

IWAKI Metering Pump AX series
Mechanically-Driven Diaphragm type
Instruction Manual

 Read this manual before use of product

Thank you for selecting the Iwaki metering pump AX type.
 This instruction manual describes the correct handling of the pump, maintenance and inspection procedures, and troubleshooting. You are requested to go through this manual, in order to make maximum use of the pump for a long period of time. This instruction manual should be kept within reach of the end user. After reading it, please keep the manual in a prominent place for ready reference.



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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.



Turn off power

- **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.



Prohibition

- **Do not modify the pump**

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



No modification

- **Wear protective clothing**

Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work. The specific solution will dictate the degree of protection. Refer to SDS precautions from the solution supplier.



Wear protective gear

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

Keep away from the pump while it is lifted up for installation. Serious injury may result if lifting ropes (chains) break. Observe the working load limit of the ropes (chains).



Prohibition

- **Use eye bolts**

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



Prohibition

- **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.



Prohibition

- **Do not stand on the pump**

Injury or damage may result when the pump turns over.



Prohibition

Safety instructions

WARNING

- **Pay attention to reciprocating motion**

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



- **Do not remove or mount the motor fan cover during operation**

The rotating fan can catch the finger, hand, or hair and can cause serious injury. Mount the cover back to its original position after adjustment and inspection. Also, do not place waste clothes near rotating parts.



- **Qualified personnel only**

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



- **Before starting the pump**

Be sure there is no one around the pump before connecting power. The pump doesn't have an ON-OFF switch. The pump starts as a power cable is plugged in.



- **Do not close a discharge or a suction valve during operation**

Operation with closed discharge may cause a sudden pressure rise in the pump and piping. This can break the pump and motor.



- **Before a long period (more than 1 year) of storage**

Drain liquid from the pump and clean the inside.



Safety instructions

CAUTION

- **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.



- **Ventilation**

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



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

1. In a flammable/explosive/corrosive atmosphere.
2. In a dusty/humid environment.
3. Where ambient temperature can exceed 0-40°C.
4. In direct sunlight or wind & rain (except an outdoor type).
5. Under mechanical vibrations.



Prohibition

- **Spill precautions**

Ensure protection and containment of solution in the event of plumbing or pump damage (secondary containment). Do not drain chemical directly onto the ground. Disposal of harmful liquid should be done in accordance with local laws.



- **Do not touch the pump or pipe with bare hands**

The surface temperature of the pump or pipe rises high along with liquid temperature in operation.



Caution

- **Do not place explosive or flammable material near the pump**

Check for oil leakage. Repair as necessary and wipe any oil off. Store the oil in accordance with local laws.



Fire ban

- **Grounding**

Risk of electrical shock. Always properly ground the pump.



Grounding

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

Risk of electrical shock. Purchase and install a GFCI (earth leakage breaker) separately.



Electrical shock

- **If foreign matter enters the pump**

Turn off power and remove foreign matter. Operation with foreign matter can cause damage or failure.



Safety instructions

CAUTION

- **Preventative maintenance**

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



- **Do not use a damaged pump**

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



Prohibition

- **Disposal of a used pump**

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



- **Do not cover the pump with cloth**

The motor temperature may build up and a fire or an electric/mechanical failure may result. Provide adequate ventilation.



Prohibition

- **Non-freezing**

Frozen liquid may damage the pump and piping. Drain liquid before leaving it at a freezing temperature or use measures to prevent liquid from freezing.



- **Solution in the discharge line may be under pressure**

Release the pressure from the discharge line before disconnecting plumbing or disassembly of the pump to avoid solution spray.



- **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 coupling cover during operation**

Touching the shaft when it is rotating, serious injury may result.



Prohibition

- **Do not wet the pump with solution or water**

Solution enters the pump through the air breather and corrodes oil/metallic parts, resulting in pump failure.

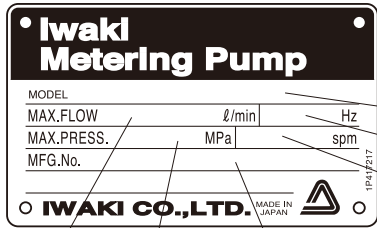


- **Keep labels clean**

If the nameplate or labels have become unglued or illegible, contact us to replace them with new ones.



1. Unpacking and Inspection



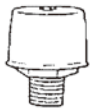
Model
 Frequency
 Number of strokes
 Discharge
 Discharge pressure
 Manufacturing No.

After unpacking the pump, check the following points to confirm that the product conforms to your order. If you find anything wrong, please contact the dealer with whom you placed the order.

1. Do the model, discharge pressure, stroke number, and other details on the nameplate correspond to those of the pump you ordered?

2. Does the package contain the following accessories?

- ① Air breathers 1
- ② Diaphragm setting tool 1



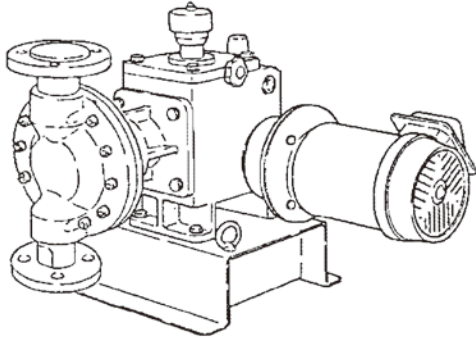
Air breather



Diaphragm setting tool

3. Has the pump been damaged, or nuts and bolts been loosened, during delivery?

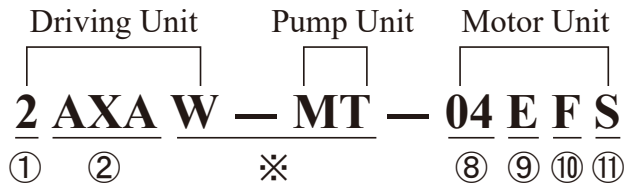
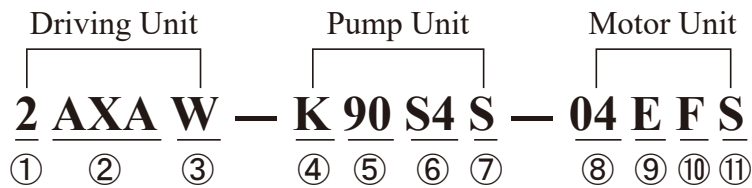
2. Principle of Operation



The Iwaki metering pump AX-series has a driving unit that employs an SL crank mechanism, and is designed for chemical processing.

The decelerating mechanism slows the motor speed, and the SL crank mechanism converts rotation to reciprocating motion, which is transmitted to the diaphragm to operate the pump. The discharge is adjusted when a control handle is rotated to change the length of stroke.

3. Identification Codes



① Serial-use model code

Without symbol 1: Single-use pump

2: Dual (or multiple)-use pump

(Indicated for models to be used in series of two or more pumps)

② Driving unit model code

Mode	Stroke Length (at 100% stroke)	Standard Motor Output
AXA-90 AXA-120	8.1mm 10.7mm	0.4 kW
AXB-150 AXB-180	14.7mm 17.6mm	0.75kW 1.5kW

③ Reduction code

Reduction Code	Reduction Ratio	Stroke Rate (50/60Hz)
G	1/30	48/58spm
W	1/20	72/86spm
H	1/15	96/116spm

④ Pump head code

K : Mechanically-driven diaphragm

KE : Mechanically-driven diaphragm for Latex

⑤ Diameter of diaphragm : 90
: 120

⑥ Material code : For details, see the table of materials in the reference data.

Code	Material of Liquid-Contacting Parts
S4	SUS304
VS	PVC
VC	

⑦ Wet end materials (Make to order)

S : Non-standard material

Special valves

Other special specifications of the pump unit and the hydraulic unit

⑧ Motor output

Code	Output
04	0.4 kW
07	0.75kW
15	1.5 kW

⑨ Stroke length adjustment

Code	Stroke Adjusting Method
Without code	Manual
E	Electric servo

⑩ RPM control

Code	RPM Control
Without symbol	Fixed rpm
F	Inverter
V	VS motor

⑪ Motor unit

S : Special base

Pulse generator

Other special specifications of the driving unit and motor unit

※ Code for multiple connection of different types of pumps

W-MT	Connected pumps have the same driving unit but different types of pump heads.
-MT	Driving units have different reduction ratios.

○ When pumps with different types of driving units are connected, one which has the largest output is indicated in ②.

4. Specifications (Outline)

■ Standard specifications (Single type)

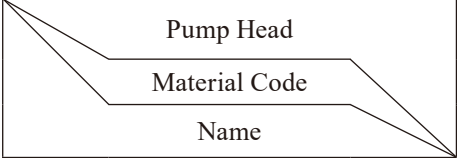
Model	Diaphragm diameter	Stroke length (mm)	Discharge capacity at each spm (L/min)						Maximum discharge pressure MPa {kgf/cm ² }	Standard Motor (kW)
			50Hz			60Hz				
			G:48 spm	W:72 spm	H:96 spm	G:58 spm	W:86 spm	H:116 spm		
AXA-	K90	0-8.1	1.4	2.1	2.8	1.7	2.6	3.4	0.5 {5}	0.4
	K120	0-10.7	3.5	5.3	7.1	4.3	6.4	8.6	0.3 {3}	
	KE90	0-8.1	1.1	1.7		1.4	2.1		0.2 {2}	
	KE120	0-10.7	2.9	4.4		3.5	5.3		0.3 {3}	
AXB-	K150	0-14.7	7.5	11.3	-	9.1	13.7	-	0.4 {4}	0.75
	K180	0-17.6	12.4	18.6		15.0	22.5		0.3 {3}	1.5
	KE180		11.0	16.5		13.2	19.9			

Note 1 : The KE type is a mechanically-driven diaphragm pump for use specifically in transferring Latex emulsion liquid.

Note 2 : Discharge consists of clear water at normal temperature under the maximum discharge pressure.

■ Common Specifications

1. Materials of Liquid-Contacting Parts

	K			KE
	S4	VS	VC	S4
Pump head	SCS13	PVC		SUS304
Valve seat	SUS304			
Valve	SUS304		Ceramic	
Valve guide	SUS304	PVC		
Valve gasket (O ring)	PTFE	(EPDM)	(FKM)	PTFE
Discharge port · Suction port	SUS304	PVC		SUS304
Diaphragm nut	SUS304		PVC	
Diaphragm seat	PTFE			
Valve case	—			SUS304
Gasket	—			PTFE

SCS13 : Stainless steel casting

SUS304 : Stainless steel

PTFE : Ethylene tetrafluoride resin

PVC : Poly vinyl chloride

EPDM : Ethylene-propylene rubber

FKM : Fluororubber

2. Temperature range of liquid : S4.....0 to 80°C

VS • VC.....0 to 50°C

3. Ambient temperature : 0 to 40°C

4. Standard coating color : Ultra Marine Blue RAL5002 (excluding motor, which is in manufacturer's standard color)

5. Motor :

Standard : Flange type (IEC Standard)

Motors of 1.5kW and above: Foot-mounted type.

※ Please note that due to product improvement, sizes are subject to change without notice.

5. Description of Pump Mechanism & Points to Note During Operation

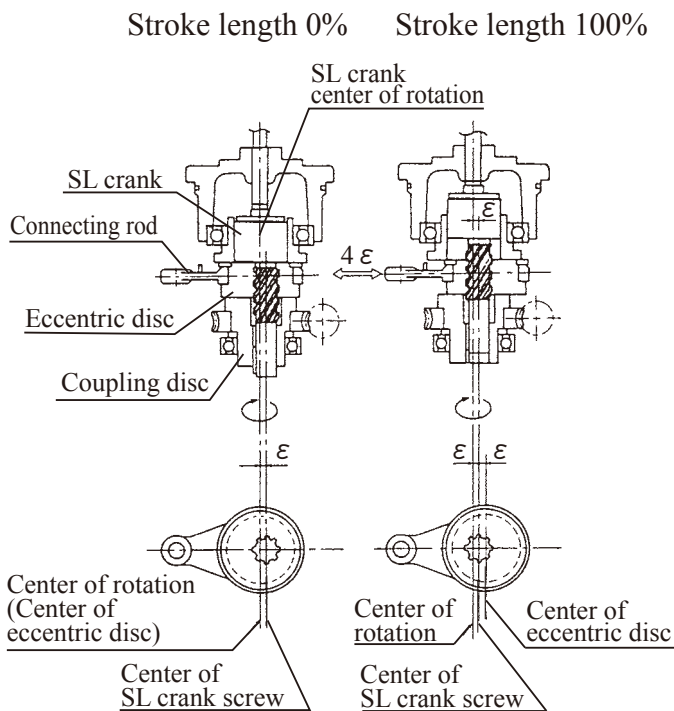
■ Description of Pump Mechanism

1. Gear reducer mechanism

The motor speed is reduced by a worm and a worm wheel. The standard reduction ratios are 1:30, 1:20, 1:15.

2. SL crank mechanism

The SL crank is a mechanism designed to adjust the stroke length. It consists of an eccentric disc of the same eccentricity, SL crank, and coupling disc.



Principle of SL crank mechanism

- When stroke length is set at 100% (SL crank is pulled up)
When the SL crank is pulled up, the eccentric disc starts rotation via the SL crank screw. At this moment, the eccentric disc is shifted from the center of SL crank rotation, resulting in a stroke length that is double the eccentricity degree. (The example shows that the eccentric disc has rotated 180° and the eccentricity degree is 2ε.)
- When stroke length is set at 0% (SL crank is pushed down)
The center of the eccentric disc is aligned with the center of SL crank rotation. The eccentricity degree ϵ of the SL crank against the center of eccentric disc rotation is offset to result in an eccentricity degree of 0.

3. Stroke length control

To set, increase or decrease the discharge rate, the length of stroke is changed, which is carried out by rotating the control handle of the pump.

■ Notes on Operation

1. Shutoff operation prohibited

Never operate the pump without opening the valves in the piping on both the discharge and the suction sides. Do not throttle or close the valves in the discharge and suction piping while the pump is in operation.

2. Influence of change in temperature

Although the performance of the pump is not affected by a change in temperature, the liquid handled changes in viscosity, steam pressure, corrosion resistance, etc., as the temperature varies. Therefore, close attention should be paid to changes in the properties of the liquid handled likely to be caused by thermal variation.

▶ Temperature range of liquid handled by pump: 0°C to 80°C (0 to 50°C for PVC type pumps)

* For the recommended temperature ranges of chemical liquids, refer to the table of corrosion resistance data. If you have any further questions, please contact the dealer you placed your order with.

▶ Temperature range of atmosphere in which the pump is operated: 0 to 40°C

3. Effect of viscosity on performance

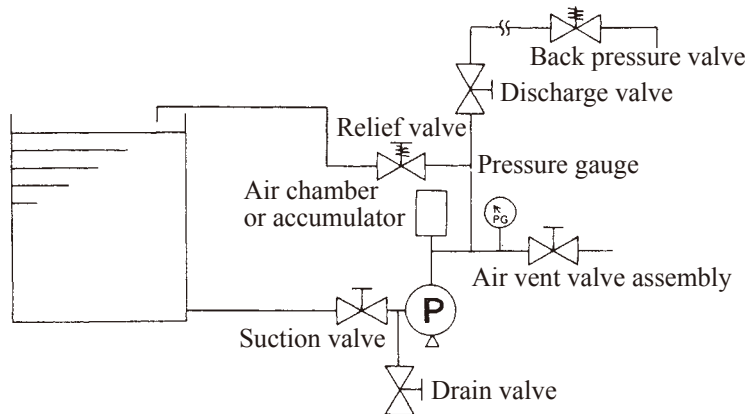
When an AX hydraulic diaphragm pump transfers a viscous liquid, the discharge tends to decrease slightly compared to clear water. In order to maintain precise metering, try to minimize a change in the viscosity through careful control of the temperature of the liquid. As the viscosity of the liquid rises, NPSHr increases. Accordingly, NPSHa should be set at a sufficiently high level if a viscous liquid is transferred.

4. Handling of slurry

- ① Please note that a metering capacity similar to that for clear water may not be achieved.
- ② When a slurry is pumped at a low stroke length, precipitation causes the valves to malfunction and the transfer of the slurry becomes impossible.
- ③ The diaphragm has a shorter life due to abrasion caused by the slurry.

6. Installation, Piping and Wiring

■ Recommended Piping



The piping system should be designed to fully meet the requirements for suction and discharge. Well-planned piping is a must particularly when a precipitable slurry is handled.

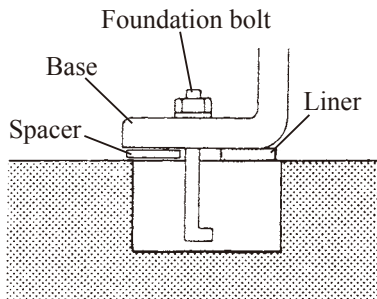
■ Installation Site

1. Position the pump as close to the suction side tank as possible, and lower than the lowest liquid surface of the tank. Choose the position that requires the shortest possible length of suction piping.
2. For ease of maintenance, have enough space around the installation. Take measures to prevent the danger of damage to the motor and power distribution equipment in disasters such as a flood.
3. The pump should be installed in a flat place, that is not subjected to the vibrations caused by other machines.

■ Foundation Work

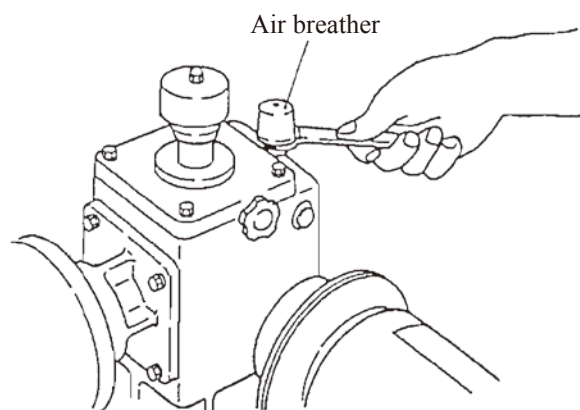
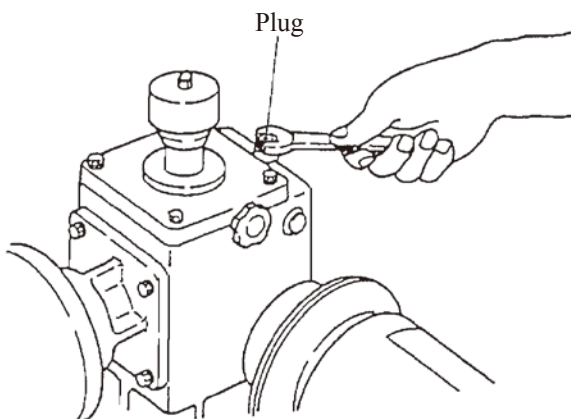
1. As a concrete floor on soft ground tends to subside or incline, it is necessary to have a space wide enough to bear the weight of the pump and deep enough to prevent the pump from freezing in winter.
2. For the foundation bolts to be driven into the concrete floor, make holes as marked in the drawing or on the product. Level the floor surface as far as possible. Start installation only after the concrete has set fully.

■ Installation



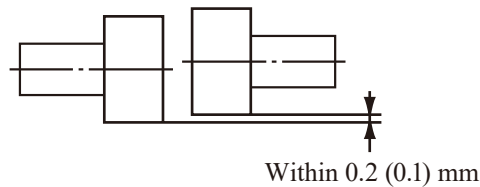
Liner: When the nut is tightened, remove the liner.

1. After preparing the foundation, position the pump on the concrete.
2. Insert the liner between the pump base and the concrete foundation to make a gap for mortar grouting. At this time, make sure the liner is inserted evenly (and horizontally) so that the base is not distorted.
3. Attach a nut at the head position of the screw of the foundation bolt and leave it hanging down in the hole for the foundation bolt hole in the base.
4. Grout mortar into the foundation bolt hole. Leave the mortar for a few days to harden. The surface of the grouted mortar must be at the same level as the surface of the concrete foundation. Use a level to check that the surface is horizontal.
5. After the mortar has hardened, remove the liner from the base and place a level on the surface of the discharge side flange (or discharge port) to check the levelness again. Next, fasten the nut on the foundation bolt. If it is not level, insert a space at the bottom of the base to obtain levelness, Then, fasten the nut to set the pump.
6. Remove the plug of the driving unit, and mount the air breathers provided (ones with sealing tape wound round them). To mount an air breather, turn its upper hexagonal portion with a wrench.



7. For the motor coupling type, centre the coupling parts.

The deviation should be 0.1mm or less for the 0.4, 0.75kW motor (0.2mm or less for the 1.5, 2.2, 3.7, 5.5, 7.5kW motor).



■ Piping precautions

1. Have the piping short as much as possible with the minimum number of bends. Do not allow any projections where the air may be trapped.
2. Provide pipe supports so that the piping weight does not totally weigh the pump.
3. If the pump is used to transfer a high or low-temperature liquid, install the flexible piping to protect the pump from the expansion and contraction of piping by thermal stress.
4. Do not make U-shaped section on piping if sedimentary slurry is to be transferred. In this case, provide a drain plug in the lower most section of the piping.
5. If a viscous, toxic, or sticky liquid is to be transferred, provide a flushing system to facilitate maintenance and inspection.
6. Select the piping material, taking account of the corrosion resistance to liquid and the pressure to piping.
7. Clean the inside of pipes before installation. Blind covers are provided at the inlet and outlet of the pump to prevent foreign matter from entering. Remove them and then connect pipes.
8. If there is a risk of the liquid freezing in piping, keep the piping warm. Equip the suction piping with a drain cock to drain liquid.

■ Piping (General Matters to be Attended to)

1. The piping should be as short and with as few bends as possible.
Care should be taken to prevent air traps.
2. Provide a support to prevent the piping from applying a load to the pump.
Pay particular attention to this point when liquid contacting ends are PVC.
3. If the pump is used to transfer a high or low-temperature liquid, the piping should be designed to protect it from the influence of thermal expansion/contraction.

4. If a precipitable slurry is to be transferred, the piping should not have a U-shaped section. It is also necessary to provide a drain plug in the lowermost section of the piping.
5. If a viscous or toxic liquid, or a liquid likely to stick, is to be transferred, provide piping for flushing to facilitate maintenance and inspection.
6. When selecting the piping material, take into account corrosion resistance to the liquid to be handled and pressure to be applied to the piping.
7. Before installing the pipes, clean their insides thoroughly. To prevent foreign matter from entering, blind covers are provided at the inlet and outlet of the pump. Remove them before starting piping work.
8. If there is a risk of the liquid freezing in the piping, the piping has to be kept warm. To discharge the liquid remaining in the piping, the suction piping should be equipped with a drain cock.
9. If a PVC pipe is used in the discharge side piping of the pump, care should be taken not to let an adhesive flow into the pump.

■ Suction Piping

1. The press-in method must be used to install suction-side pipes. Use pipes which are larger in diameter than the pump inlet.
2. Care must be taken when attaching joints to suction piping, so as not to allow air to be sucked in. If air gets inside the suction piping, the discharge rate will become unstable.

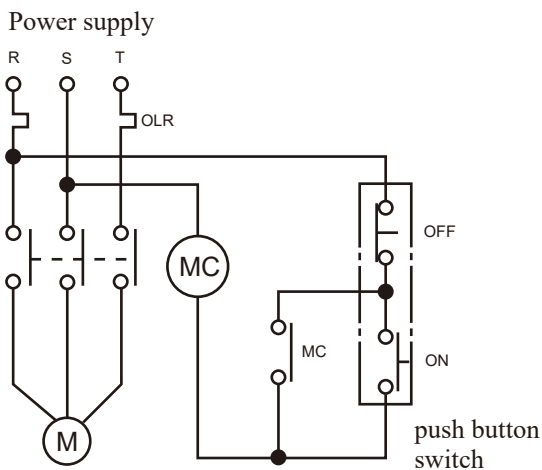
■ Discharge Piping

1. The discharge piping must be able to withstand pressure higher than the relief valve setting. Take special care in fitting joints.
2. It is recommended to provide an air chamber or an accumulator as a means to suppress pulsation and to eliminate inertia resistance.
3. It is recommended to provide a back pressure valve so as to prevent overfeed as a result of insufficient pressure.
4. Install a pressure gauge for routine checks of discharge pressure.

■ Wiring

For wiring, use good quality materials and comply with the technical standard for electric installation and the indoor wiring regulations. Strict observance of the following is requested:

Example of Circuit Diagram

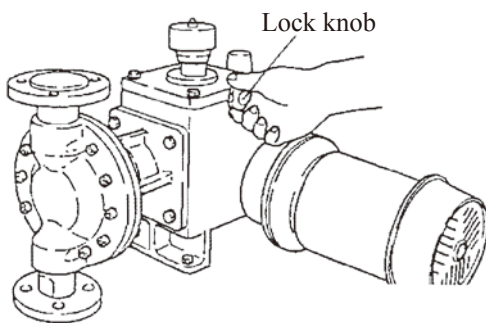
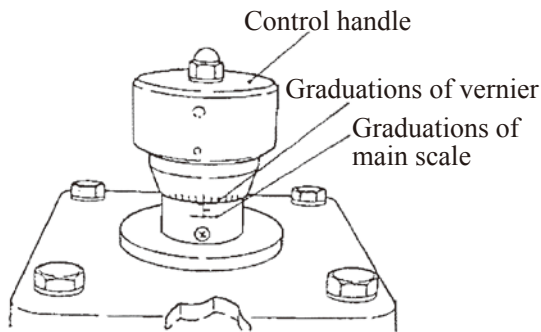


M Motor
 MC Electromagnetic switches
 ON } Push button switches
 OFF }
 OLR Overload relay

1. Use an electromagnetic switch suitable for the specifications of the motor of the pump.
2. If the pump is used outdoors, wire it so as not to expose the switches to rainwater, etc.
3. The electromagnetic switch and push button switches must be installed securely, in a place away from the pump.
4. Wire so that the motor can rotate in the direction indicated by the arrow on the plate (clockwise when viewed from the fan cover side of the motor). When you confirm the direction, make sure to set the stroke at 0% before turning the power switch on.
5. An ampere meter must be installed to monitor the operation of the pump.

7. Operation

■ Stroke Adjustment



<Manual Operation>

A dial-type control handle is used to adjust the stroke. Adjustment is possible regardless of whether the pump is in or out of operation, but it is preferable to make it while the pump is in operation.

- ▶ Turning to the right (clockwise) decreases the stroke length to reduce the discharge.
- ▶ Turning to the left (counterclockwise) increases the stroke length to raise the discharge.

1. Select a suitable stroke from the standard performance curve of the pump or the table of test results. The graduations show strokes in %.
2. Loosen the lock knob. (The control handle is freed.)
3. Set the dial at the value of the intended stroke length. The total of the figure on the main scale and the one on the vernier represents stroke length (%).
4. After setting the stroke length, tighten the lock knob firmly. Then, try to move the control handle to confirm that it does not move.

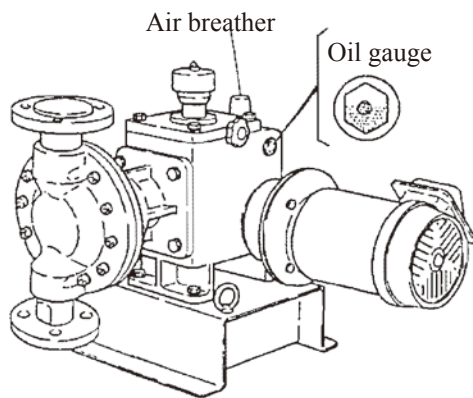
<Electric servo or air servo operation>

Please refer to the instruction manuals for the AX-type Electric Servo Unit and the Stroke Setter.

■ Preparation for Start-Up

During the initial run of the pump after its installation, the following points should be checked.

1. Is there any damage, loosened bolt, or oil leakage in the pump?
2. Have the plug in the driving unit been replaced by the air breathers provided?
(See "Installation," Item 6 on page 12.)
3. Confirm the gear oil level by means of the oil gauge in the driving unit. (The red label in the middle position of the gauge indicates the prescribed amount.)
4. Make sure that the attachments needed for pump operation, liquid to be handled, and power supply are ready.



■ Operation

Following is the operation procedure of the pump when it is run for the first time after installation.

No.	Procedure	Points to be Checked/Noted
1	○ Fully open valves in discharge and suction piping.	
2	○ Set stroke at 0%.	
3	○ Turn on power switch of motor, to activate pump.	● Confirm that motor rotates to right (clockwise) when viewed from fan cover side of motor.
4	○ Run pump with stroke at 0% for 10 minutes for break-in. During this period, confirm that everything is in order in all sections of pump.	● In cold weather, overload (amperage above rating) may be observed for a while after start-up. This phenomenon is due to low temperature of oil in pump. If this happens, keep running pump in that no-load condition until oil temperature rises.
5	○ Set stroke at 100% while avoiding pressurizing discharge side by making use of, for example, drain valve on discharge piping, and carry out break-in for approx. 10 mins.	
6	○ If everything is found to be in order in break-in, close drain valve gradually and feed liquid to predetermined pipeline.	● In this step, confirm that discharge pressure remains below max. Pressure level, that amperage stays within rating, and that there is nothing out of order in all sections of pump. (Refer to the nameplates of pump and motor.)
7	[Checking of discharge] ○ If pump has no problem, check discharge under actual working conditions by using a gauge such as measuring cylinder. (Pump is in order if repeatedly measured discharges change little and linearity of discharges to strokes is maintained.) ○ For setting discharge, graph relation between discharges and strokes under actual working conditions.	● If discharge is increased or decreased by changing stroke, wait for a minute or so before measuring it. ● If requested while placing order for pump, table of pump test results is supplied. Table shows results of tests on clear water at normal temperature (not on actual liquid or through actual piping).

■ Notes on Operation

No.	Precautions	Remarks
1	<ul style="list-style-type: none"> ○ Do not forget to open valves in piping both on suction and discharge sides before starting up pump. 	
2	<ul style="list-style-type: none"> ○ Take care not to operate with motor rotating in reverse. 	<ul style="list-style-type: none"> ● Confirm that motor rotates clockwise when viewed from fan cover side.
3	<ul style="list-style-type: none"> ○ The working pressures of the safety valve and the backpressure valve are set according to your specifications. For further details, see the instruction manuals for the safety valve and the backpressure valve. 	
4	<ul style="list-style-type: none"> ○ In case air chamber is provided. Air should be fed regularly to air chamber. For details, see instruction manual of air chamber. 	<ul style="list-style-type: none"> ● Because liquid and air are directly in contact with each other in air chamber, a small amount of compressed air absorbs into the liquid. ● Thus, air keeps decreasing as time goes by, and it becomes difficult for the air chamber to fulfill its functions. To avoid this, air should be supplied at regular intervals.

■ Stoppage of Operation and Restarting

1. When operation is resumed after a brief stoppage (within a week), the pump can be run with any length of stroke.
2. If the pump has been out of operation for a longer period (more than a week), the stroke should be set at 0% and about ten minutes' run in a no-load condition must be carried out. Do not start up the pump immediately for regular operation. Prior to that, an air vent run should be made with gradually increased stroke lengths after the inside of the driving unit is fully lubricated.
3. If the pump is put out of operation in cold weather (even briefly), open the drain piping on the suction side and run the pump without feeding liquid, to get rid of liquid from the piping and the pump chamber. This is to protect the pump from damage likely to be caused by frozen liquid. In case operation is interrupted temporarily and liquid cannot be drained, the pump should be kept warm by a band heater, etc., to prevent the liquid inside from freezing.

8. Maintenance and Inspection

■ Routine Operation

No.	Checkpoint	Checking Method
1	<ul style="list-style-type: none"> • Is pump running smoothly? 	<ul style="list-style-type: none"> • By flow meter or visually • Amperage of motor
2	<ul style="list-style-type: none"> • Is there any change in discharge or discharge pressure? 	<ul style="list-style-type: none"> • By flow meter, pressure gauge or the like. • Compare with figures on nameplate
3	<ul style="list-style-type: none"> • Is there any leakage from liquid-contacting parts? 	<ul style="list-style-type: none"> • Examine sealed sections visually.
4	<ul style="list-style-type: none"> • Does oil in gear reducer and driving units run short? • Does oil leak from an oil seal, or is it soiled? 	<ul style="list-style-type: none"> • By oil gauge • Visually <p>Use a dry or damp cloth to wipe leaked oil off. Contact us for further assistance.</p>

■ Periodic Inspection

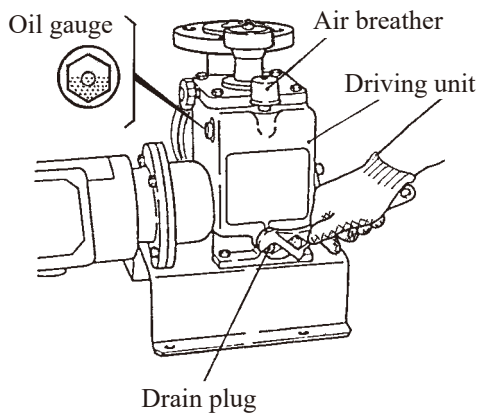
If there is a spare pump, run it from time to time. It should be serviced so as to be always ready for use.

No.	Item	Remarks
1	<ul style="list-style-type: none"> • Inspection of discharge and suction valves ▶ Inspect them semiannually. 	<ul style="list-style-type: none"> • If unusual scratch or abrasion is found in any of them, replace it. • For replacement, follow instructions in "Disassembly, Reassembly and Adjustment" section (Page 25, 26, 29 and 30).
2	<p>Oil change in driving unit</p> <ul style="list-style-type: none"> ▶ ① Replacement period: at least once a year ▶ ② Quantity of replacement oil: 2.4L ▶ ③ Brand of replacement oil: See the next page. <ul style="list-style-type: none"> • Make sure to fill oil up to red label of oil gauge (middle position). 	<p>Oil must be changed more than once a year. In the first run which causes initial wear, replace oil when pump is operated for 500 hours. If the oil becomes foul or emulsification is found in it after a lapse of 2,000 to 3,000 hours, replace it immediately.</p>

■ Suitable Oil Brands (for reference)

Company	Product Name
Shell Lubricants Japan K.K.	Shell Spirax EP80

■ Oil Change Procedure



1. Stop the pump and release it from pressure, for example, by opening the drain valve in the piping.
2. Remove the drain plug of the driving unit and let the oil out.
3. Clean the inside with new oil and flushing oil.
4. Wind sealing tape around the drain plugs and replace them in the driving unit.

■ Quantity of Oil to be Changed (for reference)

Model	Quantity of Oil (L)
AXA	2.4
AXB	7.0

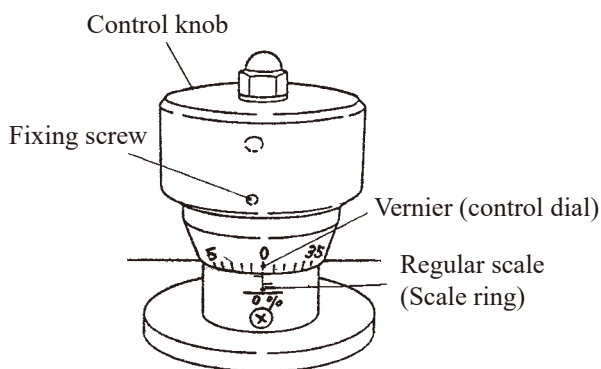
5. Next, set the stroke length at 0%.

6. Remove the air breather and feed oil of a suitable brand into the driving unit.

- The red label in the middle of the oil gauge indicates the prescribed quantity.

■ Adjustment of Stroke Length Scale

If the scale of the control knob for adjusting the stroke length (the 0 positions of the regular scale and the vernier) is not correctly positioned, adjustment is needed.



<How to Adjust>

Remove the pump head. Observe the movement of the diaphragm holder and make sure that when the movement is at its minimum, the stroke length scale is correctly positioned (the regular scale's 0 meets the vernier's 0).

<If this is not the case>

Loosen the control dial using the screw which secures it (the lower hex socket setscrew) and adjust the regular scale and the vernier scale so that their 0s meet each other. At that point, tighten the screw on the control dial again.

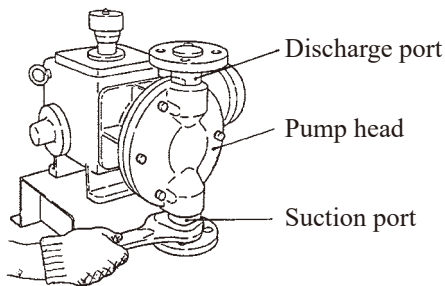
9. Troubleshooting Guide

Cause	Problem	Motor does not move.	Dis-charge is inefficient.	Dis-charge is excessive.	Dis-charge is unstable.	Amperage of motor exceeds rating.	Liquid is not discharged.	Dis-charge pressure does not rise.	Liquid leaks.	Excessive vibrations and/or noise.	Oil leaks.	No sucking	High temperature of driving unit	Remedy
Motor out of order.		○				○				○				Replace it.
Breaks or faulty connection		○				○								Check wire and mend it.
Power fuse melted.		○												Find out cause and mend it.
Voltage lowered.		○				○								Find out cause and obtain normal voltage.
Insufficient NPSH (cavitation)			○				○	○		○				Review suction requirements.
Abrasion of valve seat			○				○	○						Replace it.
Valve blocked with foreign matter.			○				○	○						Disassemble and clean.
Suction piping and strainer blocked.			○				○	○		○				Disassemble and clean.
Stroke setting dial out of place.			○											Readjust.
Liquid overfed due to insufficient differential pressure.				○				○						Increase the differential pressure.
Fluctuation in no. of strokes of pump			○					○						Examine power source, motor and gear reducer.
Over load (excessive discharge pressure)		○								○			○	Examine discharge piping system.
Improper specifications of power supply		○												Investigate and rectify.
Air sucked by suction side piping.			○				○	○				○		Inspect piping and mend it.
Liquid handled changed.			○				○		○					Review pump specifications.
Pressure gauge defective.								○						Replace it.
Mouth of pressure gauge clogged with dirt.								○						Clean it.
Leak from safety valve			○				○	○						Readjust set pressure of safety valve, or check and repair.
Diaphragm deformed.			○						○			○		Replace it.
Valve gasket/O ring out of order.			○						○			○		Replace it.
Oil seal/O ring out of order.											○			Replace them.
Improper lubricating oil used for driving unit.													○	Check amount, type and cleanliness of oil.

10. Disassembly, Reassembly and Adjustment [For K Type]

Notes:

- Power should always be turned off when the pump is disassembled or reassembled. Then follow the steps described below. Reference should also be made to the "Parts Description and Exploded View" section.
- During the disassembly process, liquid remaining in the pipes and the pump chamber spills out. Be careful of dripping liquid when removing them.
- Some types of liquid are harmful to the human body and/or pump parts. Great care should be exercised
- Don't disassemble the driving unit as it has been fully adjusted prior to shipment. If it needs to be disassembled, be sure to contact us.



■ Disassembling and Reassembling the Valve Sets

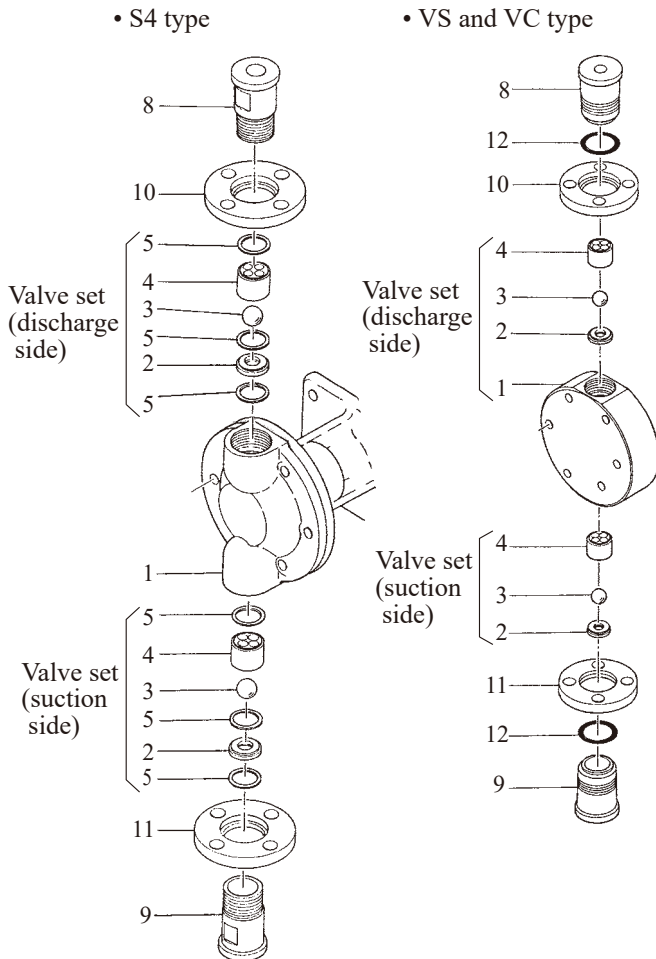
<Disassembly>

1. Remove the pipes on the discharge side and the suction side.

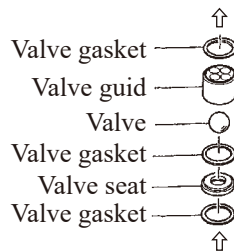
- They should be removed after letting the liquid out of them and closing the piping valves.

2. Detach the discharge port and the suction port from the pump head and take out the valve sets.

- If abnormal scratches and /or wear in any of the parts (valves, valve seats, etc.) of the sets during this process is found, the part should be replaced.
- Dispose of liquid remaining in the pump chamber and valves by wiping it away or transferring it into another container.



• Order of arrangement of valve set parts



⇒ : Direction of liquid flow

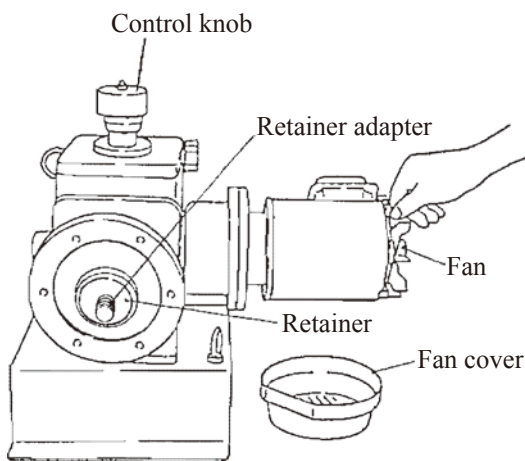
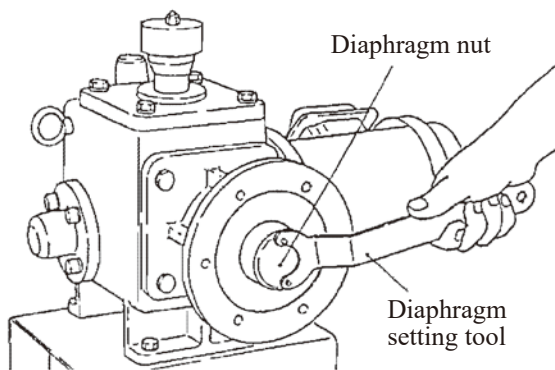
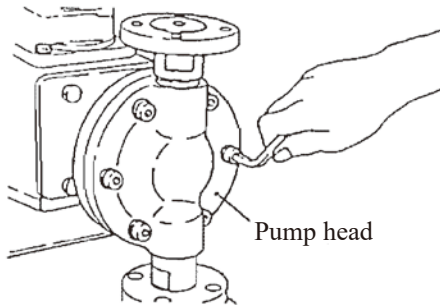
* If the pump is of the VS or VC type, turn the pump head fixing bolt two or three times to loosen it.

3. Wash the disassembled parts and keep them together so they are not lost or damaged.

<Reassembly>

For reassembly, inversely follow the steps for disassembly, paying attention to the following points:

- Errors in the direction of arranging or inserting the valve sets:
If the parts of the sets are assembled in the wrong order or in the wrong direction, it will lead to unsatisfactory feeding of liquid (leakage).
 - In assembling the valve set on the suction side, insert the set into the suction port in the proper order and then attach it to the pump head.
 - Defective connection or insufficient tightening of parts:
Connections of pipes and parts should be tightened sufficiently to prevent leakage.
 - Flange surface adjustment:
Adjust the flange surface using a level to ensure it is horizontal.
- * If the pump is of the VS or VC type, tighten the suction port first and then tighten the pump head fixing bolt.



■ Disassembling and Reassembling the Diaphragm

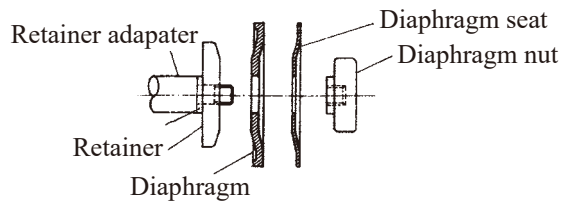
<Disassembly>

1. Remove the pipes on the discharge side and the suction side.
 - They should be removed after letting the liquid out of them and closing the piping valves.
2. Remove the pump head fixing bolt using a wrench (for S4 type, a hexagon bar wrench).
3. Remove the diaphragm nut using the provided setting tool.
 - If any wear, scratches or damage is found in the diaphragm or the diaphragm seat, the part should be replaced.

<Reassembly>

1. Position the retainer at the bottom dead center when the timing of the stroke length is 100%.
 - Turn the control knob and set the stroke length to 100%. Next, remove the fan cover of the motor and turn the fan by hand to bring the retainer to its innermost position (bottom dead center).
2. Mount the diaphragm and the diaphragm seat, and tighten the diaphragm nut using the tool provided.

- Mounting direction of diaphragm



3. Mount the pump head.

- Turn the control knob and set the stroke length to 0%. Mount and temporarily tighten the pump head.

Then, set the stroke length to 100% again and tighten the pump head.

- Fix the pump head by clamping diagonally and uniformly so that the flange surface is horizontal.

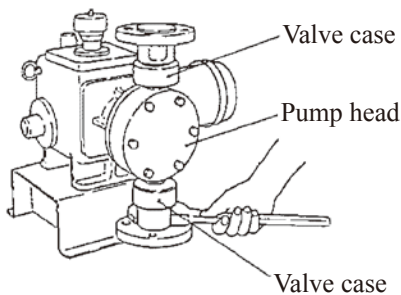
4. Fit the pipes on the suction side and discharge side.

- Connections of the pipes and the parts should be tightened sufficiently to prevent leakage.

11. Disassembly, Reassembly and Adjustment [For KE Type]

Notes:

- Power should always be turned off when the pump is disassembled or reassembled. Then follow the steps described below. Reference should also be made to the "Parts Description and Exploded View" section.
- During the disassembly process, liquid remaining in the pipes and the pump chamber spills out. Be careful of dripping liquid when removing them.
- Some types of liquid are harmful to the human body and/or pump parts. Great care should be exercised
- Don't disassemble the driving unit as it has been fully adjusted prior to shipment. If it needs to be disassembled, be sure to contact us.



■ Disassembling and Reassembling the Valve Sets

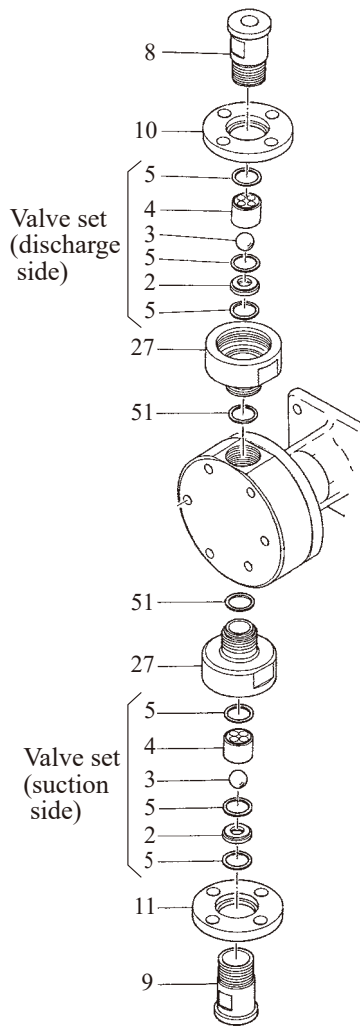
<Disassembly>

1. Remove the pipes on the discharge side and the suction side.

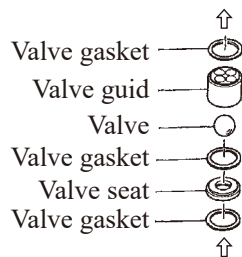
- They should be removed after letting the liquid out of them and closing the piping valves.

2. Detach the valve case from the pump head and take out the valve sets.

- If abnormal scratches and /or wear in any of the parts (valves, valve seats, etc.) of the sets during this process is found, the part should be replaced.
- Dispose of liquid remaining in the pump chamber and valves by wiping it away or transferring it into another container.



- Order of arrangement of valve set parts



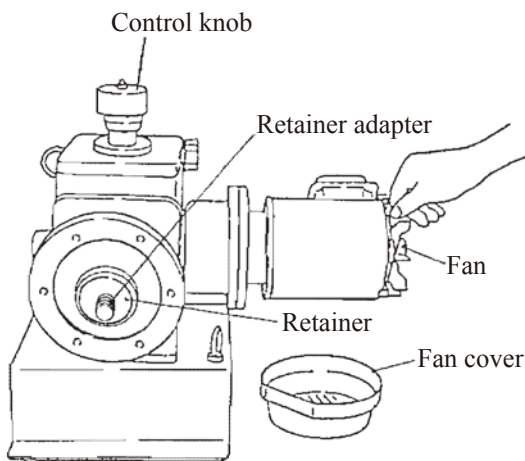
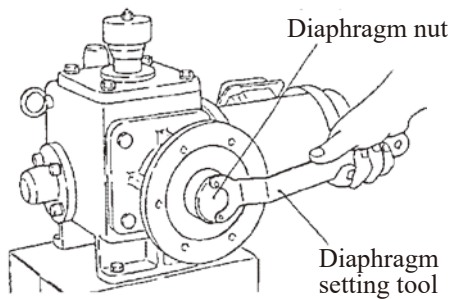
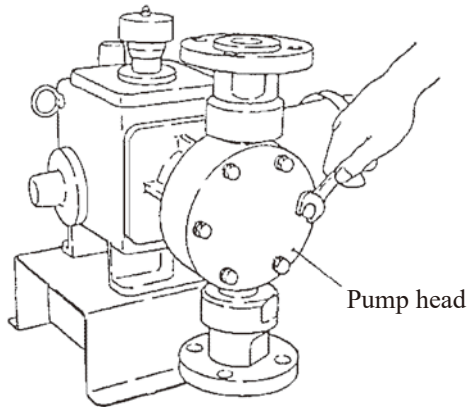
⇒ : Direction of liquid flow

3. Wash the disassembled parts and keep them together so they are not lost or damaged.

<Reassembly>

For reassembly, inversely follow the steps for disassembly, paying attention to the following points:

- Errors in the direction of arranging or inserting the valve sets:
If the parts of the sets are assembled in the wrong order or in the wrong direction, it will lead to unsatisfactory feeding of liquid (leakage).
- In assembling the valve set on the suction side, insert the set into the suction port in the proper order and then attach it to the pump head.
- Defective connection or insufficient tightening of parts:
Connections of pipes and parts should be tightened sufficiently to prevent leakage.
- Flange surface adjustment:
Adjust the flange surface using a level to ensure it is horizontal.



■ Disassembling and Reassembling the Diaphragm

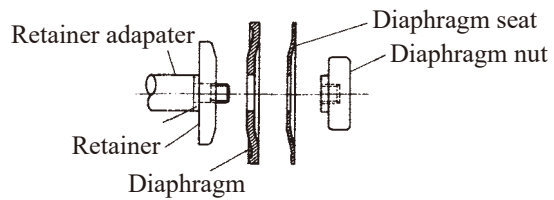
<Disassembly>

1. Remove the pipes on the discharge side and the suction side.
 - They should be removed after letting the liquid out of them and closing the piping valves.
2. Remove the pump head fixing bolt using a wrench.
3. Remove the diaphragm nut using the provided setting tool.
 - If any wear, scratches or damage is found in the diaphragm or the diaphragm seat, the part should be replaced.

<Reassembly>

1. Position the retainer at the bottom dead center when the timing of the stroke length is 100%.
 - Turn the control knob and set the stroke length to 100%. Next, remove the fan cover of the motor and turn the fan by hand to bring the retainer to its innermost position (bottom dead center).
2. Mount the diaphragm and the diaphragm seat, and tighten the diaphragm nut using the tool provided.

- Mounting direction of diaphragm



3. Mount the pump head.

- Turn the control knob and set the stroke length to 0%. Mount and temporarily tighten the pump head. Then, set the stroke length to 100% again and tighten the pump head.
- Fix the pump head by clamping diagonally and uniformly so that the flange surface is horizontal.

4. Fit the pipes on the suction side and discharge side.

- Connections of the pipes and the parts should be tightened sufficiently to prevent leakage.

12. Normal Consumable Parts

When the pump is operated continuously for a long period of time, appropriate spare parts are needed. It is recommended that you always have expendable parts ready. When parts are ordered, we need the following information:

- ① the name of the product and product no. (as per the diagrams in this instruction manual)
- ② the model code and manufacturing no. of the pump (written on the nameplate)
- ③ if approved diagrams have been submitted to you, the diagram no.

■ S4 Type

No.	Name	Expected Life (Reference Value)	K90	K120	KE90	KE120
			Quantity			
2	Valve seat	1 year	2			
3	Valve					
4	Valve guide					
5	Valve gasket		6			
51	Gasket		—	2		
55	Diaphragm		1			
56	Diaphragm seat					

■ VS • VC Type

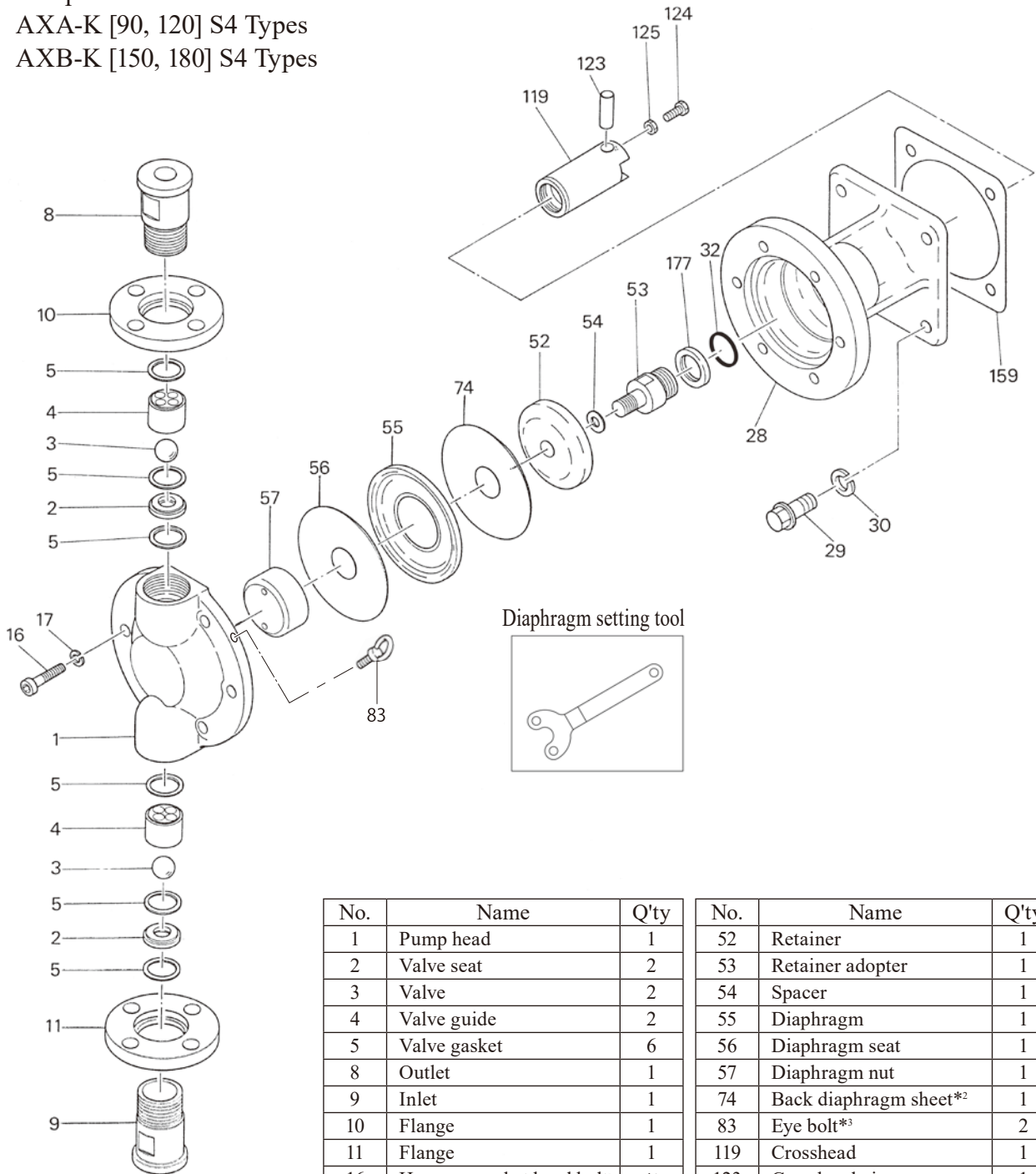
No.	Name	Expected Life (Reference Value)	K90	K120
			Quantity	
2	Valve	1 year	2	
3	Valve seat			
4	Valve guide			
12	O ring			
55	Diaphragm		1	
56	Diaphragm seat			

13. Parts Description and Exploded View

■ Pump Unit

AXA-K [90, 120] S4 Types

AXB-K [150, 180] S4 Types



No.	Name	Q'ty	No.	Name	Q'ty
1	Pump head	1	52	Retainer	1
2	Valve seat	2	53	Retainer adopter	1
3	Valve	2	54	Spacer	1
4	Valve guide	2	55	Diaphragm	1
5	Valve gasket	6	56	Diaphragm seat	1
8	Outlet	1	57	Diaphragm nut	1
9	Inlet	1	74	Back diaphragm sheet*2	1
10	Flange	1	83	Eye bolt*3	2
11	Flange	1	119	Crosshead	1
16	Hexagon socket head bolt	*1	123	Crosshead pin	1
17	Spring washer	*1	124	Hexagon head bolt	1
28	Bracket	1	125	Hexagon head nut	1
29	Hexagon head bolt	4	159	Case Gasket	1
30	Spring washer	4	177	Case	1
32	Packing	1			

*1 K90type : M10×30L6
K120type: M10×35L10

K150type: M10×95L 10 (Hexagon head bolt)
K180type: M12×40L 10

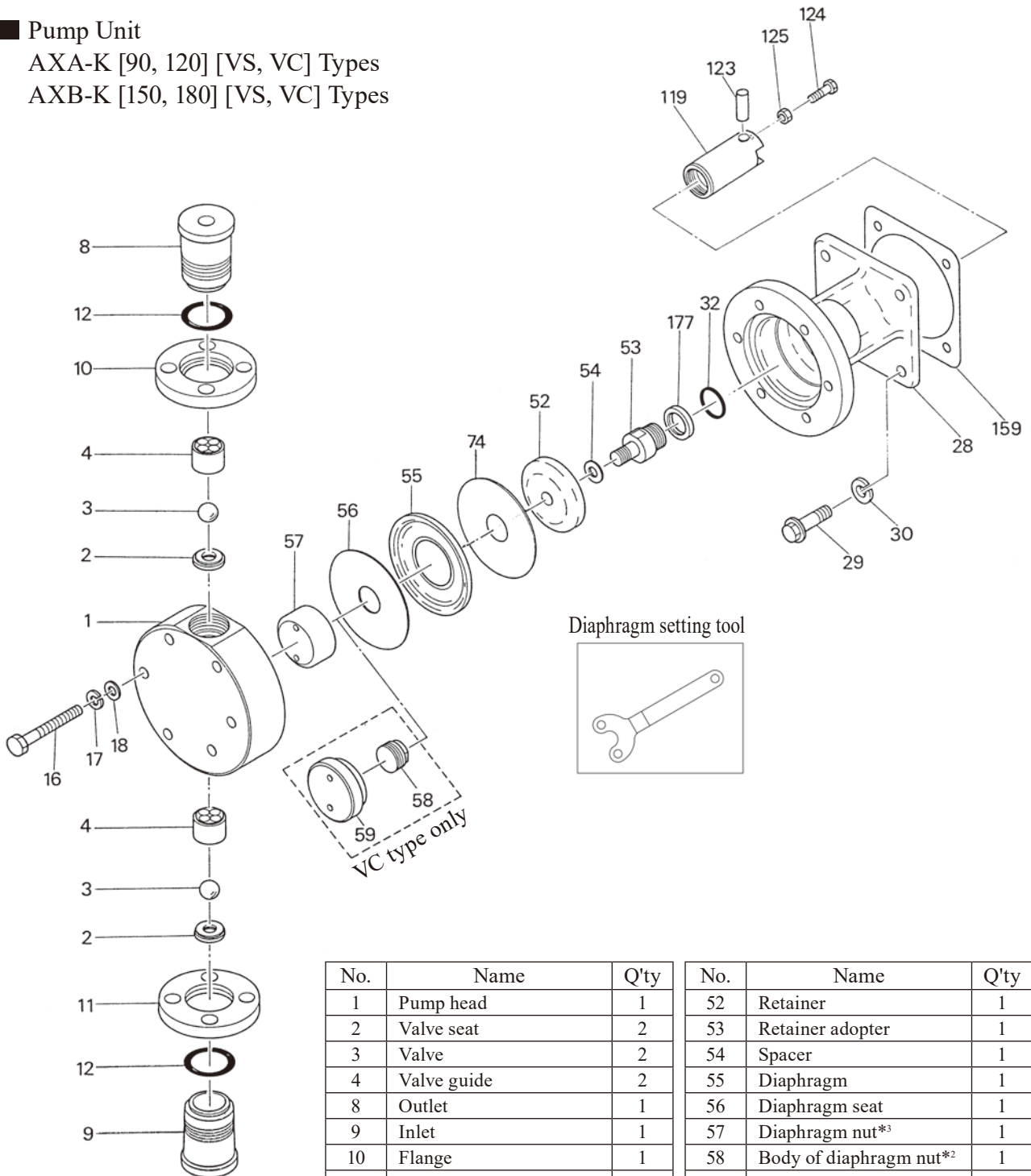
*2 AXB-K180 type only

*3 AXB-K150 type only (two eye-bolt holes on the pump head)

■ Pump Unit

AXA-K [90, 120] [VS, VC] Types

AXB-K [150, 180] [VS, VC] Types



No.	Name	Q'ty	No.	Name	Q'ty
1	Pump head	1	52	Retainer	1
2	Valve seat	2	53	Retainer adopter	1
3	Valve	2	54	Spacer	1
4	Valve guide	2	55	Diaphragm	1
8	Outlet	1	56	Diaphragm seat	1
9	Inlet	1	57	Diaphragm nut ^{*3}	1
10	Flange	1	58	Body of diaphragm nut ^{*2}	1
11	Flange	1	59	Diaphragm nut cover ^{*2}	1
12	O ring	2	74	Back diaphragm sheet ^{*4}	1
16	Hexagon head bolt	*1	119	Crosshead	1
17	Spring washer	*1	123	Crosshead pin	1
18	Plate washer	*1	124	Hexagon head bolt	1
28	Bracket	1	125	Hexagon head nut	1
29	Hexagon head bolt	4	159	Case Gasket	1
30	Spring washer	4	177	Case	1
32	Packing	1			

*1 K90type : M10×90L.....6
K120type: M10×100L.....10

*2 VC type only

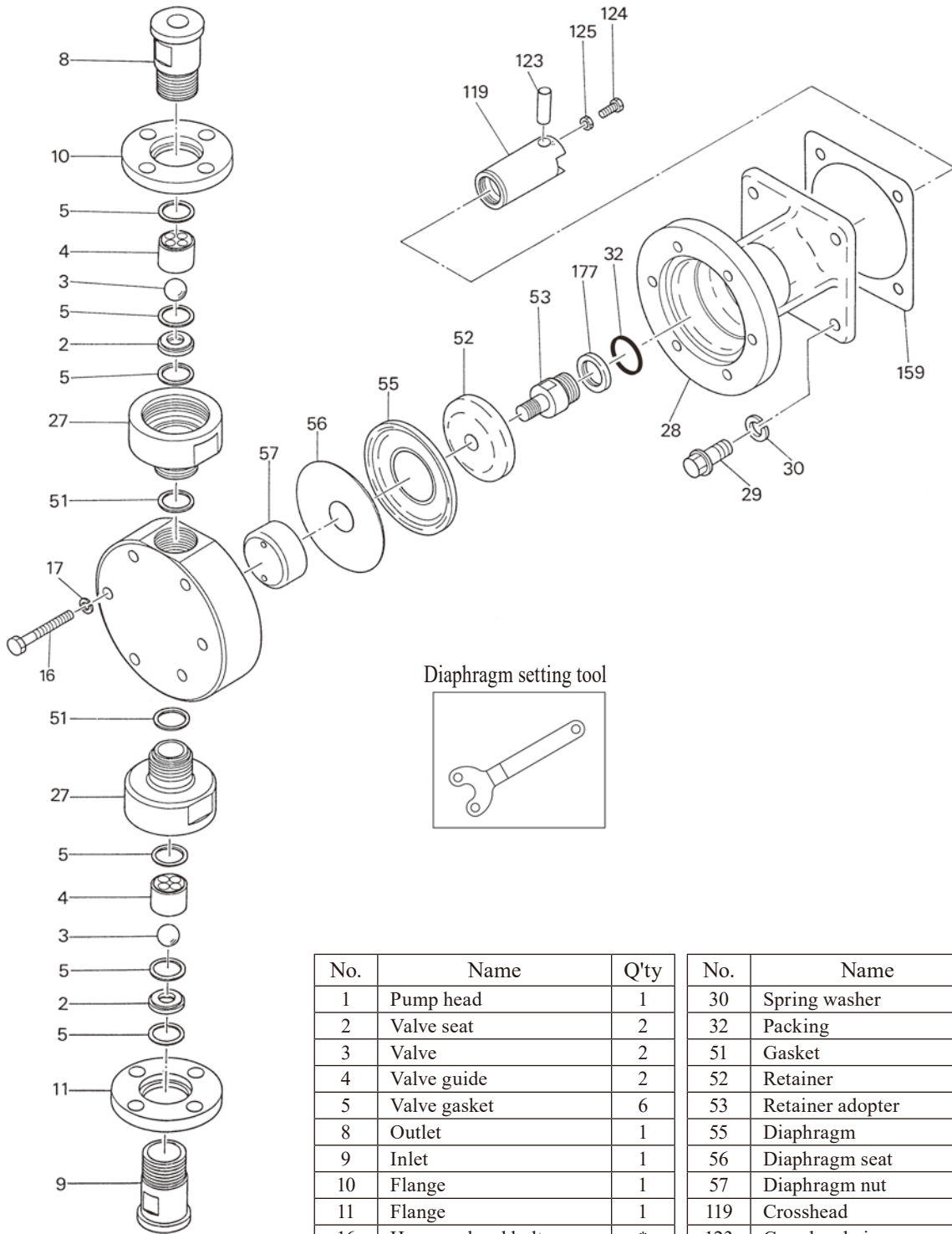
*3 VS type only

*4 AXB-K180 type only

K150type: M10×110L 10

K180type: M12×110L 10

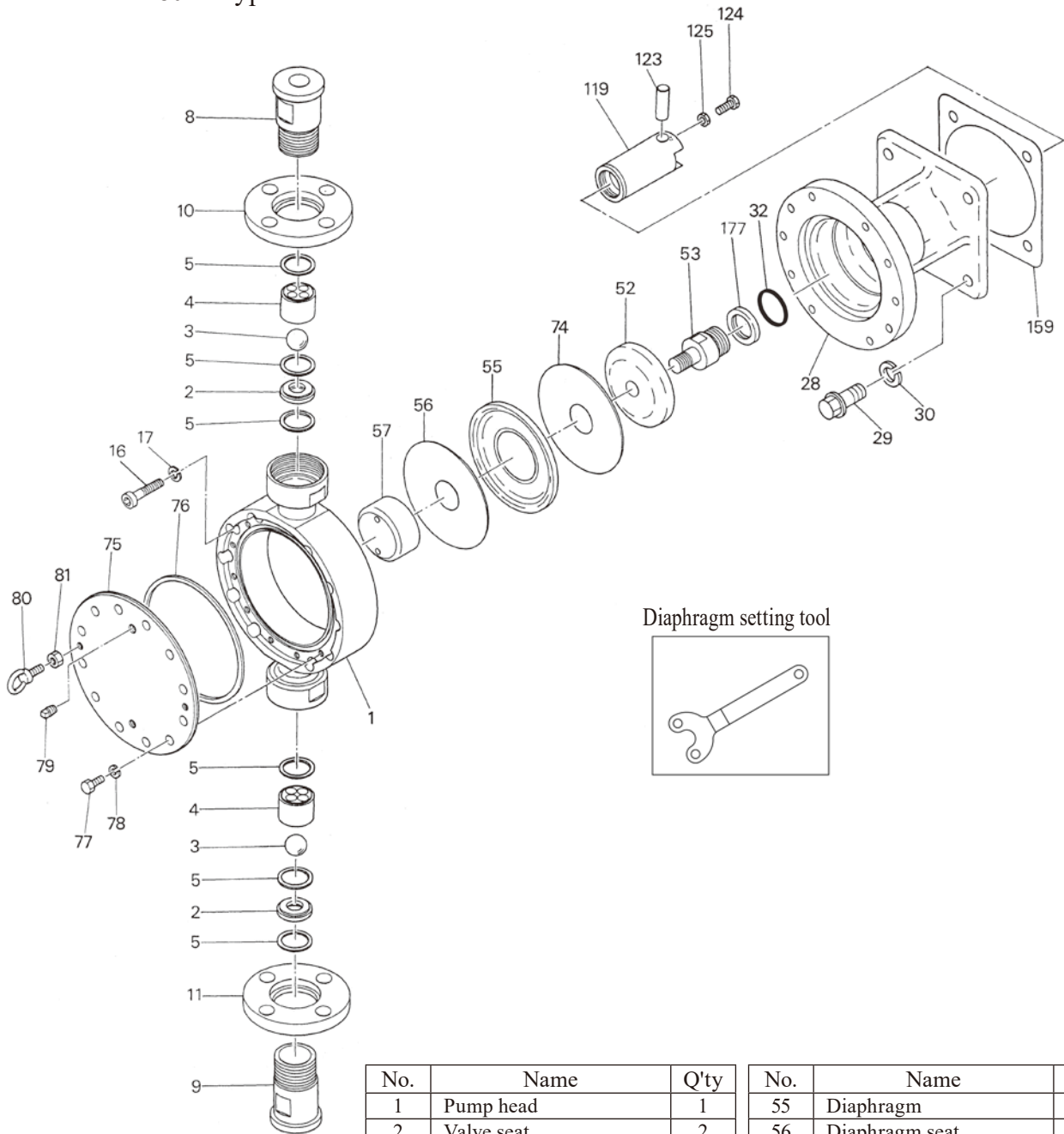
■ Pump Unit
 AXA-KE [90, 120] S4 Types



No.	Name	Q'ty	No.	Name	Q'ty
1	Pump head	1	30	Spring washer	4
2	Valve seat	2	32	Packing	1
3	Valve	2	51	Gasket	2
4	Valve guide	2	52	Retainer	1
5	Valve gasket	6	53	Retainer adopter	1
8	Outlet	1	55	Diaphragm	1
9	Inlet	1	56	Diaphragm seat	1
10	Flange	1	57	Diaphragm nut	1
11	Flange	1	119	Crosshead	1
16	Hexagon head bolt	*	123	Crosshead pin	1
17	Spring washer	*	124	Hexagon head bolt	1
27	Valve case	2	125	Hexagon head nut	1
28	Bracket	1	159	Case gasket	1
29	Hexagon head bolt	4	177	Case	1

* KE90type : M10×65L.....6
 KE120type: M10×65L 10

■ Pump Unit
 AXB-KE180S4 Types



No.	Name	Q'ty	No.	Name	Q'ty
1	Pump head	1	55	Diaphragm	1
2	Valve seat	2	56	Diaphragm seat	1
3	Valve	2	57	Diaphragm nut	1
4	Valve guide	2	74	Back diaphragm sheet	1
5	Valve gasket	6	75	Head cover	1
8	Outlet	1	76	Head gasket	1
9	Inlet	1	77	Hexagon head bolt	12
10	Flange	1	78	Spring washer	12
11	Flange	1	79	Plug	2
16	Hexagon socket head bolt	10	80	Eyebolt	2
17	Spring washer	10	81	Hexagon head nut	2
28	Bracket	1	119	Crosshead	1
29	Hexagon head bolt	4	123	Crosshead pin	1
30	Spring washer	4	124	Hexagon head bolt	1
32	Packing	1	125	Hexagon head nut	1
52	Retainer	1	159	Case gasket	1
53	Retainer adopter	1	177	Case	1









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