ones.

Maintenance

8. Parts List (ES-B type)

Item	Description	Material	Q'ty per Item			
			B11	B16	B21	B31
1	Head, 11	PVC	1			
	Head, 16			1		
	Head, 21				1	
	Head, 31					1
3	Fitting, $\phi 4 \times \phi 9$	PVC	1			
	Fitting, $\phi 6 \times \phi 8$					
	Fitting, $\phi 8 \times \phi 13$ Fitting, $\phi 9 \times \phi 12$					2
4	Fitting nut, $\phi 4 \times \phi 9$	PVC	3			
	Fitting nut, $\phi 6 \times \phi 8$					
	Fitting nut, $\phi 8 \times \phi 13$ Fitting nut, $\phi 9 \times \phi 12$					2
5	Air vent body B	PVC	1			
6	Lock nut	PVC	1			
7	Diaphragm, 11	PTFE+EPDM	1			
	Diaphragm, 16			1		
	Diaphragm, 21				1	
	Diaphragm, 31					1
9	Retainer, 11	PPS	1			
	Retainer, 16			1		
	Retainer, 21				1	
	Retainer, 31					1
10	Air vent body A	PVC	1			
11	Valve guide	PVC	4			
12	Valve seat	VH/VC EPDM/FKM	4			
13	Valve ball	VH/VC HC/CE	4			
14	Gasket	VH/VC PTFE	2			
17	O-ring, S14	VH/VC EPDM/FKM	2			
18	Spacer: 0.2, 0.3, 0.5, 0.7 mm	Brass	1			
19	Bolt, M4×40	SUS316 equivalent	4			
23	Adjusting Screw	PVC	1			
25	O-ring, P4	FKM-A	1			
26	O-ring, P10A	FKM-A	1			
27	O-ring, P7	FKM-A	1			
38	Gasket	EPDM	1			
39	Cord Gasket E $\phi 6$ mm	NBR	1			
41	Cord Nut	POM	1			
42	Case Gasket	NBR	1			
43	Control unit case	PPE	1			
44	Control unit cover	PPE	1			
45	SF Gasket	EPDM	1			
46	SF Knob	PE	1			
47	Screw M4×25	SUS304 equivalent	1			
48	Terminal Gasket	NBR	1			
53	Pump body	PPG	1			
52	Plug		1			
55	Cap Gasket	EPDM	1			
56	Screw, M3×35	SUS304 equivalent	1			

Maintenance

(ES-C type)

Item	Description	Material	Q'ty per Item			
			C16	C21	C31	C36
1	Head, 16	PVC	1			
	Head, 21			1		
	Head, 31				1	
	Head, 36					1
3	Fitting, $\phi 4 \times \phi 9$	PVC	1			2
	Fitting, $\phi 6 \times \phi 8$					
	Fitting, $\phi 8 \times \phi 13$ Fitting, $\phi 9 \times \phi 12$					
4	Fitting nut, $\phi 4 \times \phi 9$	PVC	3			2
	Fitting nut, $\phi 6 \times \phi 8$					
	Fitting nut, $\phi 8 \times \phi 13$ Fitting nut, $\phi 9 \times \phi 12$					
5	Air vent body B	PVC	1			
6	Lock nut	PVC	1			
7	Diaphragm, 16	PTFE+EPDM	1			
	Diaphragm, 21			1		
	Diaphragm, 31				1	
	Diaphragm, 36					1
9	Retainer, 16	PPS	1			
	Retainer, 21			1		
	Retainer, 31				1	
	Retainer, 36					1
10	Air vent body A	PVC	1			
11	Valve guide	PVC	4			
12	Valve seat	VH/VC EPDM/FKM	4			
13	Valve ball	VH/VC HC/CE	4			
14	Gasket	VH/VC PTFE	2			
17	O-ring, S14	VH/VC EPDM/FKM	2			
	O-ring, P16				2	
18	Spacer: 0.2, 0.3, 0.5, 0.7 mm	Brass	1			
19	Bolt, M4×35	SUS316 equivalent	4			
	Bolt, M5×35				4	
23	Adjusting Screw	PVC	1			
25	O-ring, P4	FKM-A	1			
26	O-ring, P10A	FKM-A	1			
27	O-ring, P7	FKM-A	1			
38	Gasket	EPDM	1			
39	Cord Gasket E $\phi 6$ mm	NBR	1			
41	Cord Nut	POM	1			
42	Case Gasket	NBR	1			
43	Control unit case	PPE	1			
44	Control unit cover	PPE	1			
45	SF Gasket	EPDM	1			
46	SF Knob	PE	1			
47	Screw M4×25	SUS304 equivalent	1			
48	Terminal Gasket	NBR	1			
53	Pump body	PPG	1			
52	Plug		1			
55	Cap Gasket	EPDM	1			
56	Screw, M3×35	SUS304 equivalent	1			



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