

IWAKI L series Metering Pump

Electrical servo unit

Instruction Manual

 Read this manual before use of product

Thank you for selecting an Iwaki Electrical Servo Unit for the L series (LK, LG, LK-A, -B and -C) metering pump. This instruction manual deals with "*Safety Instructions*", "*Outline*", "*Installation*", "*Operation*" and "*Maintenance*" sections.

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

Contents

Important instruction	1
Safety instructions	2
<i>Outline</i>	
1. Unpacking & Inspection	6
2. Principle of Operation	6
3. Specifications	8
4. Part names	9
<i>Installation</i>	
1. Wiring	13
<i>Operation</i>	
1. Operation	15
<i>Maintenance</i>	
1. Adjustment	18
2. Troubleshooting	20
3. Wear parts	20



This instruction manual should be kept on hand by the end user for quick reference.

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

Important instruction

For the Safe and Correct Handling of the Product

- "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 product.

For exportation

Technology related to the use of goods in this instruction manual falls in the category of technology contained in the Foreign Exchange Order Attachment, which includes complementary export control of technology. Please be reminded that export license, which is issued by the Ministry of Economy, Trade, and Industry could be required, when this is exported or provided to someone even in Japan.

Safety instructions

«For the prevention of damage, electrical shock and fire»

WARNING

- **Turn off the power supply**

Risk of electrical shock. Be sure to turn power supply off to stop the pump, electrical servo unit and related devices before engaging in any work. Workers should be careful to prevent power source from turning on unintentionally during the work.



Turn off power

- **Wear protective clothing**

Always wear protective clothing such as safety goggles and protective gloves during inspection and repair.



Wear protective gear

CAUTION

- **Ventilation**

Poisoning may result when handling a toxic or odorous liquid. Keep good ventilation in your operating site.



Caution

- **Fire ban**

Check for oil leakage and wipe it off. Repair as necessary.



Fire ban

- **Do not touch the pump and piping**

The surface temperature of the pump and piping becomes high during the operation with high liquid temperature.



Caution

- **Pay attention to rotating parts**

Be careful not to be caught in rotating parts such as the coupling and shaft. The rotating parts can catch the finger, hand, or hair and can cause serious injury. Also, do not place waste clothes near rotating parts.



Caution

- **Do not remove the Cover**

Never remove the Cover during operation. Touching the shaft when it is rotating, serious injury may result.



Prohibition

- **Damaged electrical servo**

Risk of electrical shock. Do not use a damaged electrical servo.



Prohibition

Safety instructions

《Carriage & Installation》

WARNING

- **Use strong ropes (chains) for lifting up the pump**

Serious injury may result if lifting ropes (chains) break. Check lifting ropes (chains) are strong enough before use.



- **Use eye bolts**

Use eye bolts to lift the pump. Otherwise the pump may break or fall down, resulting serious injury.



- **Keep away from the pump when it is lifted.**

The pump may fall down accidentally. Do not stay under the lifted pump.



Prohibition

《Piping & Wiring》

WARNING

- **Arrange earthing**

Risk of electrical shock. Do not operate the pump unit without connecting the earthing wire.



Grounding

- **Specified power only**

Do not apply any power than the specified one on the nameplate. Otherwise damage or fire may result.



Prohibition

- **Install an earth leakage breaker**

Risk of electrical shock. Do not use the pump without a leakage breaker. Install a leakage breaker to reduce the risk of electrical shock.



Electrical shock

- **Limited operating site and storage**

Do not install or store the pump in the following places where...

1. Ambient temperature is beyond 0-40 degrees Celsius.
2. Under a flammable/explosive atmosphere or in a dusty/humid place.
3. Under vibration or wind & rain.



Prohibition

Safety instructions

«Operation»

WARNING

- **Qualified operator only**

This product must be operated/controlled by a qualified operator(s) with a full understanding of the electrical servo.



- **Do not modify the electrical servo**

Risk of electrical shock. We are not responsible for any accidents or damage due to modification.



- **For specified application only**

The use of the electrical servo in any application other than those clearly specified may result in injury or damage. Use this product in a specified condition.



- **Do not step on the electrical servo**

Do not use the electrical servo in place of a footstool. You may fall down and may be injured.



- **Pay attention to reciprocating motion (Plunger or direct driven diaphragm type)**

The piston is reciprocating in the pump bracket. Do not enter the finger or other stuff in the bracket. Otherwise it may cause serious injury.



CAUTION

- **Do not cover the servo unit with cloth**

The heat that stays in the servo unit can cause fire or failure. Keep good ventilation.



- **Rotating parts**

Do not touch any rotating parts such as the stroke length dial and control shaft during operation. Otherwise, personal injury may result.



- **Servo unit disposal**

Any used or damaged servo unit must be disposed of in accordance with local laws and regulations. Consult a licensed industrial waste products disposing company.



- **Keep labels clean**

Always keep nameplate & labels clear for identification. If they are unglued or not legible, contact us for replacement.

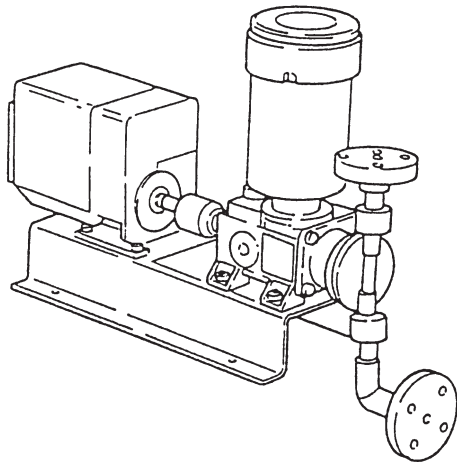


Outline

<i>1. Unpacking & Inspection</i>	<i>6</i>
<i>2. Principle of Operation</i>	<i>6</i>
<i>3. Specifications</i>	<i>8</i>
<i>4. Part names</i>	<i>9</i>

Outline

1. Unpacking & Inspection



After unpacking the pump, check the following points to see if the product conforms to your order. If you find any problems, contact us or your nearest dealer.

1. Does the information such as model on the name-plate correspond to your order?
2. Is there no transit damage or no loose bolt/nut?

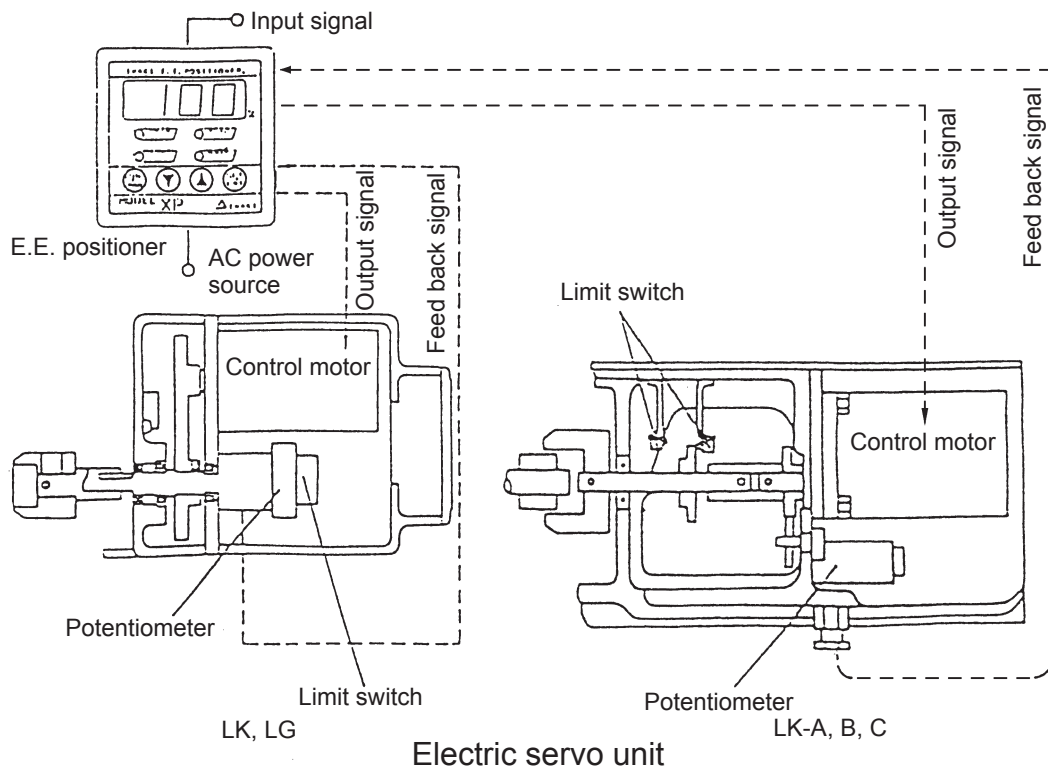
NOTE: The E.E. positioner is packed separately from the pump. Check the package for a corresponding pump mfg number.

2. Principle of Operation

The electrical servo unit is a stroke length adjustment mechanism with a potentiometer and a control motor and controls a discharge capacity by means of the signal from the PID controller or proportional setter.

The E.E. positioner receives the input signal from the controller or setter and the feed back signal (of pump stroke length) from the potentiometer, and consequently adjusts the stroke length via a control motor according to the input signal.

The potentiometer detects the stroke length and feed it back to the E.E. positioner. When the stroke length come to a point designated by the input signal, the feed back control routine is completed and the control motor stops.



Outline

■ Compositions of an electrical servo unit

The electrical servo unit is composed of a potentiometer which changes the stroke length into the electrical signal, a control motor which adjusts the stroke length and a limit switch which protects the mechanism.

Potentiometer

The potentiometer changes the stroke length into the electrical signal in order to feed it back to the E.E. positioner and to indicate the stroke length on the screen.

Control motor

A control motor rotates according to the signal from the E.E. positioner to change the stroke length.

CAUTION
Do not continuously operate the pump when "hunting" happens. Otherwise pump failure may result. Adjust the sensitivity of the E.E. positioner for the prevention of "Hunting".

Limit switch

A limit switch is to set the upper and lower limits of the pump stroke length for protecting the control motor. The limit switch operates to prevent the control motor from burning or the drive unit from breaking down when the E.E. positioner receives the incorrect signal other than the intended one.

Outline

3. Specifications

■ Electrical servo unit

	Pump model				
	LK, LK-F				LG
	11, 21, 22	31, 32	45, 47	55, 57	05, 11, 20, 40
Control motor output	15W				
Rated current of the control motor	0.42A/0.45A (100V, 50/60Hz), 0.25A (220V, 50Hz), 0.25A (220V, 60Hz), 0.2A (240V, 50Hz)				
Capacitance of a capacitor	6 microF (100V, 50/60Hz), 1.2 microF (220V, 50Hz), 1.2 microF (220V, 60Hz), 1.2 microF (240V, 50Hz)				
Feedback resistance*1	50 - 950Ω				
Start-up time (50Hz)*2	7 sec.		17 sec.		33 sec.
Allowable ambient temperature	-10 - 50°C				
Setting precision*3	±2% FS				

	Pump model								
	LK-A 55, 57	LK-A 65	LK-B 54	LK-B 65	LK-B 75	LK-C 76	LK-C 86	LK-C 87	
Control motor output	40W								
Rated current of the control motor	0.78A/1.10A (100V, 50/60Hz), 0.42A (220V, 50Hz), 0.46A (220V, 60Hz), 0.35A (240V, 50Hz)								
Capacitance of a capacitor	18 microF (100V, 50/60Hz), 5 microF (220V, 50Hz), 4 microF (220V, 60Hz), 2.7 microF (240V, 50Hz)								
Feedback resistance*1	100-900Ω		150-950Ω	100-900Ω					
Start-up time (50Hz)*2	50 sec.		40 sec.	50 sec.					
Allowable ambient temperature	-10 - 50°C								
Setting precision*3	±2% FS								

*1. The figure shows the resistance between PM2 and PM3 when the stroke length is changed from 0 to 100%. Take it as a guide. Feedback resistance may vary (±50 Ω) depending on an individual model.

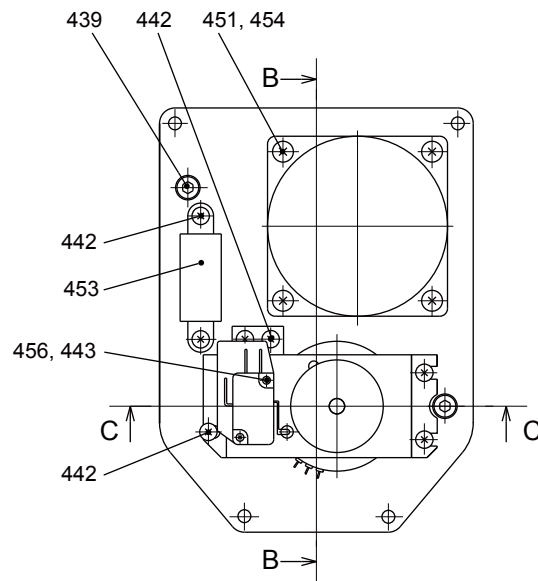
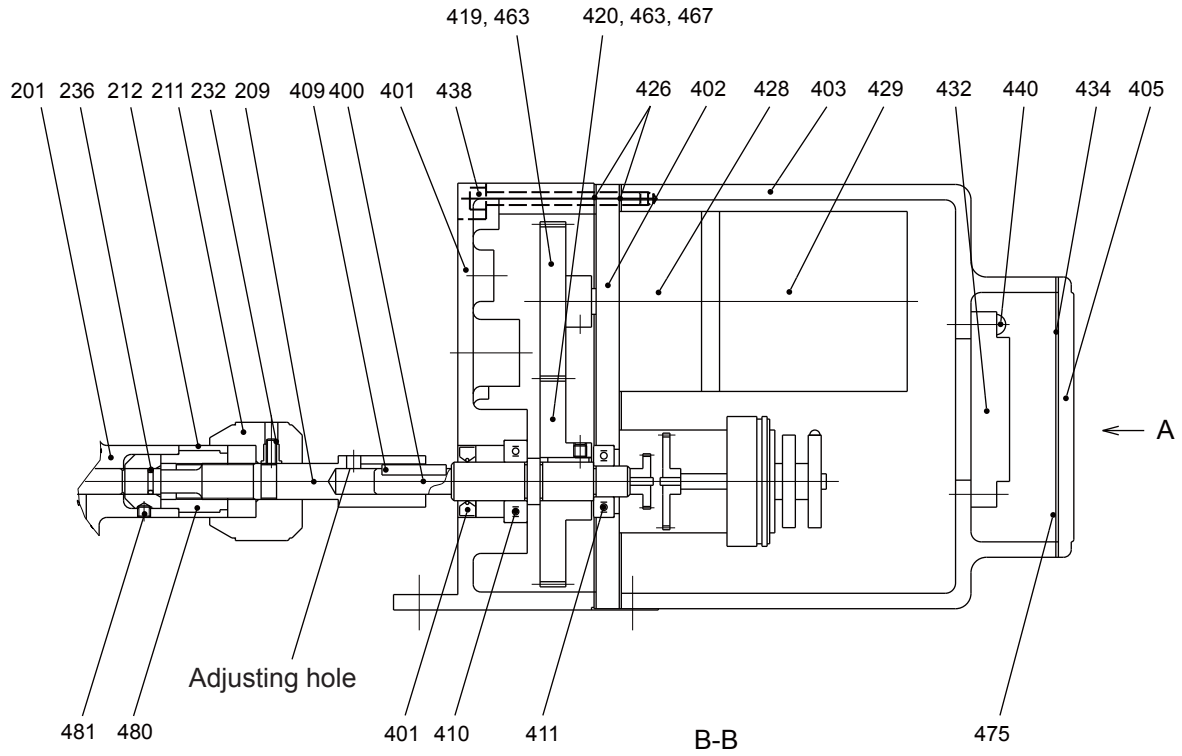
*2. Start-up time is the time required to change stroke length from 0 to 100%. Start-up time changes depending on how much load is applied to the pump.

*3. Setting precision changes according to the sensibility adjustment for the prevention of hunting.

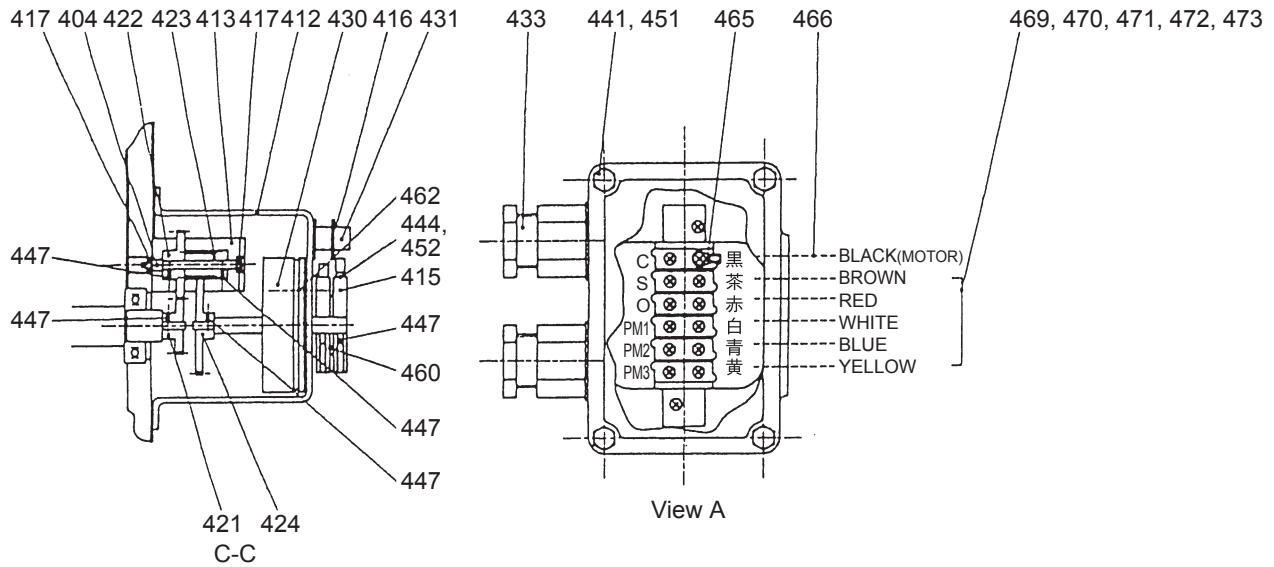
Outline

4. Part names

■ LK, LG type



Outline

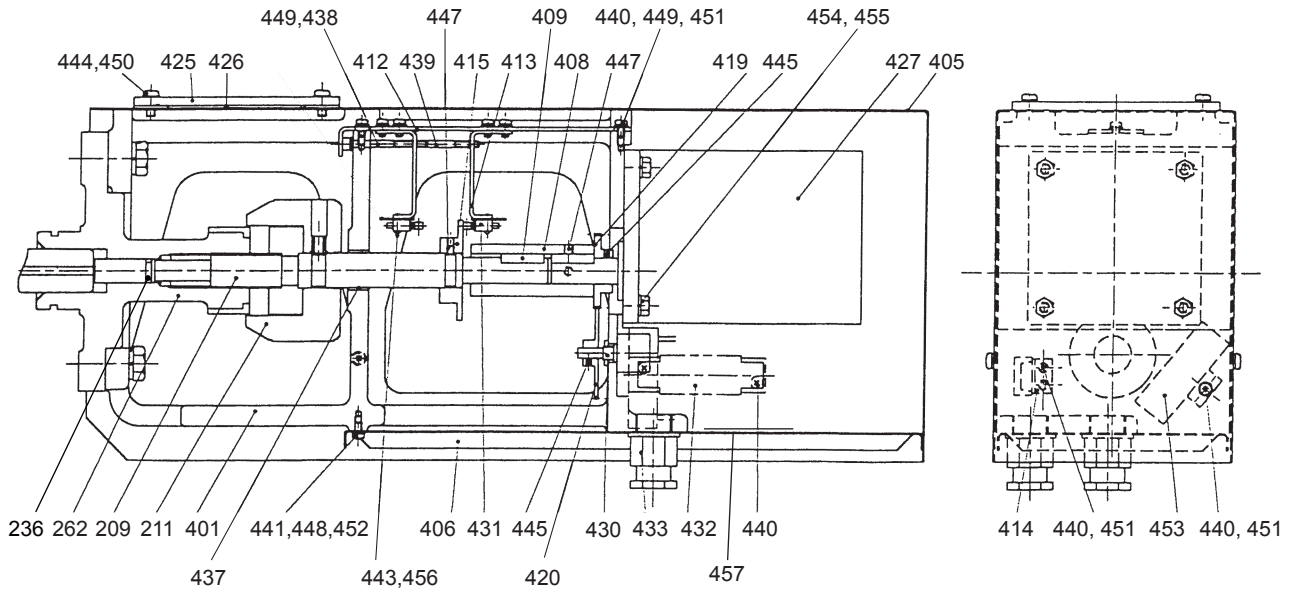


No.	Name of parts	Q'ty	Remarks
201	Case	1	
209	Stroke length adjusting shaft	1	
211	Dial	1	
212	Stroke length scale	1	
232	Hex socket set screw	1	4×10
236	O ring	1	P7
400	Control shaft B	1	
401	Case A	1	
402	Plate	1	
403	Case B	1	
404	Gear shaft	1	
405	Cover B	1	
409	Key	1	4×4×25
410	Ball bearing	1	6002ZZ
411	Ball bearing	1	6001ZZ
412	Support frame A	1	
413	Support frame B	1	
415	Limit cam	2	
416	Seat A	2	
417	Ball bearing	2	RF-620ZZY52
419	Gear K (drive)	1	
420	Gear I (driven)	1	
421	Gear	1	
422	Gear	1	
423	Gear L	1	
424	Gear M	1	
426	Gasket (2)	2	
428	Gear head	1	
429	Control motor	1	
430	Potentiometer	1	
431	Limit switch	2	

No.	Name of parts	Q'ty	Remarks
432	Terminal block	1	
433	Bell mouth	2	
434	Gasket (1)	1	
438	Cap bolt	4	M5×70
439	Cap bolt	2	M5×10
440	Pan head screw	2	M4×12
441	Hex. bolt	4	M5×15
442	Round screw	7	M4×8
443	Round screw	2	M2×20
444	Round screw	2	M3×6
447	Set screw	6	M3×6
451	Spring washer	8	M5
452	Spring washer	2	M3
453	Capacitor	1	
454	Pan head screw	4	M5×60
456	Spring washer	2	M2
460	Packing spacer	2	
461	Oil seal	1	AB 0592 EO
462	Pan head screw	3	M3×5
463	Set screw	2	M3×5
465	Press fit terminal	6	
466	Band	2	
467	Key	1	4×4×16
469	Cord	1	
470	Cord	1	
471	Cord	1	
472	Cord	1	
473	Cord	1	
475	Nameplate for terminals	1	
480	Control bush	1	
481	Hex socket set screw	1	5×5

Outline

■ LK-A, -B, -C type



No.	Name of parts	Q'ty	Remarks
209	Control shaft	1	
211	Dial	1	
236	O ring	1	P10A
262	Control case	1	
401	Bracket	1	
405	Cover	1	
406	Lower cover	1	
408	Key	1	
409	Slide shaft	1	
412	Support frame A	1	
413	Support frame B	2	
414	Stay	1	
415	Limit cam	1	
419	Drive gear	1	
420	Driven gear	1	
425	Side glass	1	
426	Side gasket	1	
427	Geared motor	1	
430	Potentiometer	1	
431	Limit switch	2	
432	Terminal block	1	

No.	Name of parts	Q'ty	Remarks
433	Bell mouth	2	Rc1/2"
437	Bearing	1	
438	Hex. socket head bolt	1	M4×45
439	Hex. socket head bolt	1	M4×75
440	Pan head screw	11	M4×10
441	Pan head screw	5	M4×8
443	Pan head screw	4	M3×16
444	Pan head screw	4	M5×12
445	Hex. socket head screw	2	M3×4
447	Hex. socket head screw	3	M4×6
448	Washer	5	M4
449	Washer	8	M4
450	Washer	4	M5
451	Spring washer	9	M4
452	Spring washer	5	M4
453	Capacitor	1	
454	Hex. bolt	4	M6×20
455	Spring washer	4	M6
456	Spring washer	4	M3
457	Terminal name plate	1	

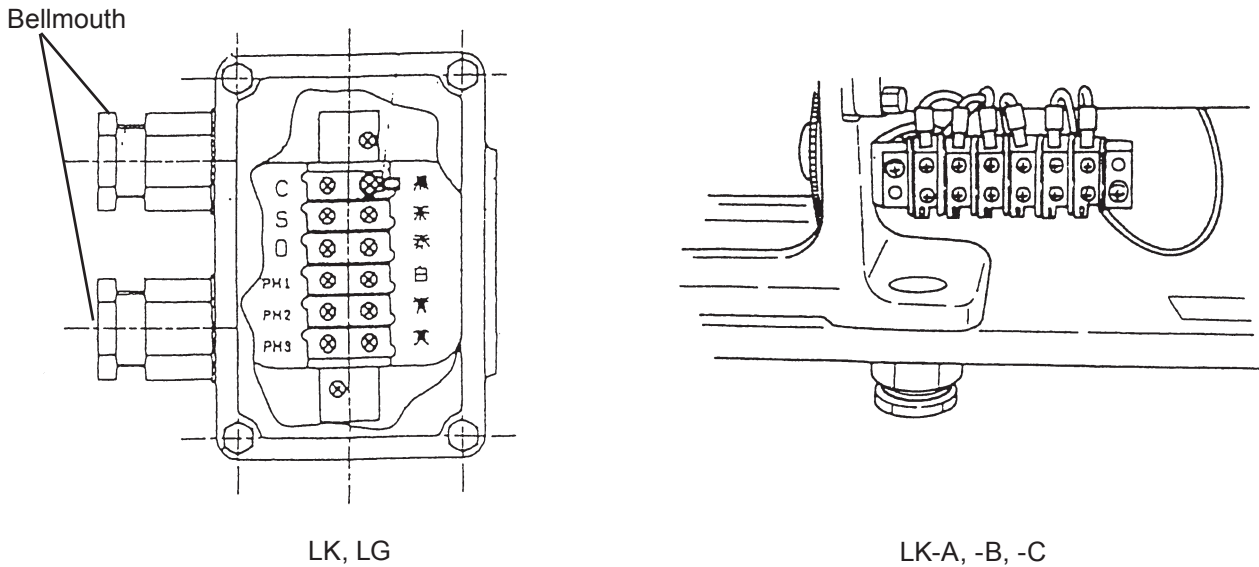
Installation

1. *Wiring*..... 13

Installation

1. Wiring

Connect wires via bellmouths to respective terminals according to terminal symbols. Keep a certain allowance for terminals. The terminals of the LK and LG are located at the rear end. Remove the cover B (405) with a 8mm spanner to connect wires. The terminals of the LK-A, -B and -C are in the servo unit. Remove the cover (405) with a screwdriver to connect wires.



Always use suitable wiring tools when wiring work. Observe relevant technical criteria and regulations.

1. Arrange sequence so that the E.E. positioner is turned off as the pump motor stops. Otherwise the control motor is overloaded.
2. Even if the pump stroke length is at 0 %, a small amount of liquid may happen to be discharged. If you wish to make the discharge capacity perfectly zero at 0% stroke length, arrange sequence so that the pump stops at 0% stroke length. Contact us for detail.
3. The wiring of the potentiometer (PM1, 2 and 3) and the control motor (C, O and S) must not share the same bellmouth. Otherwise, line induction happens every time the control motor operates, resulting in malfunction. Always separate them.
4. For wiring, use the 0.75 - 1.25mm² CT or CV cables of 9 mm outer diameter.
Use shield cables for the feed back signal from the potentiometer (PM1, 2 and 3). Always connect to ground. If a conduit tube is used, use a single IV wire of 1.6mm or less.
5. If a conduit tube is used, try not to weigh on the electrical servo unit. Position the conduit tube at lower than bellmouths so that rain water can not get into the servo unit.

Operation

1. *Operation*..... 15

Operation

1. Operation

■ Before operation

The pump and servo unit are adjusted according to the user's specification before delivery.

Check the operation according to the following procedures before starting continuous operation.

NOTE: Be sure to fully open both discharge and suction valves before operation.

■ Automatic operation

Operation check

1. Push the AUTO/MAN key to enter AUTO mode (AUTO lights).
2. Apply the 4mADC (1V) input signal to the E.E. positioner.
3. At this time, check the stroke length dial and the E.E. positioner indication to see if they both indicate the same stroke length ($0\pm 1\%$). If not, adjustment is required (See the instruction manual of the E.E. positioner.)
4. Apply the 20mADC (5V) input signal to the E.E. positioner.
5. At this time, check the stroke length dial and the E.E. positioner indication to see if they both indicate the same stroke length ($100\pm 1\%$). If not, adjustment is required (See the instruction manual of the E.E. positioner).
6. Check setting precision. Increase and decrease amperage by 4mA between 4 and 20mADC (by 1V between 1 and 5VDC), reading the stroke length at each step. Check the stroke length dial to see if deviation is $\pm 1\%$ to the E.E. positioner indication.
7. Set the stroke length at any point between 1-99% and check for "hunting". Reduce sensitivity if hunting happens (See instruction manual of the E.E. positioner.).

CAUTION

Do not continuously operate the pump when "hunting" happens. Otherwise pump failure may result.

NOTE: Voltage in () is in case the input signal is 1-5VDC.

Operation

1. Push the AUTO/MAN key to enter AUTO mode (AUTO lights.).
2. Enter the input signal to the E.E. positioner by your controller.

NOTE 1. Manually adjust the stroke length to the specified point. Otherwise the stroke length may suddenly reach 100% in the start-up operation.

2. Do not run the pump at or below 25% stroke length for a long period, Otherwise the pump may fail.
3. Suction pressure shall not exceed 0.1MPa. Otherwise the pump may fail.
4. Frequent stroke length change may lead to pump failure. In this case use of a constant response transducer is recommended in order to keep a control target constant.
5. The use of an isolator is recommended in order to avoid trouble caused by noise.

Operation

■ Manual operation (Remote control operation)

Operation check

1. Push the AUTO/MAN key to enter MANUAL mode (MANUAL lights).
2. Press and hold the DOWN key until the servo unit stops. Check the stroke length dial to see if the stroke length is between 0 and -1%. If not, adjust the limit switch (See page 18, **1. Adjustment.**).
Also, check the stroke length dial to see if deviation is within $\pm 1\%$ to the E.E. positioner indication. If not, adjustment is required(See the instruction manual of the E.E. positioner.).
3. Press and hold the UP key until the servo unit stops. Check the stroke length dial to see if the stroke length is between 100 and 101%. If not, adjust the limit switch (See page 18, **1. Adjustment.**).
Also, check the stroke length dial to see if deviation is within $\pm 1\%$ to the E.E. positioner indication. If not, adjustment is required(See the instruction manual of the E.E. positioner.).
4. Check precision setting. Increase and decrease the stroke length by 25% between 0 and 100%, using the UP and DOWN keys. Check the E.E. positioner and the stroke length dial to see if deviation is $\pm 1\%$ at each point.

Operation

1. Push the AUTO/MANU key to enter MANUAL mode (MANUAL lights.).
2. Operate the pump according to a corresponding pump instruction manual.

■ Operation without the servo unit

If the input signal is not usable, the stroke length can be manually adjusted for operation. Remove the Cover from the servo unit and follow the next procedure.

1. Turn off the E.E. positioner.
2. For the LK and LG, rotate the stroke length adjusting shaft with a bar in the adjusting hole in order to set the stroke length (see page 9).
For the LK-A, -B and -C, remove the Cover from the servo unit. And then use a spanner to turn the Slide shaft (hex. bar shape: 28mm) and adjust the stroke length. Mount the Cover to the servo unit after adjustment.
3. Operate the pump according to a corresponding pump instruction manual.

NOTE: Be sure to turn off the E.E. positioner when adjusting the stroke length manually. If the stroke length dial is turned while the power is ON, the control motor operates for automatic control.

Maintenance

<i>1. Adjustment</i>	18
<i>2. Troubleshooting</i>	20
<i>3. Wear parts</i>	20

Maintenance

1. Adjustment

The servo unit is tuned before shipment in factory, so adjustment is not required in general.

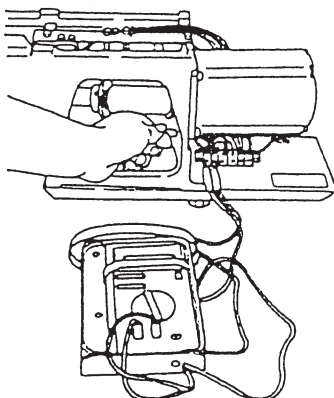
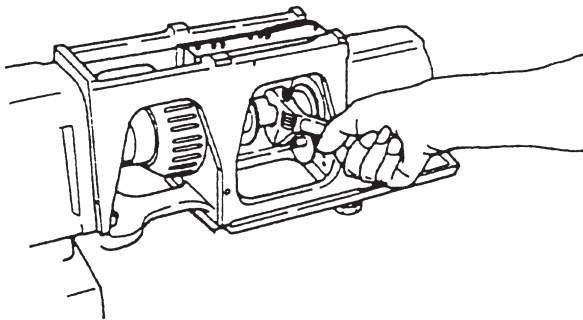
However, if the deviation between the E.E. positioner and the stroke length dial become large or if gears step out and the potentiometer rotates, adjust the servo unit according to the following procedure.

■ Adjustment of the LK and LG types

1. Set the E.E. positioner indication to 50%. And then turn off the driving motor and E.E. positioner.
2. Remove the Cover B (405), Terminal block (432) and Case B (403) from the servo unit. Rotate the stroke length adjusting shaft with a bar in the adjusting hole in order to set the stroke length dial indication to 50%.
3. Loosen the three fixing screws of the Support frame A (412) so that potentiometer (430) can turn freely.
4. Remove lead wires of the E.E. positioner. Adjust the resistance between PM2 (Blue wire) and PM3 (Yellow wire) to $500\Omega (\pm 5\Omega)$, using a tester.
5. Mount the Support frame A, engaging gear L (423) with gear M (424).
6. If the stroke length dial indication does not correspond to the operating point of the limit switch, adjust the cam position by a 1.5mm hex. wrench. Set the upper limit to 100-101% and the lower limit to 0-minus1%, checking the stroke length dial indication.
7. Mount the Case B, Terminal block and Cover B in this order.

NOTE: After adjustment, always give consistency between the servo unit and the E.E. positioner via the adjustment mode(See the instruction manual of the E.E. positioner.).

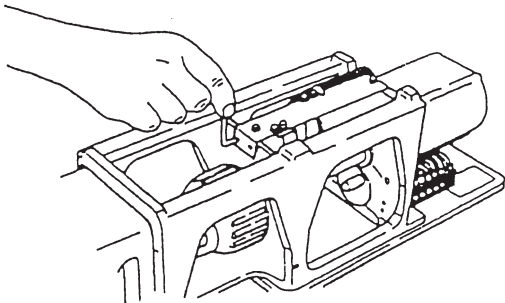
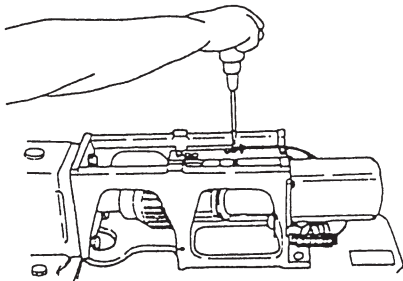
■ Adjustment of the LK-A, -B and -C



1. Adjust the E.E positioner indication to 50% and then turn off the driving motor and E.E. positioner.
2. Remove the Cover (405) from the servo unit.
3. Check a stroke length dial shows 50%. If not, use a spanner and turn the slide shaft (408) in order to turn the dial (211) to 50% stroke length.
4. Remove the Gear (420) from the potentiometer with a 1.5mm wrench.
5. Remove lead wires of the E.E. positioner. Adjust the resistance between PM2 (Blue wire) and PM3 (White wire) to $500\Omega (\pm 5\Omega)$, using a tester.

Maintenance

6. Engage the Driven gear(420) to the Drive gear(419). Be careful not to rotate the potentiometer. And then connect lead wires of the E.E. positioner.
7. Turn ON the driving motor and E.E. positioner. Push the AUTO/MAN key to enter the MANUAL mode.
8. Press and hold the UP key until the stroke length reaches the upper limit and check the limit switch functions between 100-101% of the stroke length dial indication. If not, adjust it according to the procedures 9-11.
9. Loosen the fixing screws of the Support frame B(413).



10. Turn hex. socket head bolts (438, 439) of the Support frame B with a 3mm hex. wrench to adjust an operating point of the limit switch. And then tighten the fixing screws of the item 9.
11. Press and hold the UP and DOWN keys and run the control motor in order to check the operating point of limit switch.
12. Press and hold the DOWN key until the stroke length reaches the lower limit and check the limit switch functions between 0-minus1% of the stroke length dial indication. If not, make an adjustment seeing item 10.
13. Mount the Cover (405) to the servo unit.

NOTE: After adjustment, always give consistency between the servo unit and the E.E. positioner via the adjustment mode(See the instruction manual of the E.E. positioner.).

Maintenance

2. Troubleshooting

Failure	Root cause	Measures
<ul style="list-style-type: none"> ● The control motor does not rotate. ● The stroke length indication of E.E. positioner goes back. 	<ul style="list-style-type: none"> ● The thermal protector in the control motor functions. ● The positioner is powered off. ● Wrong connection 	<ul style="list-style-type: none"> ○ Stop the servo unit until temperature reduces. ○ Check the power source. ○ Check wiring.
<ul style="list-style-type: none"> ● The stroke length is adjusted in one way. 	<ul style="list-style-type: none"> ● Disconnection or wrong connection between the servo unit and positioner 	<ul style="list-style-type: none"> ○ Check wiring.
<ul style="list-style-type: none"> ● The stroke length dial does not rotate. ● The E.E. positioner indication does not change. 	<ul style="list-style-type: none"> ● Failure of the servo drive unit ● Wrong wiring 	<ul style="list-style-type: none"> ○ Open the Cover and check if gears engage each other and rotate correctly. ○ Check wiring.
<ul style="list-style-type: none"> ● The control motor rotates but the stroke length dial does not rotate. 	<ul style="list-style-type: none"> ● Failure of the drive unit 	<ul style="list-style-type: none"> ○ Contact us.

3. Wear parts

To run the pump for a long period, wear parts need to be replaced periodically.

It is recommended that the following part is always stocked for immediate replacement.

No.	Part name	# of parts per pump	Estimated life
236	O ring	1	1 year

NOTE: The estimated life time may vary with operating conditions and is not warranted.



()Country codes
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