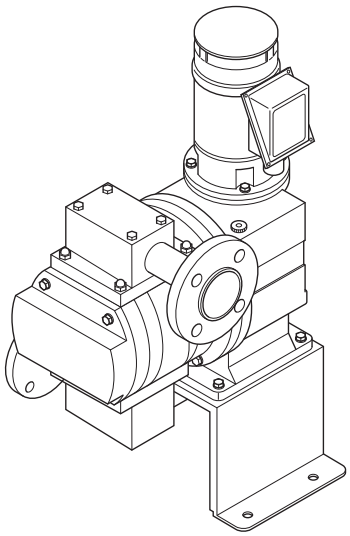
TACMINA

Smoothflow Pump

APL/APLS Series

OPERATION MANUAL

**Please read this OPERATION MANUAL carefully before use.
Operating the pump incorrectly in disregard of these instructions may lead to death, injury and/or cause property damage.**



This illustration is for the APL Series.

Applicable Models

APL-5	APLS-1
APL-10	APLS-3
APL-20	APLS-5
APL-35	APLS-10
APL-50	APLS-20
	APLS-35
	APLS-50

- TACMINA accepts no liability whatsoever for any damage caused by malfunction of this product and other damage caused by use of this product.
- For details on using the inverter and other components, refer to the respective manuals.
- In this manual, the explanations of motors are based on TACMINA-standard motors. If you have selected a motor that is not a standard product or if you have purchased the pump and motor separately, refer to the operation manual of the motor being used. Also check whether the motor has the appropriate explosion-proof specifications.
- If the pump you bought conforms to special specifications not described in this manual, use the pump according to the details of the separate meetings, drawings, and approval documents.
- Additional information on this product and manuals in other languages may be found on our website.

For the Safe Use of This Product

This manual is intended to help the operator to handle the product safely and correctly. In support of this aim, important safety-related instructions are classified as explained below.
Be sure to follow them at all times.

⚠ WARNING

• If the product is operated incorrectly in contravention of this instruction, it is possible that an accident resulting in death of serious injury will occur.

⚠ CAUTION

• This indicates that improper operation can result in an injury or physical damage to the product.

IMPORTANT

• This indicates information that should always be followed to maximize the product's performance and service life.

NOTE

• This indicates supplementary explanations.

Conditions of Use

⚠ WARNING

• In explosion-proof areas and in explosive/ignitable atmospheres, specify a motor and inverter that are compatible with these environmental conditions. This product cannot be used in these environments with the standard specifications.

⚠ CAUTION

• This pump can be used for transfer of liquids only. Do not use this pump for other applications. Doing so might cause accidents or malfunction.
• Do not use this pump outside the operating ranges indicated below. Doing so might cause malfunction.

Ambient temperature/humidity	0 to 40°C*1/35 to 85%RH
Transferred liquid temperature	0 to 40°C: PVC type (freezing not allowed) 0 to 60°C: stainless steel type (freezing not allowed)
Max. discharge pressure	0.5 MPa (5 bar)

*1 -10 to 50°C during transport and storage.

Transportation, Installation & Piping

⚠ WARNING

• Use a dedicated motor in explosion-proof areas or in explosive or combustible atmospheres. The pump with the standard motor cannot be used.
• In explosion-proof areas or in explosive or combustible atmospheres, work such as pump transportation, installation, piping, and wiring must be carried out by individuals who have knowledge of explosion-proof structures, the construction of electrical equipment, the related laws and regulations, and the principles and functions of the pump as well as the technical skills related to handling the pump. Failure to heed this warning may result in explosions, ignition, electric shocks, or injury.
• Install the pump in a location that cannot be accessed by anyone but control personnel.
• Do not stand or move under a hoisted pump. The pump might fall, causing an accident.

⚠ CAUTION

• Take preventative measures such as a chemical drainage ditch that is capable of handling the flow of the transfer liquid. Implement the measures so that the fluid level does not rise up to the surface where the pump is installed.
• Do not subject the pump to strong impacts.
• Keep the product level while transporting it. If the product is tilted by 10° or more, it may fall over.
• If this pump has been dropped or damaged, consult your vendor or a TACMINA representative. Using a dropped or damaged pump may result in accidents and/or malfunctions.
• The installation work must be carried out by individuals who have received the required training.
• Do not install the pump in humid or dusty locations. Otherwise there is a risk of electric shock or malfunction.
• When a tightening valve is located on the discharge-side piping, and when there is a risk of blockage, be sure to

install a relief valve on the piping immediately on the discharge side of this pump.

- If there is a chance of the fluid solidifying or freezing due to reasons such as using water-diluted solutions in areas where the temperature is low, install a heating apparatus or heat insulation. The fluid solidifying or freezing may lead to damage to the pump or surrounding equipment.
- The water used for the shipment tests may remain in the liquid-end section of the pump. If the pump will transfer chemicals that harden or give off gas when they react with water, be absolutely sure to drain the water and dry off the liquid-end section prior to use.
- The discharge volume cannot be adjusted by operating valves on the discharge piping.
- The pump head is not designed to support the piping. Ensure that the pump and pipe joints will not be subjected to any excessive force that might be exerted by, for instance, the weight of the piping or the shifting of the pipe joints out of position. In particular, pulsation will occur at the suction side, so provide sufficient support to ensure that the piping does not shake.

Electrical Wiring

⚠ WARNING

- If the pump is installed in a location where there is a risk of an explosive atmosphere of gas or steam (further referred to as a hazardous location), use an explosion-proof motor that is tailored to the hazardous location where the pump will be installed. If an explosion-proof motor is not used, there is a risk of explosion or ignition.
- The electrical wiring must be undertaken by a qualified electrician or other individual with the requisite electrical knowledge. Electrical work for preventing explosions must be performed for the wiring work as well. This work must be undertaken by a specialist who has the knowledge and skills relating to explosion-proof products in compliance with the technical standards governing electrical equipment, interior wiring regulations, guidelines for preventing explosions in facilities. Failure to heed this warning may result in explosions, ignition and/or electric shocks.
- Do not operate the pump with wet hands. Doing so may result in electric shocks.
- Take steps to ensure that the power will not be turned on during the course of work. Hang a sign on the power switch indicating that work is in progress.
- Securely ground the protective earth terminal, and be absolutely sure to install an earth leakage breaker. Otherwise, you may receive electric shocks.
- Use cables with a thickness that conforms to the rated current of the motor for the electrical wiring and the earth wire.
- To prevent water from entering the terminal box, implement waterproofing by way of cable glands or other similar methods.

⚠ CAUTION

- Connect the wires after checking the supply voltage. Do not connect the wires to a power supply that is not within the rated voltage range.
- Check the motor's voltage, phases, and power supply before wiring, and then correctly wire it. If the wiring is incorrectly wired, there is a risk of malfunction.
- The rotation direction for the motor has been predetermined for this pump. Wire the motor so that it rotates in the predetermined rotation direction.

Operation and Maintenance

⚠ WARNING

- Install the pump in a location that cannot be accessed by anyone but control personnel.
- Do not operate the pump with wet hands. Doing so may result in electric shocks.
- Take steps to ensure that the power will not be turned on during the course of work. Hang a sign on the power switch indicating that work is in progress.
- When there is a problem (such as when smoke appears or there is a burning smell), shut down the pump immediately, and contact your vendor or a TACMINA representative. Otherwise, there is a risk of fire, electric shock, malfunction, or accident.
- Check if the valves are open before operating the pump. If you have forgotten to open a valve or foreign objects are blocking the piping on the discharge side of the pump, an excessive pressure rise that will exceed the pump's specification ranges may occur, liquid may spray out, or piping may be damaged, which is dangerous.
- During air release, chemicals spray forcefully from the tip of the piping. Return the tip of the air release piping to the tank. During this operation, secure the air release hose in position.
- When working on the liquid-end section of the pump, wear protective gear suited to the chemical concerned (such as rubber gloves, a mask, protective goggles and work overalls that are resistant to chemical).
- Before maintaining or repairing the pump, be sure to release the discharge-side pressure, drain the chemicals from the liquid-end section, and wash the pump with deionized water.

⚠ CAUTION

- **The sound pressure level may exceed 80 dB. When performing work near the pump while it is operating, wear protective gear to protect your ears.**
- **Set the relief valve pressure to a value that is 120% or less of the pump's normal operation pressure.**
- **Gear oil may spray out when you open the oil filling hole. Wait for the drive box to cool off sufficiently before you perform this work.**
- **Replace the gear oil every 4,000 hours (operation time) or 1 year (usage period), whichever is reached first.**
- **Do not mix different brands of gear oil.**

Other precautions

⚠ CAUTION

- **Do not modify or alter the pump.**
- **The materials of the parts used in this pump are written in the provided diagrams and similar documents. When it comes time to dispose of the pump, do so after first giving careful consideration to the appropriate disposal method for each material according to the laws and regulations in the area where the pump will be disposed of. Alternatively, contract the disposal of the pump to a dedicated waste disposal company.**

Checking the Product

When unpacking, please confirm the following items:

(1) Is the enclosed product the same model you ordered?

(2) Do the details on the pump nameplate match your order?

(3) Are all the accessories present and correct?
Please refer to the accessory list below.

(4) Can you detect any damage due to vibration or shock during transportation?

(5) Are there any loose or disconnected screws?

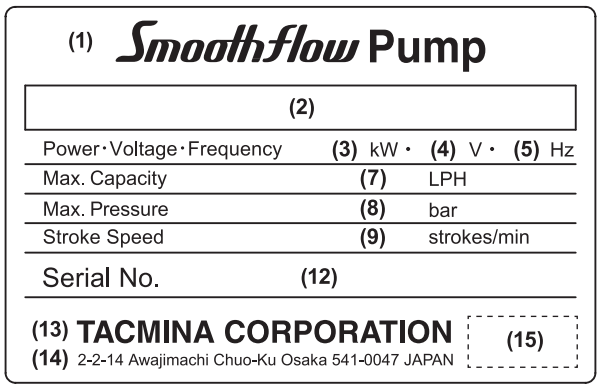
All TACMINA products are carefully checked prior to shipment. If, however, you find a defect, please contact your supplying agent.

■Accessory List

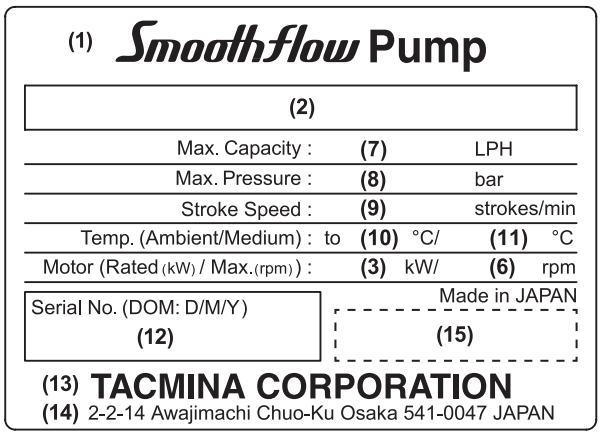
For all models: Operation Manual 1 copy

■Name plate

Products with CE marking
(65mm × 35mm)



Products with CE and ATEX markings
(60mm × 43mm)



(1) Brand Name
(2) Model Code
(3) Motor Power (kW)
(4) Motor Voltage (V)
(5) Motor Frequency (Hz)
(6) Max. Motor Speed (rpm)
(7) Max. Capacity (LPH)
(8) Max. Pressure (bar)
(9) Stroke Speed (strokes/min)
(10) Ambient Temperature (°C)
(11) Temperature of Liquid Used (°C)
(12) Serial Number
Day of Manufacture (Day/Month/Year)
(13) Manufacturer
(14) Address
(15) Marking and type of Protection
Refer to the EU Declaration of Conformity for directives that apply to this product.
Only pump parts are applied to this standard.
Please note a motor for the pump is not included.

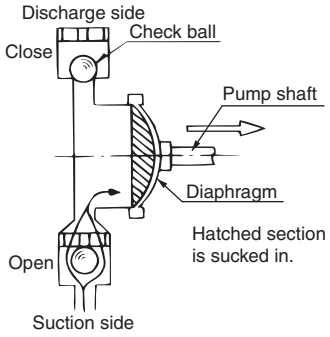
Contents

Explanation of Product

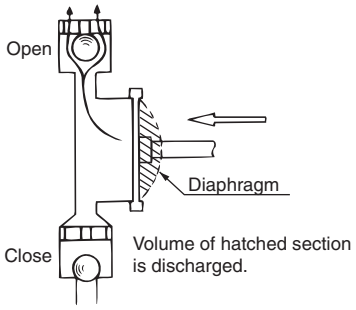
The APL/APLS Series pumps are direct drive diaphragm pumps that minimizes the pulsation of diaphragm metering pumps. These diaphragm pumps feature outstanding economy. As pulse on the discharge side is small, the aperture of the piping can be made narrower and a pulsation attenuator is no longer required. This makes it easier to use the pump as a pump for transferring liquid or as a pump for manufacturing processes. On APL/APLS Series compact pumps, the two pump heads are arranged in series and the motor is located vertically.

Principle of Operation

(1) Motor rotation is decelerated by a reduction gear.
(2) Rotary action is converted to reciprocating motion by an eccentric cam mechanism.
(3) When the diaphragm at the end of the pump shaft moves in a reciprocal manner, the volume inside the pump head changes.
(4) When the diaphragm moves backward, minus pressure is generated inside the pump head. At this time, the check ball on the discharge side closes the flow path as shown in Figure 1 to prevent reverse flow from inside the discharge-side piping. On the hand, liquid flows into the pump head from the suction side as the check ball on the suction side opens the flow path.
(5) Next, when the diaphragm is pushed out forwards, positive pressure is generated inside the pump head. For this reason, the check ball on the suction side closes the flow path to open the discharge side, and discharge liquid to the discharge side. (Figure 2)



(Figure 1)

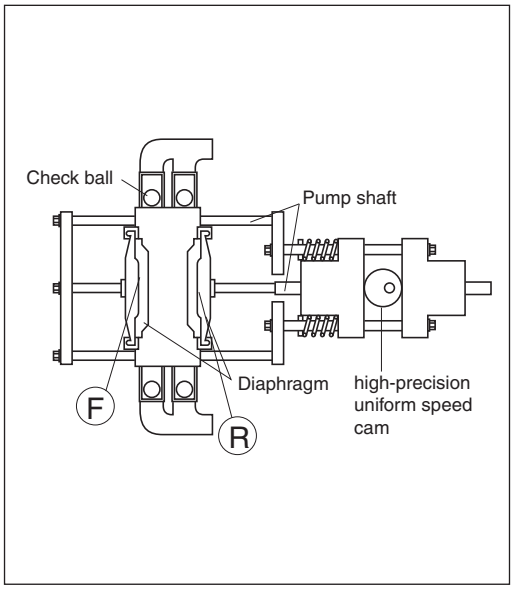


(Figure 2)

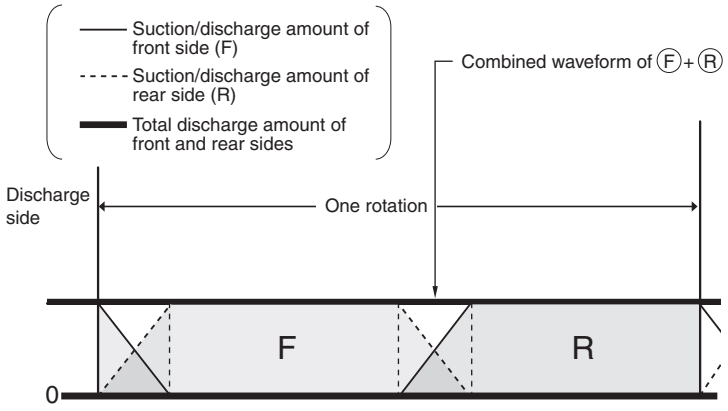
■Duplex Pulseless Mechanism

This pump employs a high-precision uniform speed cam mechanism as the eccentric cam mechanism. It results in a trapezoid shaped waveform F as shown in Figure 1, and the successive discharge waveforms from each pump head partially overlapping by a 180° phase in such a way as R that the combined waveform is a horizontal straight line. Pulsation occurs on the suction side.

* Do not operate the motor in the reverse direction as this causes large pulsation on the discharge side.



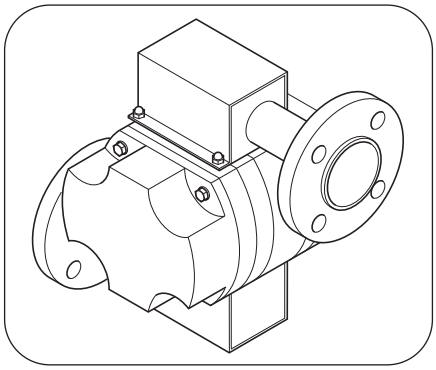
■Discharge waveform



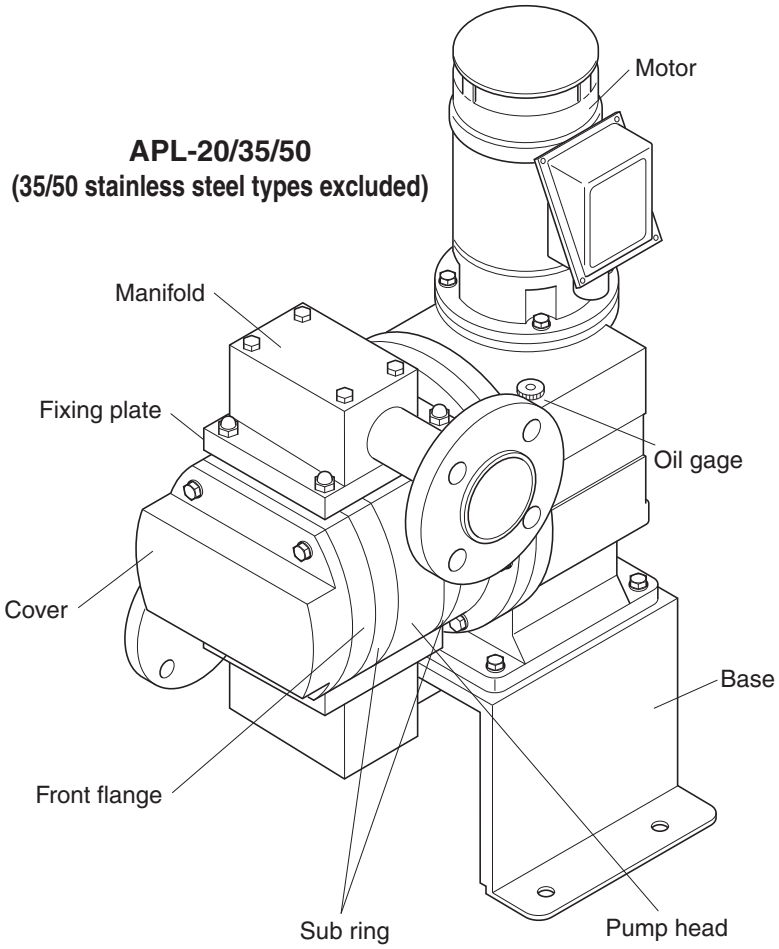
Names of Parts

APL Series

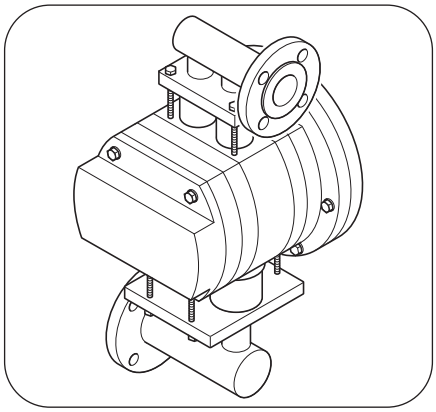
APL-5/10



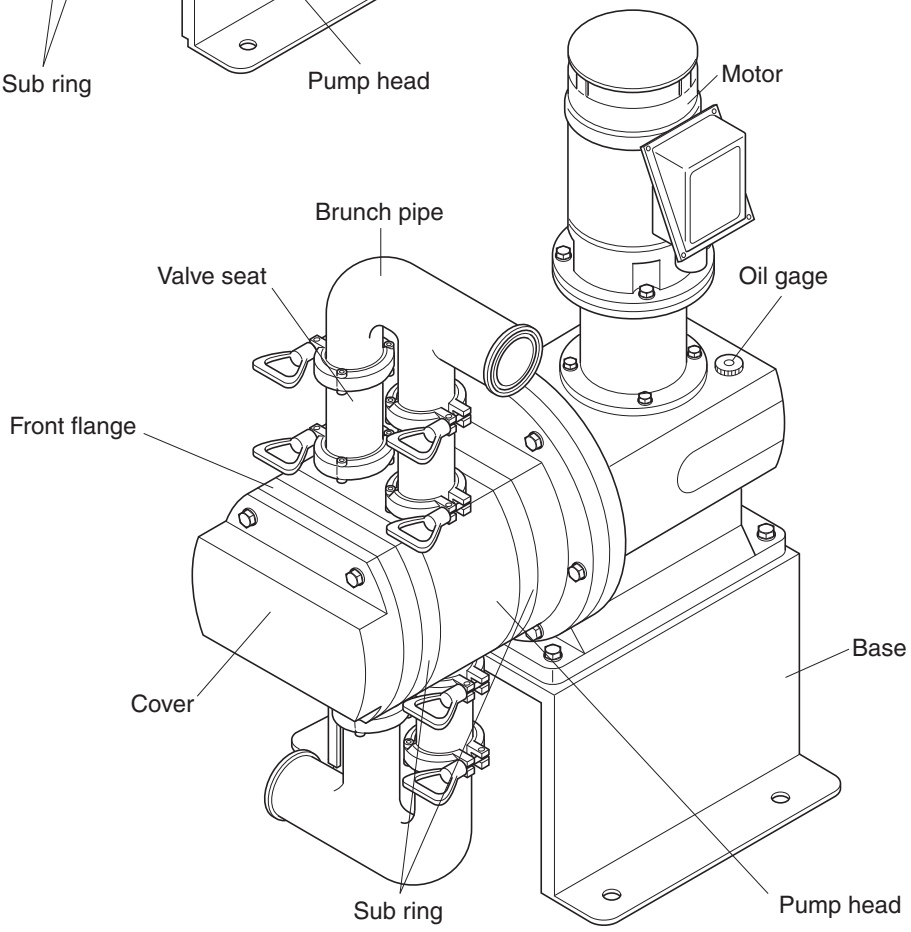
APL-20/35/50
(35/50 stainless steel types excluded)



APL-35/50
(Stainless steel types only)



APLS Series



Installation

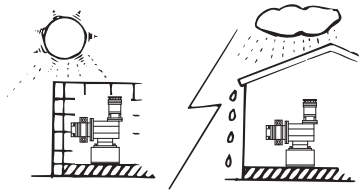
⚠ WARNING

- **Use a dedicated motor in explosion-proof areas or in explosive or combustible atmospheres. The pump with the standard motor cannot be used.**
- **In explosion-proof areas or in explosive or combustible atmospheres, work such as pump transportation, installation, piping, and wiring must be carried out by individuals who have knowledge of explosion-proof structures, the construction of electrical equipment, the related laws and regulations, and the principles and functions of the pump as well as the technical skills related to handling the pump. Failure to heed this warning may result in explosions, ignition, electric shocks, or injury.**
- **Do not stand or move under a hoisted pump. The pump might fall, causing an accident.**
- **Install the pump in a location that cannot be accessed by anyone but control personnel.**

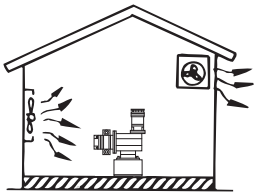
Installation Site

- This pump can be installed both indoors and outdoors. However, avoid installing the pump in sites that might shorten its service life.

Avoid the following sites:
- Sites subject to the direct sunlight or sites where corrosive gases are generated
- Sites exposed to the wind and rain, or poorly ventilated sites
- Sites subject to lots of moisture or dust

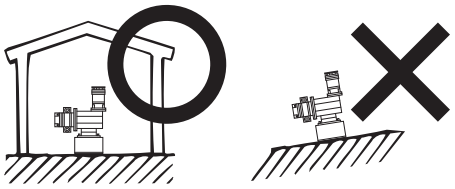


- Install the pump in a location that is well-ventilated during summer, and where chemicals will not freeze in winter.



- Leave enough space to allow easy access for maintenance and inspection work.

- Install the pump on a flat horizontal surface and fix it securely to prevent it from vibrating during operation. If the pump is installed on an inclined surface, the pump may not be able to discharge properly or at all.

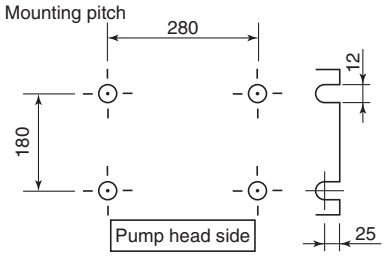


Position of Installation Bolts

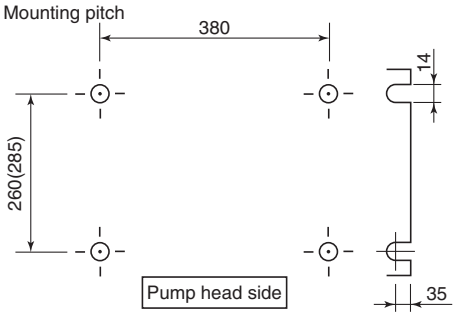
●When using a base

Prepare four M10 or M12 bolts for fixing the base.

APL/APLS-1/3/5/10



APL/APLS-20/35/50

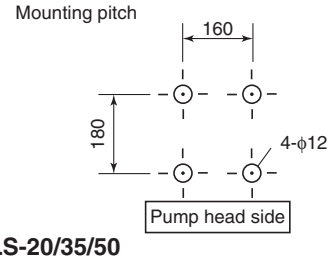


✻ Values in parenthesis "( )" is the mounting pitch for 35/50 types.

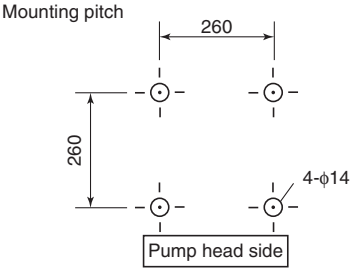
●When removing the base and installing directly on the floor

Prepare four M10 bolts for fixing the base.

APL/APLS-1/3/5/10



APL/APLS-20/35/50

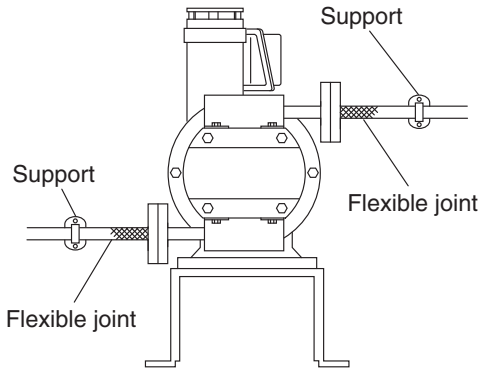


Piping

Requests during Piping

● Pump head joining section with pipes

- Provide sufficient support for the piping so that the pump and the pipe joining section do not bear loads applied by the weight of the piping or shifts in the joining section. It is also recommended that flexible joints be installed in order to protect the pump and pipe joining sections.



● Length of piping

- If the piping is too long, pressure loss might increase, causing the pump's permissible pressure to be exceeded and overfeed to occur.
- When extending the piping, pressure loss might exceed the pump's maximum discharge pressure. So, larger piping must be provided. Notify your supplying agent of (1) viscosity of the liquid, (2) length (positional relationship) of the piping, (3) specific gravity of the liquid, and other information.
  Your supplying agent will select the ideal piping sizes for you.

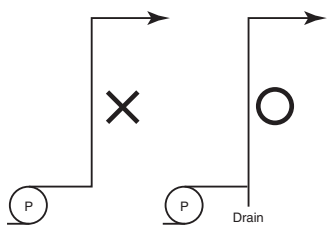
● Liquid containing slurry

When transferring liquid containing slurry on this pump, satisfy the following conditions and observe the piping cautions.

- For details of the size and concentration of slurry that can be transferred by this pump, contact TACMINA.

Piping cautions

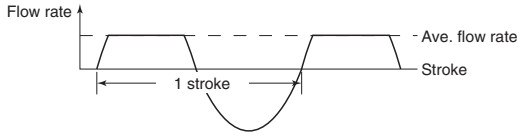
- Install a drain on the ascending piping immediately after the joint on the pump's discharge side.



● Pulsation on the suction-side piping

- Though pulsation is minimized on the discharge side, pulsation*1 occurs on the suction piping.
- In principle, the piping aperture must be larger than the pump's aperture.

*1) Pulsation
This pump generates pulsation unique to reciprocating pumps. This pulsation has sine wave characteristics, and the momentary flow rate is about twice that of the average flow rate. For example, this means that a momentary flow rate of 6 L/min is shown on a reciprocating pump having an average flow rate 3 L/min.
For this reason, when selecting piping, the piping differs from that used on a continuous flow pump such as a centrifugal pump in that a value twice the operating discharge volume (L/min) must be used.

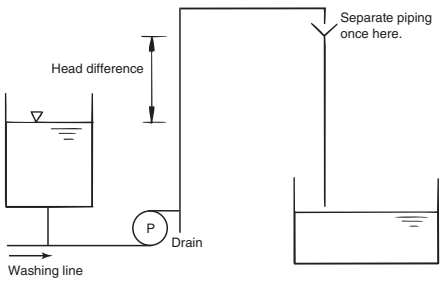


Flow rate wave form of this pump (one side)

● Other

- When transferring liquid that coagulates due to temperature changes, the transferred liquid will coagulate in the pump head or piping, which sometimes might break the pump or its periphery. Be sure to install a heater or heat retainer.

- When transferring liquid is containing slurry, use narrower piping to increase the flow velocity inside the piping within the permissible pressure loss range.
- Install a washing water (pressurized water such as city water) line on the suction-side piping. Before stopping pump operation, flush the pump and piping with washing water to remove any slurry inside.
- Avoid use of a back pressure valve. Slurry sticking to valve seals will prevent the valves from functioning.
- When siphoning or overfeed might occur, provide a countermeasure as much as possible on the ascending piping (by a head difference).



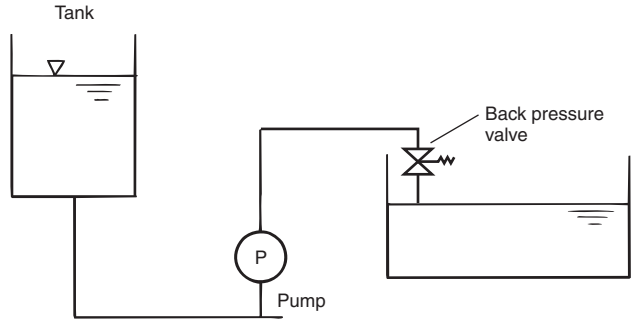
- When a relief valve is installed and is acting, slurry will bite into the seals. So, the piping must be flushed with washing water.

Piping

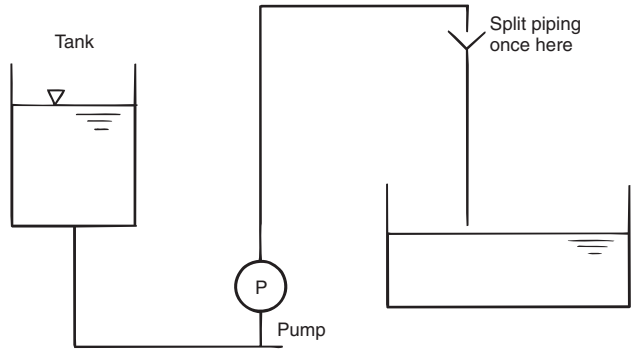
Injecting fluid below the level of the liquid in the tank

When injecting to a position lower than the level of the liquid in the tank, siphoning will cause liquid to flow down naturally. To prevent this, either install a back pressure value, or install a ventilation duct at a position above the level of liquid in the tank and near the injection point.

(Example 1)



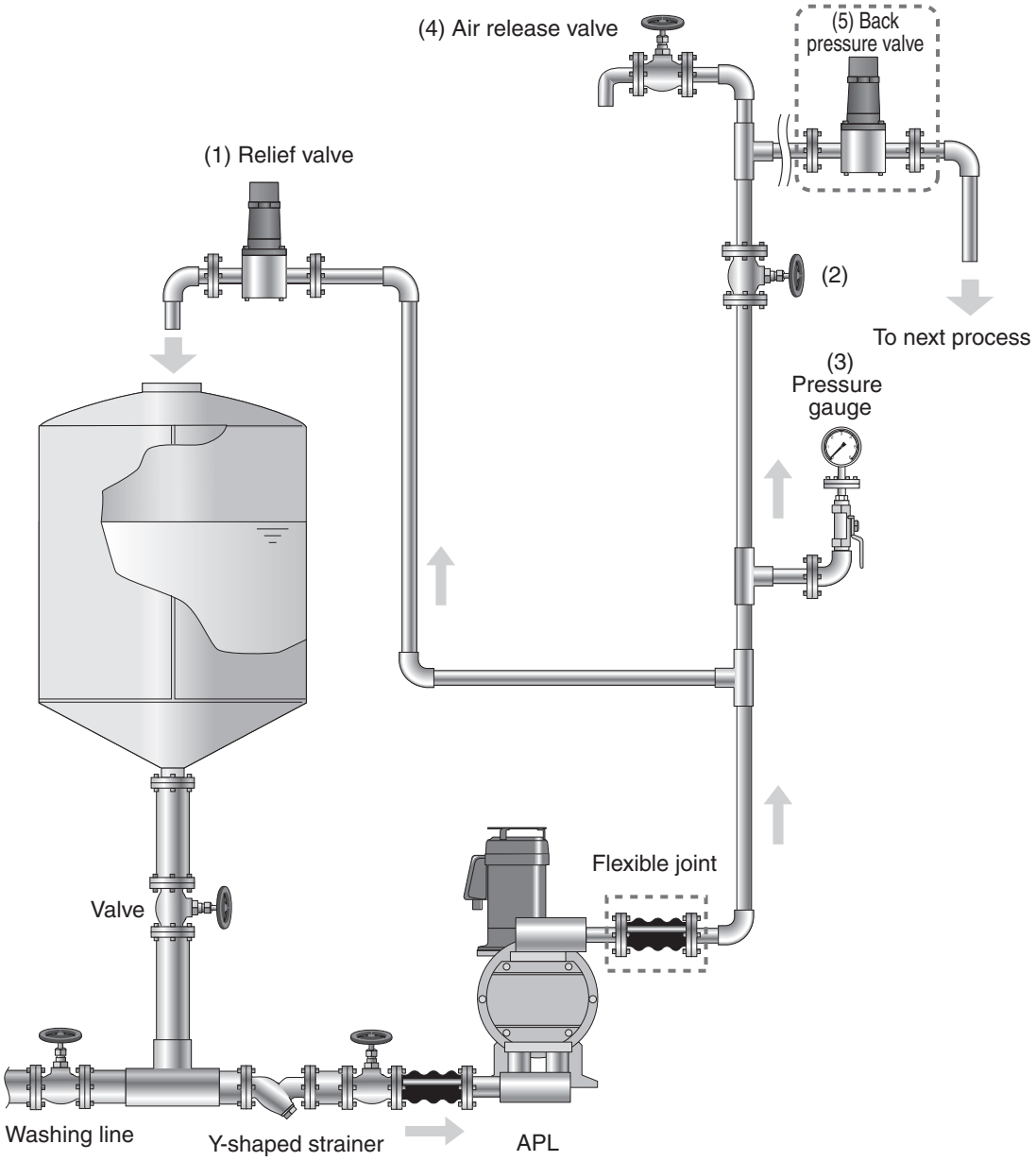
(Example 2)



Piping

Recommended piping example

Install the pump so that it is lower than the minimum liquid level in the tank. (Pressure booster piping)
The length that the piping can be extended to differs according to the viscosity and specific gravity of the liquid and the piping diameter. Lay piping taking the piping resistance and other factors into full consideration.
Make the suction-side piping as short as possible and use piping with as few bends and joints that will cause resistance as possible.



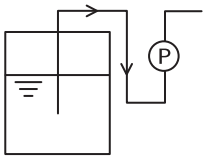
(1) Install a relief valve, which can automatically release the pressure, close to the pump within the discharge-side piping.
(2) To facilitate maintenance, install tightening valves near the pump on both the discharge and suction sides.
✻ Do not shut off these valves while the pump is operating.
(3) Install a pressure gauge to measure the pump's discharge pressure near the pump.
(4) It is convenient to install the air release valve on the piping immediately after the discharge side.
(5) Installing a back pressure valve is effective if overfeeding and dripping are occurring due to the piping conditions.

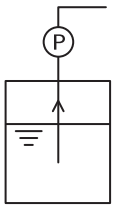
Relief piping
- Do not use relief piping that is narrower than the standard size.
- Point the secondary piping down into the tank without going up.

Piping

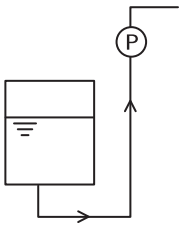
Poor Examples of Piping

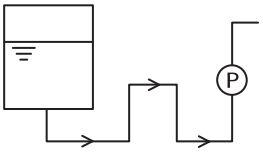
Do not lay piping as shown in the following examples. This will cause unstable discharge or liquid may not be able to be discharged.



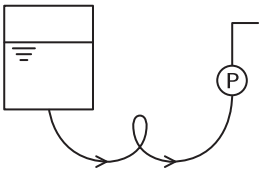


Suction upwards
(reduced accuracy)

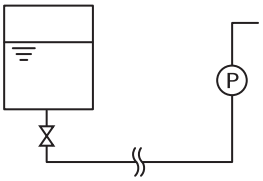




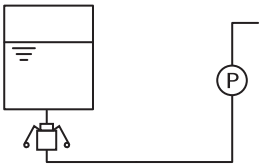
Rise-and-fall midway piping
(reduced accuracy)



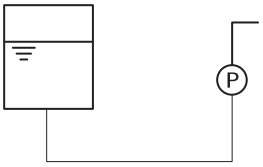
Soft hose
(blockage on suction side, pulsation)



Suction-side piping too long
(cavitation, entry of air, pulsation)



Coupler
(entry of air)



Suction-side piping too narrow
(cavitation)

Electrical Wiring

⚠ WARNING

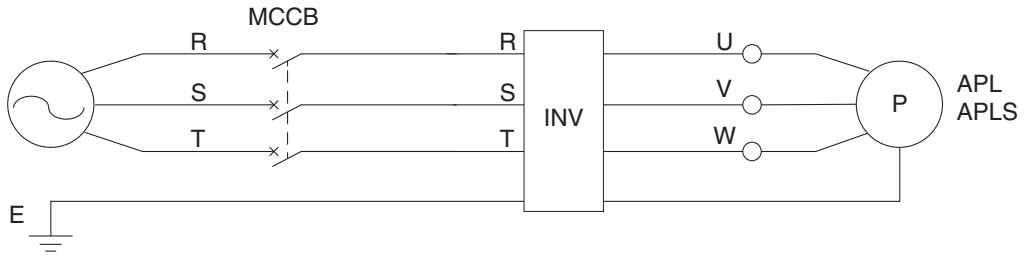
- **If the pump is installed in a location where there is a risk of an explosive atmosphere of gas or steam (further referred to as a hazardous location), use an explosion-proof motor that is tailored to the hazardous location where the pump will be installed. If an explosion-proof motor is not used, there is a risk of explosion or ignition.**
- **The electrical wiring must be undertaken by a qualified electrician or other individual with the requisite electrical knowledge. Electrical work for preventing explosions must be performed for the wiring work as well. This work must be undertaken by a specialist who has the knowledge and skills relating to explosion-proof products in compliance with the technical standards governing electrical equipment, interior wiring regulations, guidelines for preventing explosions in facilities. Failure to heed this warning may result in explosions, ignition and/or electric shocks.**
- **Do not operate the pump with wet hands. Doing so may result in electric shocks.**
- **Take steps to ensure that the power will not be turned on during the course of work. Hang a sign on the power switch indicating that work is in progress.**
- **Securely ground the protective earth terminal, and be absolutely sure to install an earth leakage breaker. Otherwise, you may receive electric shocks.**

The pump's flow rate is adjusted by changing the inverter frequency and controlling the motor speed.

- The connection size of the inlet of the wiring conduit of standard motors is G3/4. If you are using a non-standard motor, check its wiring conduit connection diameter.
- Be sure to use a conduit to protect the wiring.

* Wire the motor so that rotation direction of the cooling fan is clockwise as viewed from above. If the motor rotates in the opposite direction, reconnect two of the three wires.

Wiring Example



MCCB : Molded case circuit breaker
INV : Inverter

* For pump maintenance, install separate MCCBs for this pump.

Operation

⚠ WARNING

- **Install the pump in a location that cannot be accessed by anyone but control personnel.**
- **Do not operate the pump with wet hands. Doing so may result in electric shocks.**
- **Take steps to ensure that the power will not be turned on during the course of work. Hang a sign on the power switch indicating that work is in progress.**
- **When there is a problem (such as when smoke appears or there is a burning smell), shut down the pump immediately, and contact your vendor or a TACMINA representative. Otherwise, there is a risk of fire, electric shock, malfunction, or accident.**
- **Check if the valves are open before operating the pump. If you have forgotten to open a valve or foreign objects are blocking the piping on the discharge side of the pump, an excessive pressure rise that will exceed the pump's specification ranges may occur, liquid may spray out, or piping may be damaged, which is dangerous.**
- **During air release, transfer liquid may spray forcefully from the tip of the piping. Return the tip of the air release piping to the tank. During this operation, secure the air release hose in position.**
- **Before starting operation, be sure to check the amount of gear oil and add more if the amount is low.**

Before the First Operation

- Make sure that the operating ranges (ambient temperature, liquid used, etc.) are appropriate. (For details on operating ranges, see “Conditions of Use” on page 1.)
- Flush the piping with water or other safe liquid, and make sure that the piping is free of leaks and blockages. Also, flush the piping to prevent chips and other foreign objects from remaining in the pipes during piping.

Check the following items every day.

Before Operation

Check Point	Details to Check	Remarks
Pump head Joints	Check for looseness. If the joints are loose, retighten them.	When first operating the pump after maintenance, retighten in the same manner.
Chemical tank	Make sure that there are sufficient chemicals in the chemical tank. Replenish the chemical tank if necessary.	Pay particular attention when handling chemicals or performing processes that are adversely affected by contact with air.
Piping	Check the piping for any disconnections, liquid leaks caused by damage to piping. Reconnect or repair damage if necessary.	
Valves (suction side and discharge side)	Make sure that valves on the suction side and discharge side are open. Open any closed valves.	Closed valves may cause pressure to build up, chemicals to spurt out or damage piping.
Power supply	Make sure that the pump is connected correctly to the specified power supply.	Connection to a wrong power supply may cause motor seizure.
Electrical wiring	Make sure that electrical connections to inverters and other devices are correct.	Wrong connections may cause short circuits or electrical leakage.
Driven parts	Make sure that the amount of drive oil in the drive box is appropriate. Check the drive box for oil leakage.	Refer to "Checking the Amount of Drive Oil" and re-tighten if you find an oil leak.

During Operation

Check Point	Details to Check	Remarks
Pump head	Check for liquid leaks from the holes on the gland flange, front flange and bottom of the sub-ring.	Liquid leaks may indicate the damage of diaphragm. So, inspect the diaphragm also.
Joints	Check for liquid leakage.	If there are liquid leaks, inspect for insufficient tightening and loosening of bolts, and re-tighten as necessary. If this does not correct the liquid leak, inspect each of the O-rings (packing in the case of a sanitary type pump).
Discharge-side pressure	Check the needle of the pressure gage on the pump discharge side.	If an abnormal numerical value is indicated, the piping may be clogged or valves may be blocked. Inspect the piping also.
Motor unit Pump unit	Check for generation of heat or abnormal noise.	Refer to "Troubleshooting."

- When using the pump for the first time
- When changing the discharge volume

Adjust the discharge volume (page 17)

- When stopping operation for a long time
- When restarting the pump after prolonged downtime

When stopping operation for a long time (page 17)

Trial Operation

IMPORTANT

- Make sure that the motor is rotating to the right (clockwise) when the motor is viewed from the cooling fan side. (Do not operate the pump in the opposite direction. If the motor is rotating in the opposite direction, considerable pulse occurs on the discharge side.)

(1) Operate the pump by inching, and check the direction of pump operation.
(2) Operate the pump by normal operation.

When liquid is not sucked up by trial operation
A probable cause is that foreign objects are biting into the seals on the discharge or suction side (sections sealed by check balls). Remove any dirt by the following procedure:
(1) Turn the pump OFF.
(2) Remove the manifolds or valve seats, and wash the check balls and valve seats with water.
(3) Re-assemble the check balls and valve seats into the pump heads while still wet making sure not to mistake the discharge and suction sides.
(Be sure to allow the inside of the pump to dry when using liquid that is adversely affected by water.)

Adjusting the Discharge Volume

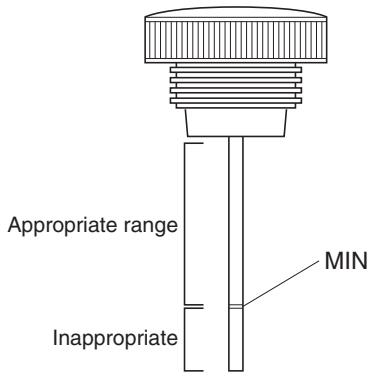
IMPORTANT

• Limit the maximum revolution speed to 60 Hz even when using a high-speed mechanism such as an inverter.

This pump does not have a flow rate adjusting dial like a general metering pump. The stroke length is fixed to 100% at all times and cannot be changed.
The injection amount is changed by varying the revolution speed of the motor by an inverter or other device.
This pump can be operated within the range 6 to 60 Hz by a combination of a standard motor and TACMINA specified inverter.

Checking the Amount of Drive Oil

(1) Draw out the oil replenishment cap/oil gage at the top of the drive box with pump operation stopped, and wipe the oil gage.
(2) Install the oil gage again. (Tighten the screw as far as possible.)
(3) Remove the replenishment cap/oil gage, ad check the amount of oil by the oil sticking to the oil gage.
• If oil is at or above the notch on the oil gage, then the amount of oil is sufficient.



(4) Return the replenishment cap/oil gage to its original position.

When Stopping Operation for a Long Time

Perform the following operation when stopping operation for a long time (e.g. due to an off season) and restarting pump operation after a prolonged downtime.

When Stopping Operation

(1) Wash inside the pump head.
Suck in and discharge clean water or diluted detergent for about 30 minutes.
(2) Completely turn OFF the pump's power supply.
(3) Attach the pump's covers.
Adopt other measures to prevent dirt or dust from accumulating on the pump, and protect the pump from corrosive environments.

When Resuming Operation

(1) Check the inside of the tank for sediment, clouding of liquid and other abnormalities.
If the liquid inside the tank has deteriorated, drain the liquid, wash the inside of the tank with water, and completely replace with fresh liquid.
(2) Check the check ball and valve seats inside the pump heads for adhesion of dirt.

Maintenance

⚠ WARNING

- **When working on the liquid-end section of the pump, wear protective gear suited to the chemical concerned (such as rubber gloves, a mask, protective goggles and work overalls that are resistant to chemical).**
- **Take steps to ensure that the power will not be turned on during the course of work. Hang a sign on the power switch indicating that work is in progress.**
- **Before maintaining or repairing the pump, be sure to release the discharge-side pressure, drain the chemicals from the liquid-end section, and wash the pump with deionized water.**

Periodic Inspection

• 4000 hours of operation or once every year (2000 hours of operation or once every 6 months on the 35/50 models) • Abnormal discharge (reduced discharge volume) • Chemical leakage around the pump head	**Replacing the diaphragm (page 19)**
• 4000 hours of operation or once every year • Abnormal discharge (reduced discharge volume)	**Replacing the valve seat and check ball (page 24)**
• 4000 hours of operation or once every year • Abnormal noise from the drive section • Abnormal generation of heat on the drive section	**Replacing and checking the drive oil (page 17, 26)**

When an Abnormality Occurs

• Other abnormalities	**Troubleshooting (page 27, 28)**

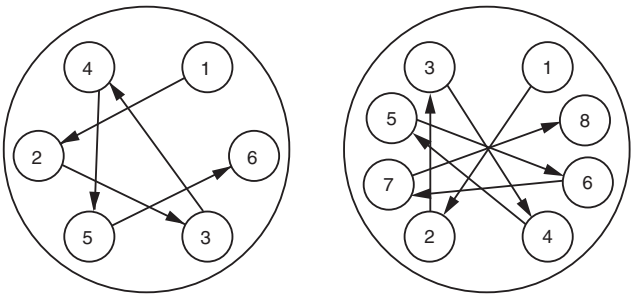
NOTE

- Perform maintenance and inspection every 4000 hours of operation or once every year, whichever comes first.

Replacing the Diaphragm

IMPORTANT

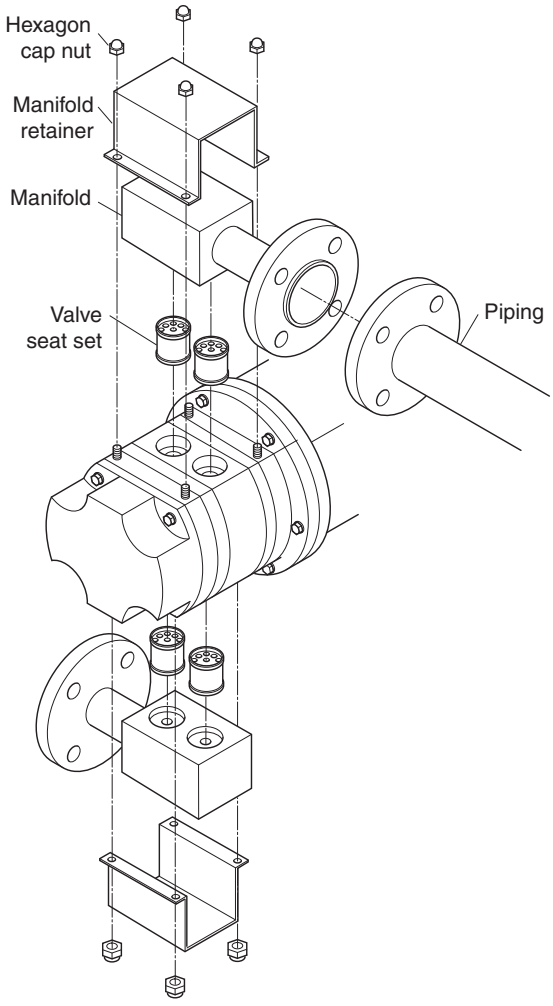
- When loosening or tightening the hexagon head bolts on the front flange, loosen or tighten them in the order shown in the figure on the right a little at a time using even force.
  Insufficient tightening of the bolts might cause liquid to leak from the pump head.



Replacing the Valve Seats

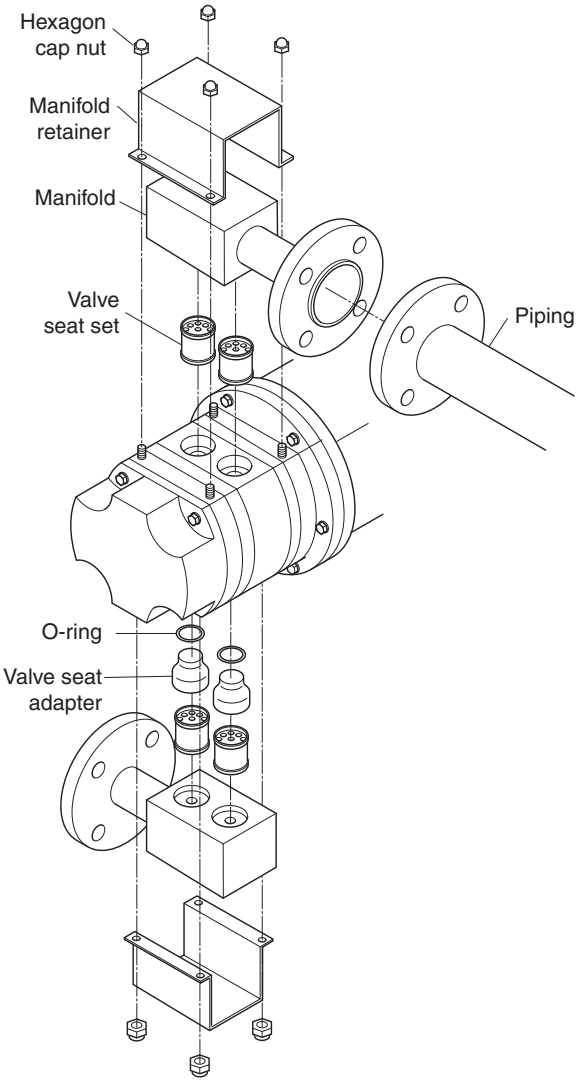
■APL-5

[Common to both upper/lower sections]
(1) Remove the manifold from the piping.
(2) Remove the four hexagon cap nuts, and remove the manifold retainer.
(3) Remove the valve seat set.



■APL-10

[Common to both upper/lower sections]
(1) Remove the manifold from the piping.
(2) Remove the four hexagon cap nuts, and remove the manifold retainer.
(3) Remove the valve seat set and valve seat adapter (lower section only).



■APL-20/35/50(35/50 stainless steel types excluded)

[Upper section]

(1) Remove the manifold from the piping.
(2) Remove the four hexagon head bolts fixing the manifold in place.
(3) Remove the manifold.
(4) Remove the valve seat set.

To disassemble the pump head, remove the fixing plate.

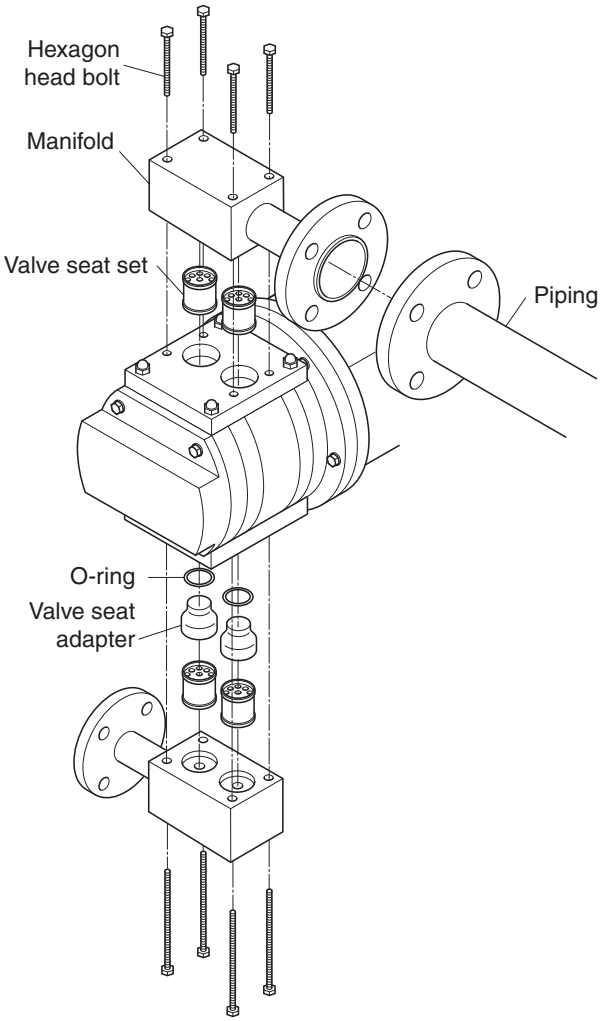
(5) Remove the four hexagon cap nuts.
(6) Remove the fixing plate.

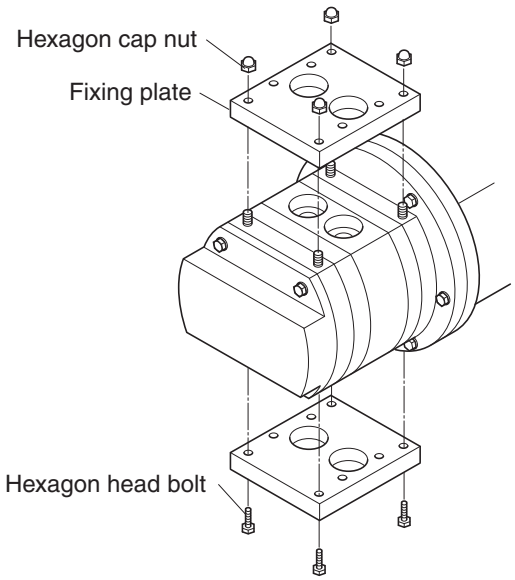
[Lower section]

(1) Remove the manifold from the piping.
(2) Remove the four hexagon head bolts fixing the manifold in place.
(3) Remove the manifold.
(4) Remove the valve seat set and valve seat adapters.

To disassemble the pump head, remove the fixing plate.

(5) Remove the four hexagon head bolts fixing the fixing plate in place.
(6) Remove the fixing plate.





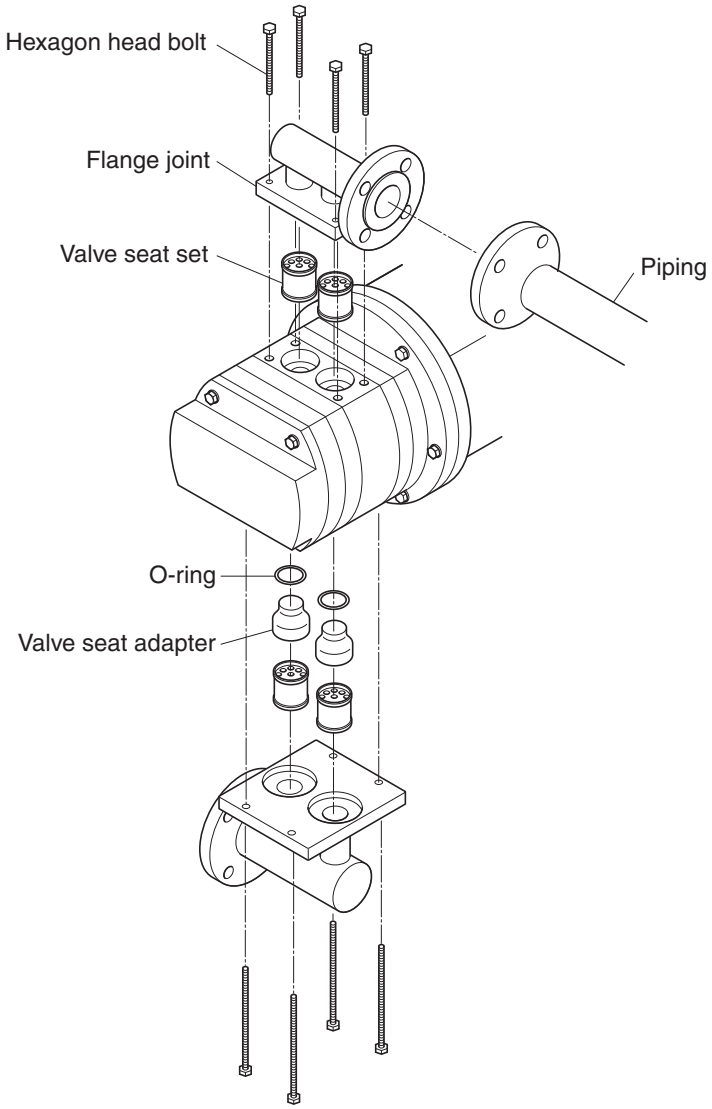
■APL-35/50(Stainless steel type)

[Upper section]

(1) Remove the flange joint from the piping.
(2) Remove the four hexagon head bolts fixing the flange joint in place.
(3) Remove the flange joint.
(4) Remove the valve seat set.

[Lower section]

(1) Remove the flange joint from the piping.
(2) Remove the four hexagon head bolts fixing the flange joint in place.
(3) Remove the flange joint.
(4) Remove the valve seat set and valve seat adapter.



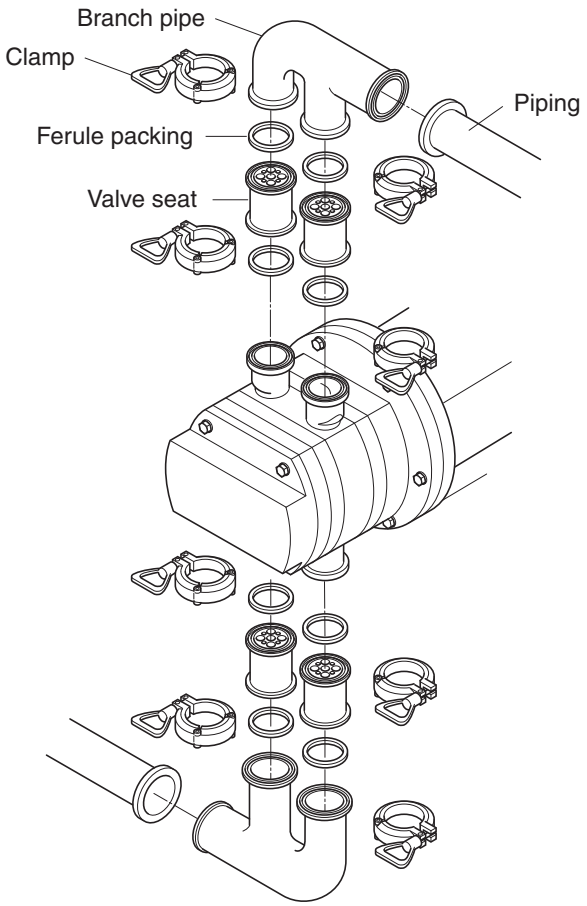
■APLS-1/3/5/10/20/35/50

[Common to both upper/lower sections]

(1) Remove the branch pipe from the piping.

(2) Remove the eight clamps fixing the upper and lower valve seats in place.

(3) Remove the valve seat set.



Replacing the Diaphragm

⚠ WARNING

- **Do not operate the pump while performing maintenance. If it is necessary to operate the pump while replacing the diaphragms, take steps to ensure that your fingers are not nipped.**

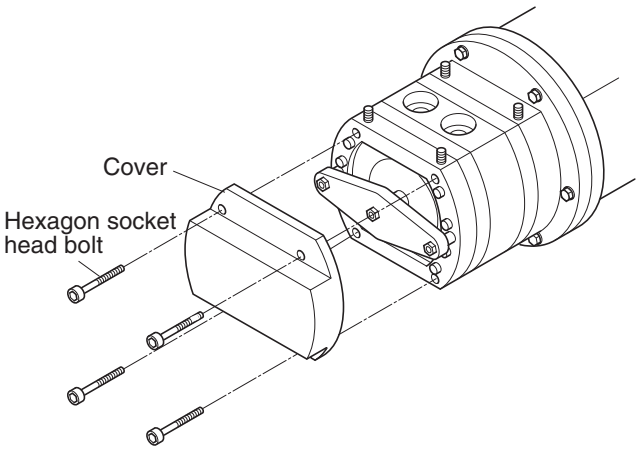
IMPORTANT

- When replacing the diaphragms, replace both the diaphragms at the front and rear.

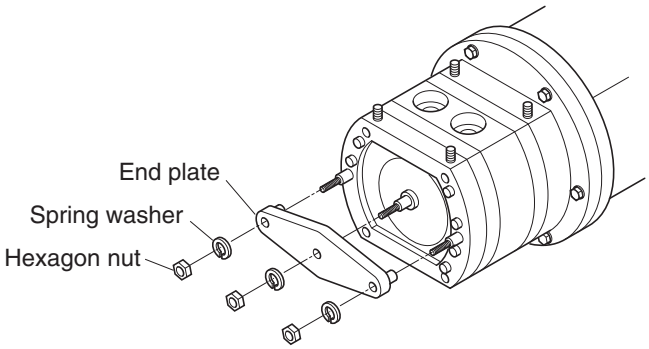
* The illustrations below describe an example for the APL Series.
The procedure is the same for the APLS Series.

(1) Remove the manifold and valve seats following the procedure in "Replacing the Valve Seats."

(2) Remove the four hexagon socket head screws and remove the cover.



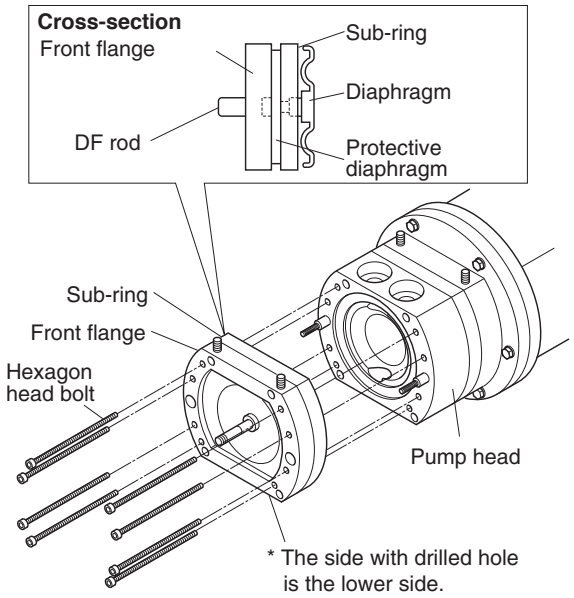
(3) Remove the three hexagon nuts and remove the end plate.



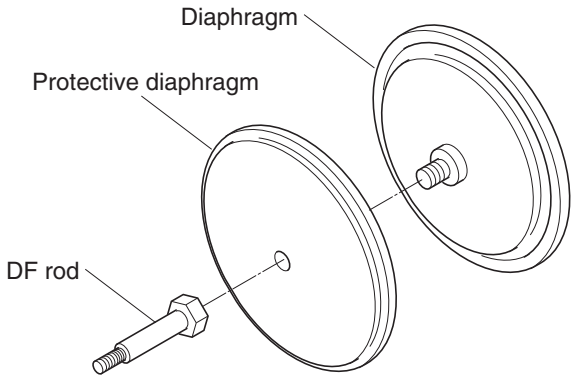
(4) Remove the eight or four hexagon bolts (hexagon socket head bolts), and remove the front flange together with the sub-ring. The protective diaphragm also comes away with the diaphragm.

*** When installing the front flange and the sub-ring, do not mistake the upper and lower parts. The side with the drilled hole is the lower side.**

(5) Draw out the diaphragm and protective diaphragm from the front flange.

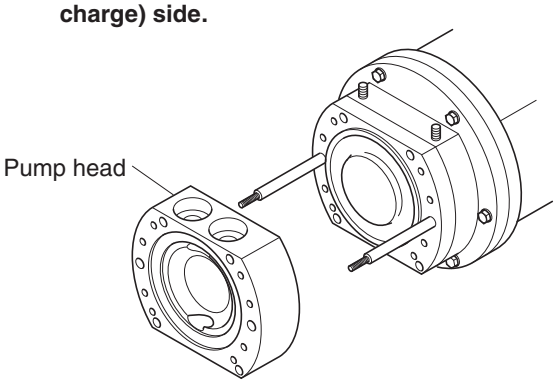


(6) Turn the DF rod with a spanner to remove, and replace the diaphragm.



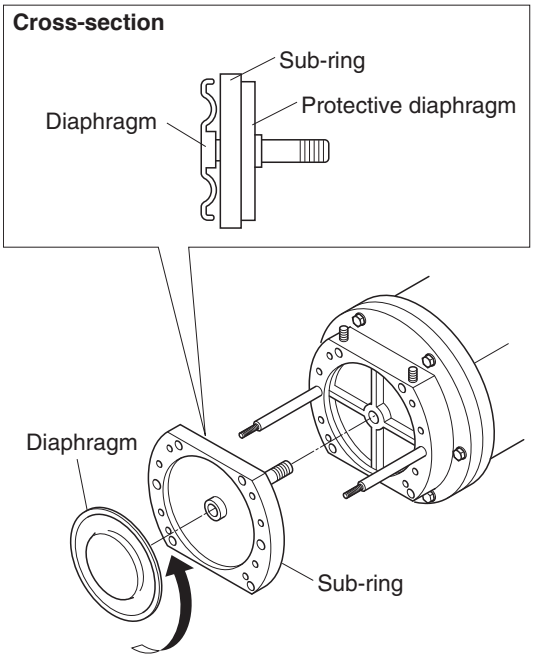
(7) Remove the pump head to replace the diaphragm on the rear side.

*** The pump head has a lower side and an upper side. The side with the narrow spacing between the holes for the valve seat is the upper (discharge) side.**



(8) Run the motor by inching or other such mode until the diaphragm is pushed out to the maximum extent.

(9) Gripping the outer periphery of the diaphragm turn counterclockwise to remove.



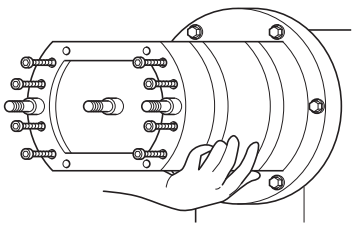
(10) Replace the diaphragm.

(11) Install in the reverse order.

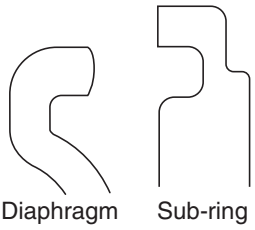
*** Basically, assembly is performed in the reverse order. For extra information, refer to "Key points during installation" to make sure that assembly is performed correctly.**

[Key points during installation]

- When fixing the pump heads, sub-rings and front flange in place, insert the bolts while supporting the pump head from below. Otherwise, the weight of the pump head may cause the bolts to bend.



- Make sure that the protrusion on the periphery of the diaphragm is properly aligned with the groove on the sub-ring.

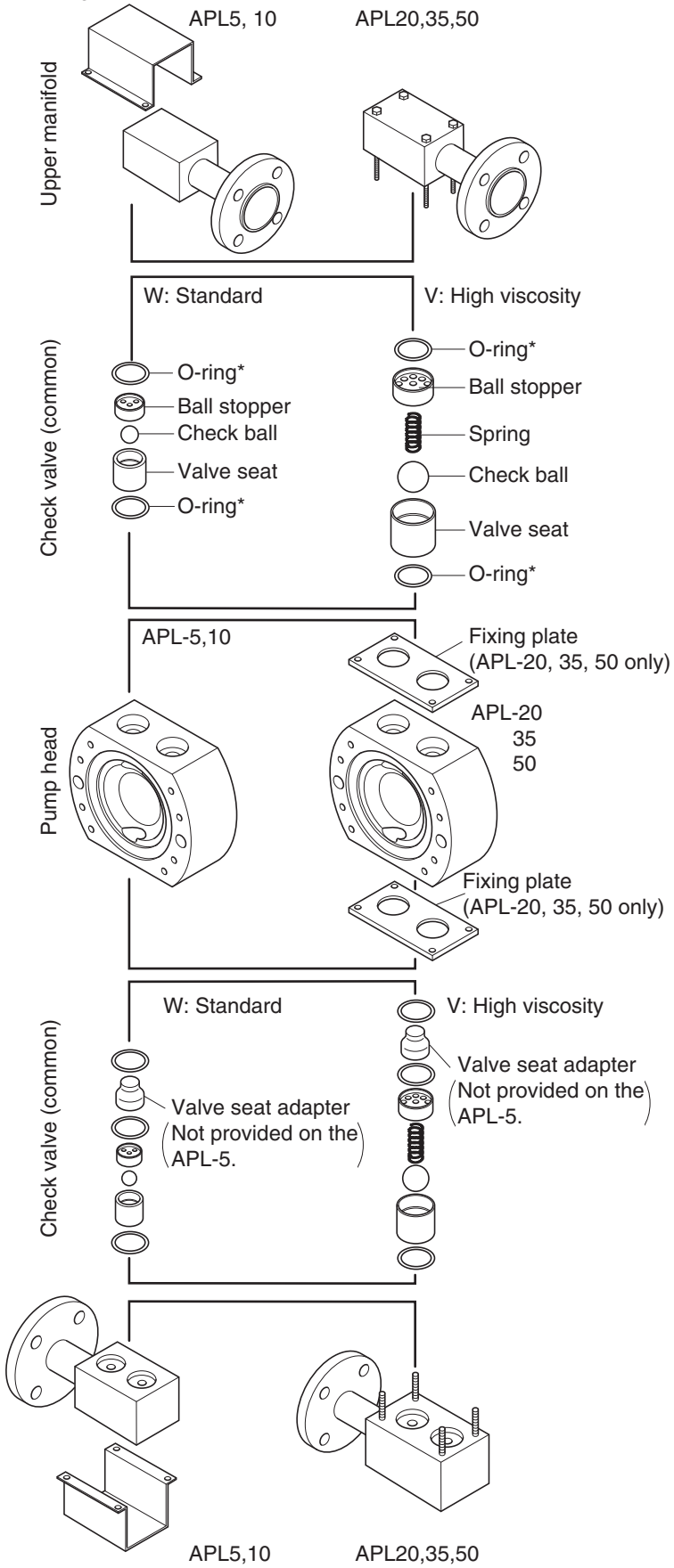


- Install the sub-ring and front flange with the side with the holes facing down.

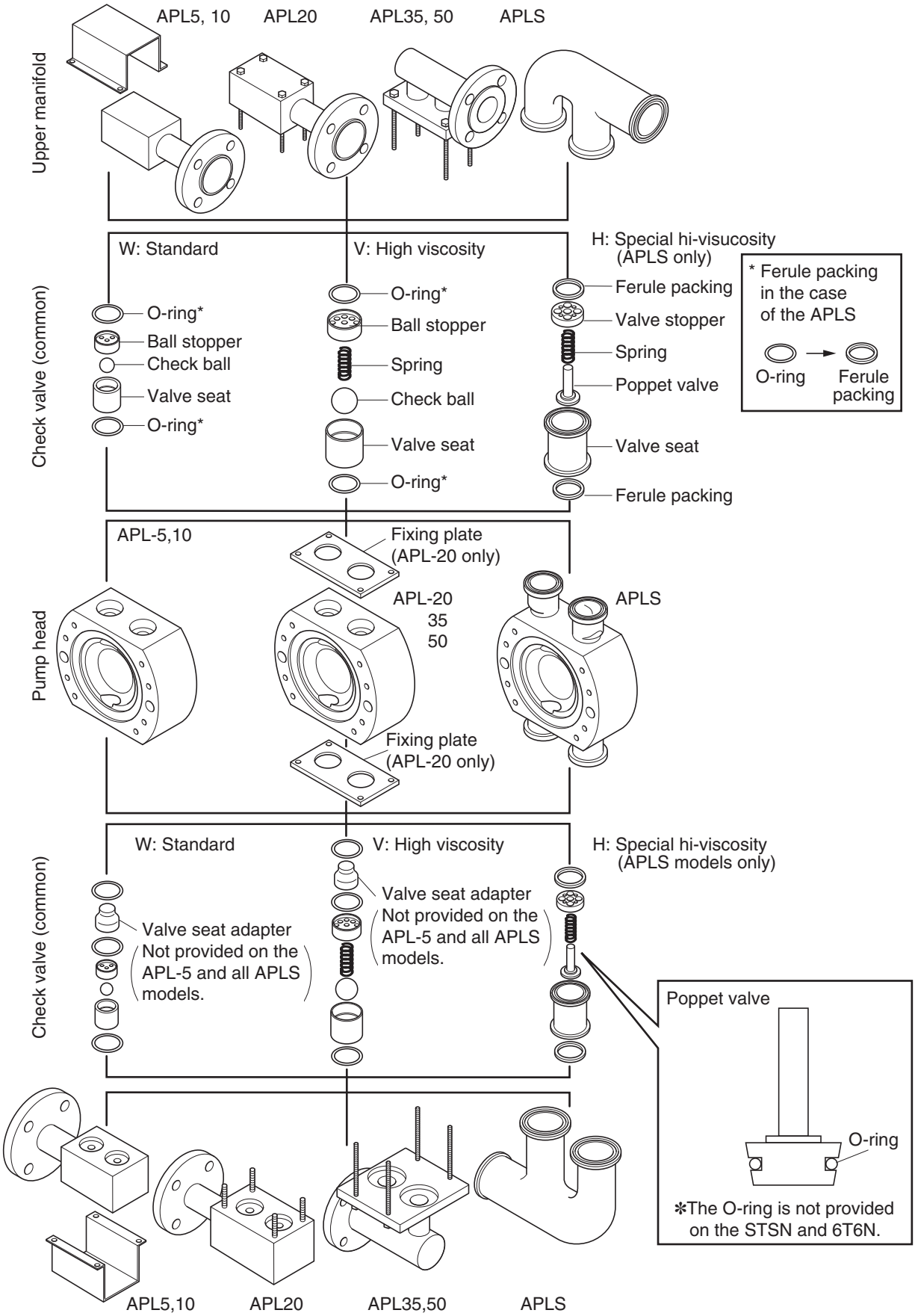
Replacing the Valve Seat and Check Ball

- Attach O-rings, ball stoppers and check balls making sure that they face the correct direction.
- When removing and re-fitting the upper and lower valve seats, make sure that you do not mistake the upper and lower valves seats.
- Also, make sure that the O-ring and check balls are not scratched, and dust or dirt is not sticking to the valve seats.

PVC type



Stainles steel type



Changing the Drive Oil

Changing the Drive Oil

When draining drive oil, be sure to catch the oil in an oil pan or similar receptacle.

(1) Loosen the oil replenishment cap/oil gage.

(2) Catch the oil into the oil pan and remove the drain plug.

(3) Drain all of the drive oil.

(4) Wrap new sealing tape around the drain plug and re-insert the plug.

✻ The proper torque when tightening the drain plug is 19.5 N·m. Do not use excessive force, as this may damage the drive box.

(5) Pour in an appropriate amount of new drive oil.

Type and Amount of Drive Oil

The drive section uses an oil bath system. Change all of the drive oil after 4000 hours of operation or once every year.

■Amount of Drive Oil when Changing Oil (to MAX position on oil gage)

APL/APLS-1/3/5/10	Approx. 1.2 L
APL/APLS-20/35/50	Approx. 3.5 L

■Recommended Drive Oil

When shipped, the pump is filled with Daphne Super Gear Oil 320, manufactured by Idemitsu Kosan Co., Ltd.
Other recommended products can be checked by accessing the following URL.
www.tacmina.co.jp/gearoil

Troubleshooting

■Liquid is Not Discharged.

Details of Trouble		Cause	Remedy
Pump does not operate.	Motor does not run.	(1) Defective power supply and voltage	(1) Check the power supply and voltage, and connect to the correct power supply.
		(2) Defective motor wiring	(2) Inspect the wiring and correct as required.
		(3) Disconnection of leads	(3) Repair or replace.
		(4) Switch is OFF	(4) Turn the switch ON correctly.
		(5) Breaker tripped or fuse blown	(5) Check the causes, and restore or replace the fuse.
		(6) Motor immersed in water	(6) Replace the motor.
		(7) Motor malfunction	(7) Replace the motor.
		(8) Defective magnet switch	(8) Replace the magnet switch.
		(9) Inverter malfunction	(9) Inspect and repair the inverter.
		(10) Inverter setting frequency too low	(10) Set the appropriate frequency.
	Motor runs.	(1) Damaged speed reduction mechanism	(1) Repair or replace.
		(2) Damaged eccentric cam mechanism	(2) Replace.
Pump operates though liquid is not transferred.	Air enters the pump.	(1) Gas is being generated due to the nature of the liquid.	(1) Remove causes of gas generation.
		(2) Liquid leaks from joints, seals, etc.	(2) Check O-rings, etc. and re-tighten.
		(3) Empty chemical tank	(3) Replenish transferred liquid and release air.
	Liquid is not sucked in.	(1) Clogged strainer	(1) Wash the strainer and tank.
		(2) Dirt biting into valve seats	(2) Disassemble and wash.
		(3) Scratched valve seats	(3) Replace.
	Liquid leakage	(1) Damaged diaphragm	(1) Replace the diaphragm.

■Low Discharge Volume

Details of Trouble	Cause	Remedy
Low discharge volume though pump operates normally.	(1) Damaged diaphragm	(1) Replace the diaphragm.
	(2) Foreign matter biting into valve seats and check balls.	(2) Inspect and clean.
	(3) Air sucked in from suction-side piping	(3) Inspect and re-tighten the piping.
	(4) Defective valve seats and seals	(4) Replace the valve seat, check balls and O-rings.
	(5) Cavitation occurring in suction-side piping and pump head.	(5) Provide larger or shorter suction-side piping.

■Excessive Discharge

Details of Trouble	Cause	Remedy
Excessive discharge volume though pump operates normally.	(1) Overfeed is occurring.	(1) Review the piping and install a back pressure valve.
	(2) Connected to the suction side (minus pressed side) of the main pump	(2) Install a back pressure valve.
Liquid discharge does not stop.	(1) Siphoning is occurring.	(1) Review piping, and provide a ventilation duct or install a back pressure valve.
	(2) Air remains in piping, or damper effect is occurring.	(2) Release air inside the piping.

■Unstable Discharge Volume

Details of Trouble	Cause	Remedy
Unstable discharge volume	(1) Cavitation occurring in suction-side piping and pump head.	(1) Provide larger or shorter suction-side piping.

■Large Pulsation

Details of Trouble	Cause	Remedy
Large pulsation	(1) Motor is rotating in the opposite direction. (2) The discharge volume of each pump head is not uniform as the check valve in the pump head is worn or foreign matter is biting into the check valve. (3) Pulsation is being carried in by the suction-side piping.	(1) Change the wiring or switch pump operation by the inverter. (2) Replace parts or disassemble and wash. (3) Connect the pump to the piping or firmly support the piping using flexible joints.

■Liquid Leakage

Details of Trouble	Cause	Remedy
Liquid leakage	(1) Pressure rise caused by blockage inside discharge-side piping (2) Damaged diaphragm (3) Insufficiently tightened screws (4) Insufficiently tightened manifold (5) Deteriorated O-rings (6) Defective valve seat mounting (7) Unevenly tightened bolts	(1) Disassemble and clean. (2) Replace the diaphragm. (3) Re-tighten. The bolts on the pump head are insufficiently tightened. (4) Re-tighten. (5) Replace. (6) Mount correctly. (7) Tighten the bolts evenly.

■Abnormal Heat Generation or Sounds

Details of Trouble	Cause	Remedy
Abnormal noise or heat is being generated at the drive section.	(1) Overload (2) Insufficient lubrication (3) External temperature or temperature of transferred liquid too high (4) Speed reduction mechanism worn or damaged (5) Damaged springs (6) Abnormal pressure applied on discharge side (7) Inverter setting frequency too high or too low	(1) Inspect discharge pressure and clogging of parts. (2) Inspect the drive oil. (3) Improve the installation environment. (4) Repair or replace. (5) Replace. (6) Inspect the piping. (7) Set the inverter to the appropriate frequency.

■Model Code

APL	-	20	-	VTCE	-	F	W	S	-			-	
(1)		(2)		(3)		(4)	(5)	(6)		(7)	(8)		(9)

Models with CE marking only.

● **APL**

(1)Series name

APL: Large-capacity transfer model

(2)Pump model (discharge volume standard)

Model	Max. Discharge Volume
5	5(5.5) L/min
10	10(10.5) L/min
20	20(22) L/min
35	35(36) L/min
50	45(47) L/min

Conditions: room temperature, clean water, standard valve used
Values in parentheses ( ) are values at 0.2 MPa.

(3)Liquid-end type/materials

Type	Pump head	Dia-phragm	Check ball	O-ring	Joint
VTCE	PVC	PTFE	Ceramic	EPDM	PVC
VTCF				Fluoro rubber	
VTSE			SUS304	EPDM	
STST	SCS13*1			PTFE	SUS304
6T6T	SCS14*2		SUS316		SUS316

*1 SCS13: Stainless - cast steel equivalent to SUS304
*2 SCS14: Stainless - cast steel equivalent to SUS316

(4)Connection type

F	Flange
X	Special

(5)Valve structure

W	Standard
V	High-viscosity
X	Special

(6)General specifications

S	Standard
X	Special

(7)Connection standard

G	Straight pipe thread
R	Taper pipe thread
D	DIN
A	ANSI
I	ISO
J	JIS
F	Fuji standard
X	Special specification

(8)Motor

M	Standard motor
N	Without motor

(9)Standard

CE	CE standard
CA	CE and ATEX standard

● APLS

(1)Series name

APLS: Large-capacity transfer model for sanitary use

(2)Pump model (discharge volume standard)

Model	Max. Discharge Volume
1	1 L/min
3	2.5 L/min
5	5(5.5) L/min
10	10(10.5) L/min
20	20(22) L/min
35	35(36) L/min
50	45(47) L/min

Conditions: room temperature, clean water, standard valve used
Values in parentheses ( ) are values at 0.2 MPa.

(3)Liquid-end type/materials

Type	Pump head	Dia-phragm	Check ball/ poppet valve	O-ring for poppet valve	Ferule packing	Joint
STSN	SUS 304	PTFE	SUS 304	–	PTFE	SUS 304
STSE				EPDM		
STSF				Fluoro rubber		
STST				PTFE*1		
6T6N	SUS 316		SUS 316	–		SUS 316 *2
6T6E				EPDM		
6T6F				Fluoro rubber		
6T6T				PTFE*1		

*1 In the case of an H (special) valve structure, the O-rings for the poppet valve are made of PFA/silicon.
*2 Brunch pipes are made of SUS316L.

(4)Connection type

C	Sanitary clamp
X	Special

(5)Valve structure

W	Standard
V	High-viscosity
H	Special high-viscosity
X	Special

(6)General specifications

S	Standard
X	Special

(7)Connection standard

G	Straight pipe thread
R	Taper pipe thread
D	DIN
A	ANSI
I	ISO
J	JIS
F	Fuji standard
X	Special specification

(8)Motor

M	Standard motor
N	Without motor

(9)Standard

CE	CE standard
CA	CE and ATEX standard

■Performance Specifications

• APL Series

Model			5	10	20	35	50
Max. discharge volume *1		L/min	5(5.5)	10(10.5)	20(22)	35(36)	45(47)
		L/h	300(330)	600(630)	1200(1320)	2100(2160)	2700(2820)
		US G/h	79.2(87.12)	158.4(166.32)	316.8(348.48)	554.4(570.24)	712.8(744.48)
Max. discharge pressure		MPa	0.5				
		bar	5				
		psi	72.5				
Strokes		spm	96		89		
Connection type aperture		Discharge side	25A	25A	25A	40A	40A
		Suction side	25A*2	40A	50A	65A	65A
Motor specifications	Power supply (V)/frequency (Hz)		3-phase, 200 V/50 Hz, 200 V/60 Hz, 220 V/60 Hz, totally enclosed fan-cooled outdoor type (vertical flange mounting)				
	Output (kW)		0.2	0.4	0.75	1.5	
	Motor rated current value/startup current value (A)	200V/50Hz	1.34/6.1	2.3/10.2	3.5/23.0	6.9/56.0	
		200V/60Hz	1.12/5.5	2/9.07	3.2/20.0	6.1/44.0	
		220V/60Hz	1.17/6.0	2/9.98	3.1/22.0	5.9/51.0	
	Number of poles (P)		4				
	Wiring conduit connection aperture		G 3/4				
Operating temperature range*3		Ambient temperature	0 to 40˚C				
		Operating liquid temperature	0 to 40˚C: PVC type (freezing not allowed) 0 to 60˚C: stainless steel type (freezing not allowed)				
Weight (kg)		VTCE	50		105	137	
		VTCF	50		105	137	
		VTSE	50		105	137	
		STST	65		135	166	
		6T6T	65		135	166	
Sound pressure level			77.638dB				

*1 Conditions: room temperature, clean water, standard valve used Figures in parentheses ( ) are values at 0.2 MPa.
*2 In the case of high-viscosity type (FV □) is JIS10K40A.
*3 The lifetime of diaphragm may change depending on the operating temperature.

⚠ CAUTION

• This product generates the noise listed above. If you will be exposed to this noise for a long period of time, use devices to protect your hearing.

● APLS Series

Model			1	3	5	10	20	35	50
Max. discharge volume *1		L/min	1(1.1)	2.5(2.6)	5(5.5)	10(10.5)	20(22)	35(36)	45(47)
		L/h	60(66)	150(156)	300(330)	600(630)	1200(1320)	2100(2160)	2700(2820)
		US G/h	15.84(17.42)	39.6(41.18)	79.2(87.12)	158.4(166.32)	316.8(348.48)	554.4(570.24)	712.8(744.48)
Max. discharge pressure		MPa	0.5						
		bar	5						
		psi	72.5						
Strokes		spm	96				89		
Connection type aperture		Discharge side	1.5S	1.5S	1.5S	1.5S	2S	2S	2S
		Suction side	1.5S	1.5S	1.5S	2S	2.5S	2.5S	2.5S
Motor specifications	Power supply (V)/ frequency (Hz)		3-phase, 200 V/50 Hz, 200 V/60 Hz, 220 V/60 Hz, totally enclosed fan-cooled outdoor type (vertical flange mounting)						
	Output (kW)		0.2			0.4	0.75	1.5	
	Motor rated current value/startup current value (A)	200V/50Hz	1.34/6.1			2.3/10.2	3.5/23.0	6.9/56.0	
		200V/60Hz	1.12/5.5			2/9.07	3.2/20.0	6.1/44.0	
		220V/60Hz	1.17/6.0			2/9.98	3.1/22.0	5.9/51.0	
	Number of poles (P)		4						
	Wiring conduit connection aperture		G 3/4						
Operating temperature range*2		Ambient temperature	0 to 40˚C						
		Operating liquid temperature	0 to 60˚C: stainless steel type (freezing not allowed)						
Weight (kg)		STS □	55		60		115	151	
		6T6 □	55		60		115	151	
Sound pressure level			77.638dB						

*1 Conditions: room temperature, clean water, standard valve used Figures in parentheses ( ) are values at 0.2 MPa.
*2 The lifetime of diaphragm may change depending on the operating temperature.

⚠ CAUTION

- **This product generates the noise listed above. If you will be exposed to this noise for a long period of time, use devices to protect your hearing.**

■Performance Curves

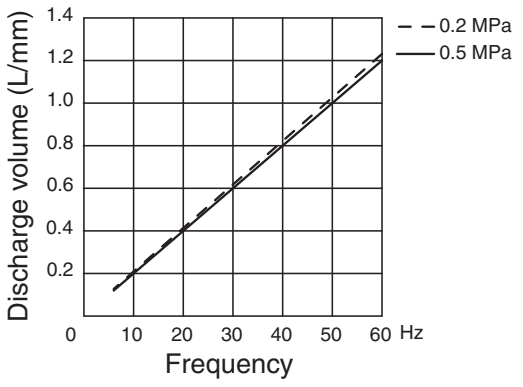
The following performance curves were obtained by measuring on test equipment at TACMINA under the following conditions. These performance curves may differ slightly depending on various on-site conditions and product differences.

Measure the discharge volume under actual operating conditions, and set the frequency according to the performance curve that is obtained.

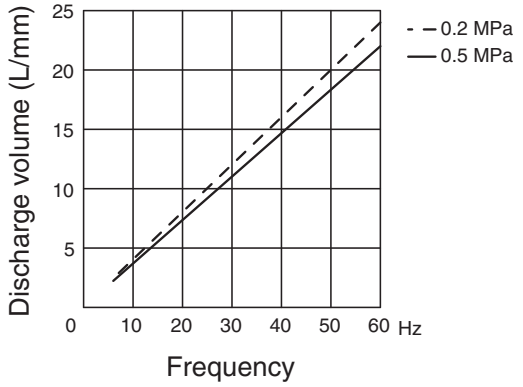
• Basic specifications

Conditions: clean water, room temperature,standard valve specifications

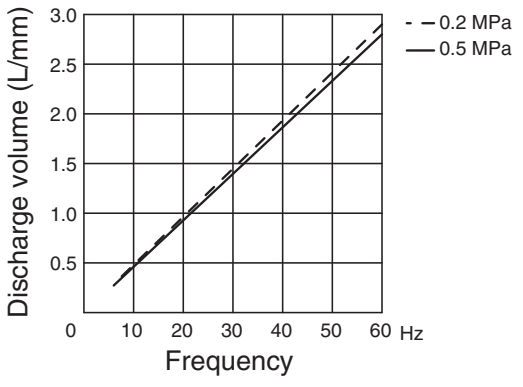
APLS-1



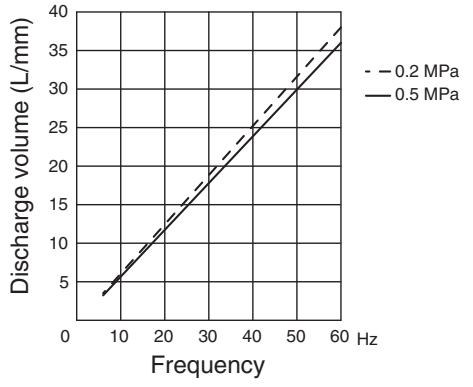
APL/APLS-20



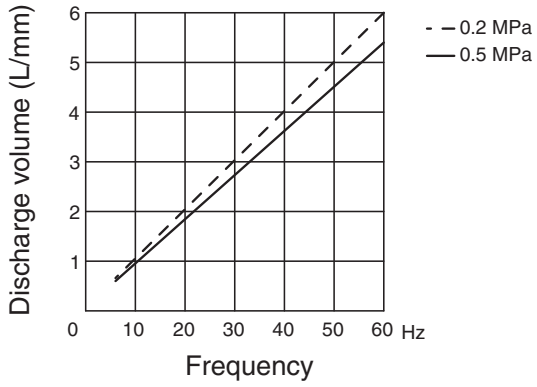
APLS-3



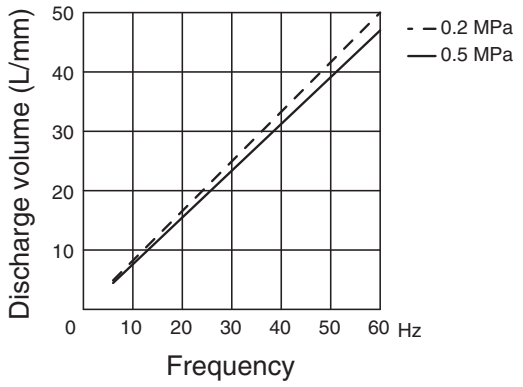
APL/APLS-35



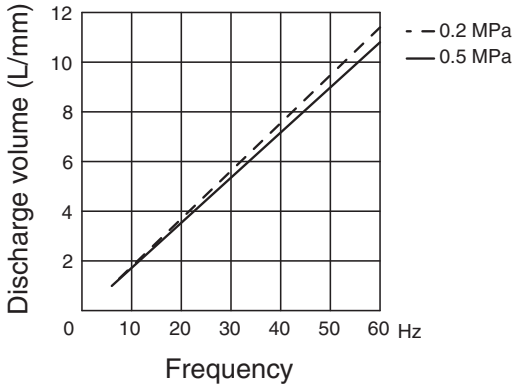
APL/APLS-5



APL/APLS-50



APL/APLS-10

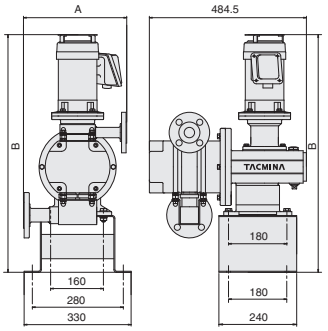


Specifications

■External Dimensions

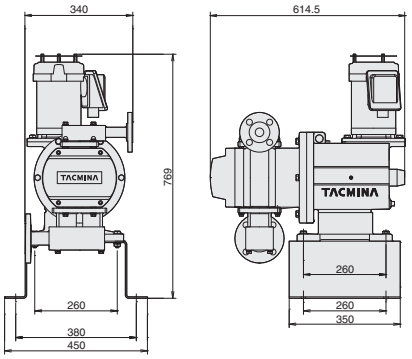
* The example given here is of the standard model. For information on the separate models, see the diagrams.

APL-5/10-STST-FWS

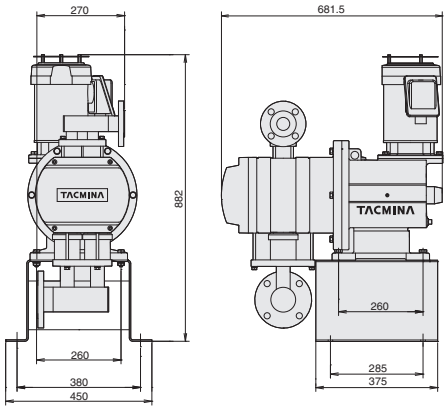


	A	B
APL-5-STST-FWS	283	732
APL-10-STST-FWS	308.5	733

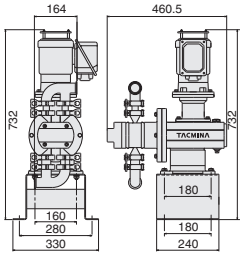
APL-20-STST-FWS



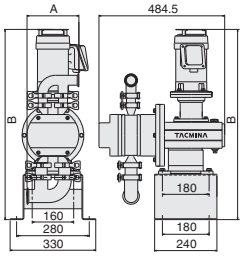
APL-35/50-STST-FWS



APLS-1/3-STSN-CWS

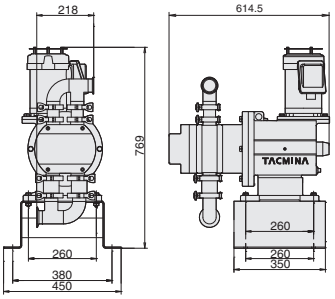


APLS-5/10-STSN-CWS

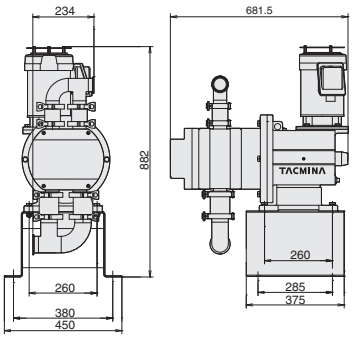


	A	B
APLS-5-STSN-CWS	168	732
APLS-10-STSN-CWS	182	733

APLS-20-STSN-CWS

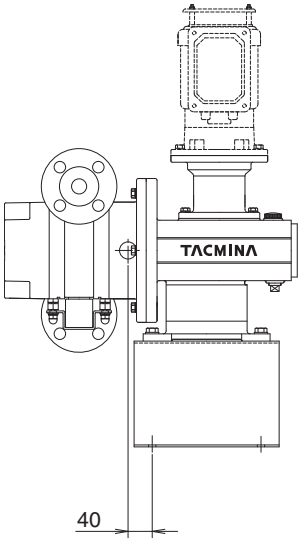


APLS-35/50-STSN-CWS

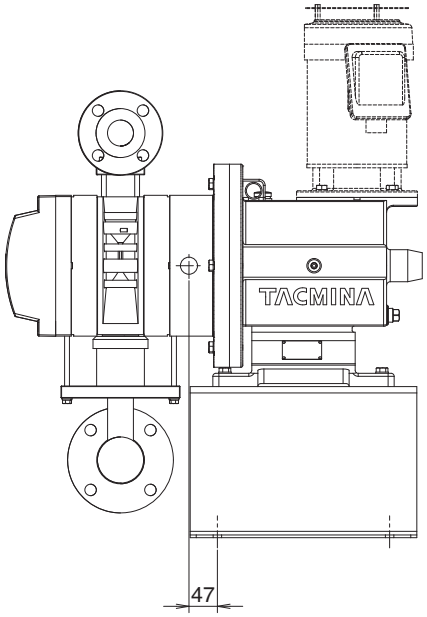


■Center of Gravity

APL-5·10
APLS-1·3·5·10



APL-20·35·50
APLS-20·35·50



Consumables

The recommended replacement cycles are for cases where the pump is operated under constant conditions (room temperature and clean water). These cycles change according to individual site conditions. Use these cycles as rough guidelines for replacing consumables. Neglecting to replace consumables may cause defective discharge (injection) or malfunction.

⚠ CAUTION

- **When slurry liquids containing highly abrasive solids or highly penetrative/permeable liquids are used, the durability of consumables may vary significantly depending on the conditions of use, therefore the time for replacement must be adjusted according to the inspection results even if the recommended replacement time has not been reached.**

■Standard Type

Part Name		Recommended Replacement Cycle
Joints	Valve seat	4000 hours of operation or 1 year
	Check ball	4000 hours of operation or 1 year
	Ball stopper	4000 hours of operation or 1 year
	O-rings	4000 hours of operation or 1 year
Diaphragms		1 to 20: 4000 hours of operation or 1 year 35, 50: 2000 hours of operation or 1 year
Protective diaphragm		When the diaphragm is replaced

For details of the special valve structure on a sanitary type, contact TACMINA.

Options and Related equipment

• Back pressure valve

This option is used to prevent "overfeeding" and "siphoning" that occur depending on the piping conditions. These phenomena are the flow of liquid at an excessive discharge volume.

• Relief valve

This valve automatically releases pressure to the air when excessive pressure occurs in the pump's discharge-side piping due to clogging by foreign objects or a closed valve.

• Refiner

This pump minimizes pulsation on the discharge side. However, to reduce pulsation even more, this option can be installed on the discharge-side piping.

Glossary

• Siphoning

This is the phenomenon where transferred liquid continues to flow even if the pump is stopped as the tip of the pump's discharge side piping is lower than the level of liquid in the suction-side tank.

• Cavitation

Back pressure in the pump head causes air bubbles to occur, which reduces the discharge volume and cases abnormal noise or vibration to occur.

List of Tools

■Drive Oil Replacement

Model	Wrench Size	Plug
All models	12	R3/8 sq. head

■Valve Seat and Check Ball Replacement

Model	Size
All models	Spanner, 13 mm across flats (for M8)

■Diaphragm Replacement

Model	Tool Used
APLS-1-10	Allen wrench, 6 mm across flats (M8) Spanner, 10 mm across flats (M6)
APLS-20	Allen wrench, 6 mm across flats (M8)
APLS-35-50	Allen wrench, 6 mm across flats (M8) Across flats 10 (M12)
APL-5,10	Spanner, 13 mm across flats (for M8) Across flats 10 (M6) Allen wrench, 6 mm across flats (M8)
APL-20	Spanner, 13 mm across flats (for M8) Allen wrench, 6 mm across flats (M8)
APL-35-50	Spanner, 13 mm across flats (for M8) Allen wrench, 6 mm across flats (M8) Across flats 10 (M12)

After-sales Services

If any aspects of the terms and conditions of the after-sales service applying to the repairs to be provided during the warranty period and other such matters are not clear, consult your vender or a TACMINA representative.

Warranty

(1) The warranty period shall be one year from the date of dispatch from TACMINA's factory.

(2) If, during the warranty period, the product sustains malfunctions or damages as a result of design, manufacturing, or material defect, or if the product does not meet its specifications, TACMINA will arrange for repairs, provide replacement components, or replace the product, at TACMINA's discretion, at no charge to the customer. However, this warranty only covers direct damage to the product. Any consequential losses or damages, including, but not limited to, profit losses and any secondary damages, caused by malfunctions, breakage, or impaired performance of this product shall not be covered by this warranty. The limitation of TACMINA's liability shall not exceed the sales value of the defective product.

(3) If a malfunction or damage is found, notice shall be given to distributor or TACMINA with documents that prove the malfunction or damage is caused by improper design, manufacturing failure or material defect within 14 days after awareness of such malfunction or damage. If the distributor or TACMINA does not receive such notice within aforementioned period, even though the warranty period is still in effect, TACMINA shall not be liable for any malfunction and damage.
Please note that TACMINA may request to give further information or to return the product for investigation. If the cause is attributable to TACMINA's action, the shipping fees, cost of investigation and checks performed by TACMINA shall be borne by TACMINA.

(4) Even in the warranty period, the cost of repairs in the following conditions shall be paid to the distributor or TACMINA.
1) Damages and deterioration of consumables.
2) Damages or malfunctions of the warranted product caused by carelessness in handling or incorrect use.
3) Damages or malfunctions of the warranted product caused by the failure to perform maintenance such as periodic inspections and repairs and replacements of consumables.
4) Damages or malfunctions of the warranted product caused by falls or impacts.
5) Damages or malfunctions of the warranted product resulting from the use of parts other than the ones supplied by TACMINA.
6) Damages or malfunctions of the warranted product resulting from product repairs or remodeling undertaken by individuals other than TACMINA employees or personnel of businesses authorized by TACMINA.
7) Damages or malfunctions of the warranted product resulting from fires, natural disasters, geological calamities, and force majeures.
8) Damages or malfunctions of the warranted product resulting from loose bolts or nuts or from defective hose connections.
9) Discoloration, deterioration, damages, or malfunctions of the warranted product resulting from ultraviolet rays, corrosive gases, or flooding.
10) Damages or malfunctions of the warranted product resulting from corrosion, swelling, or melting caused by the adhesion or chemical effect of the used liquid.
11) Damages or malfunctions of the warranted product resulting from damages to products other than those made by TACMINA.
12) Damages or malfunctions of the warranted product resulting from usage outside of the range of the usage conditions listed in the operation manual.

(5) The judgment of damages, malfunctions, and impaired performance as well as the judgment of whether the cause is the design of the product and product defects shall be performed by TACMINA's technical department.

Repair

■Before requesting repairs

Please read this operation manual carefully and inspect the product again.

■Who to request repairs from

Ask your vendor to take care of the repairs. If you are not sure of who your vendor is, contact TACMINA.

■Precautions when sending the product for repairs

Be sure to observe the following items to protect worker safety and to protect the environment:

- If any chemicals have affixed to the product, wash it clean.
- Attach the safety data sheet (SDS) to the product.
- If a "maintenance data" page is present at the end of the operation manual, fill in this page and attach it to the product.

✻ The product may not be repaired if the necessary materials are not attached.

✻ Even when the necessary materials are attached, TACMINA may send the product back if it is determined that repairing the product will constitute risks or dangers.

■Minimum retention period for consumables

TACMINA will continue to supply consumables for its pumps for a period of eight (8) years after the manufacture of the pumps has been discontinued.

Maintenance Data

If the pump requires repair, wash the interior thoroughly with water, make a copy of this sheet and fill out all relevant details. Then enclose a copy when you dispatch the pump for repair.

	No.
Customer name:	Telephone No.:
Address:	
Department:	Person in Charge:
Name of sales agent:	
Model:	Serial No.:
Power source: ☐ 50 Hz ☐ 60 Hz ☐ 3-phase ☐ 200 V ☐ Other (V)	
Control method: ☐ Inverter ☐ Other ( )	
Delivery date: ___ (D) ___ (M) _____ (Y)	First operation date: ___ (D) ___ (M) _____ (Y)
Operating hours: _____ hours/day	
Strokes per minute: ( )strokes/min	
Installation conditions: ☐ Indoor ☐ Outdoor	Ambient temperature ( ) °C
Name/composition of chemicals transferred:	Concentration ( )%
Specific gravity: ( )	Temperature: ( )°C Viscosity: ( )mPa.s
Slurry: ☐ No ☐ Yes Content ratio: ( )wt%	Particle size: ( )
Layout (Flow sheet)	Piping diameter:_____A Piping length: Suction side m Discharge side m Discharge pressure: _____MPa Accessories used:
Failure explanation (summary)	

Others

EU DECLARATION OF CONFORMITY
(Directive 2006/42/EC and 2014/30/EU)

Manufacturer : TACMINA CORPORATION
Address : 2-2-14, Awajimachi Chuo-ku, Osaka 541-0047, Japan

Herewith declares that

Machine Name : Metering Pump
Brand Name : Smoothflow Pump
Model (Type) : APL Series (APL, APLS)

- is in conformity with the provisions of Machinery Directive 2006/42/EC,
- and, is in conformity with the provisions of EMC Directive2014/30/EU

And furthermore declares that

- the following (parts / clauses of) harmonized standards have been applied :

EN809: 1997+A1:2009/AC:2010	Pumps and pump units for liquids-Common safety requirements
EN12100:2010	Safety of machinery-General principles for design -Risk assessment and risk reduction
EN60204-1: 2006+A1:2009	Safety of machinery —Electrical equipment for machines —Part 1: General Requirements
EN61000-6-2: 2005	Electromagnetic compatibility(EMC) —Part 6-2:Generic standards—Immunity for industrial environments
EN61000-6-4: 2006	Electromagnetic compatibility(EMC) —Part 6-4:Generic standards—Emission for industrial environments

Date: November 1, 2016

H. Inoue

Name : Hirokimi Inoue
Position : Head of Development Center
TACMINA CORPORATION

EU DECLARATION OF CONFORMITY
(Directive 2006/42/EC and 2014/34/EU)

Manufacturer : TACMINA CORPORATION
Address : 2-2-14, Awajimachi Chuo-ku, Osaka 541-0047, Japan

Herewith declares that

Machine Name : Metering Pump
Brand Name : Smoothflow Pump
Model (Type) : APL Series (APL, APLS)
- without motor type
- pump head and joint material is metallic type

- is in conformity with the provisions of Machinery Directive 2006/42/EC,
- and, is in conformity with the provisions of ATEX 2014/34/EU

And furthermore declares that

- the following (parts / clauses of) harmonized standards have been applied :

EN809: 1997+A1:2009/AC:2010	Pumps and pump units for liquids-Common safety requirements
EN12100:2010	Safety of machinery-General principles for design -Risk assessment and risk reduction
EN ISO 80079-36: 2016 Explosive atmospheres-Part36	Non-electrical equipment for explosive atmospheres-Basic method and requirements

Type of Protection : CE Ex II 2 G Ex h IIB T4 Gb

Date: August 1, 2019

Name : Hirokimi Inoue
Position : Director of Technical Headquarters
TACMINA CORPORATION

Product designs and specifications are subject to change without notice for product improvement.

TACMINA CORPORATION

Head Office:
2-2-14 Awajimachi, Chuo-ku, Osaka 541-0047 Japan
Tel.+81(0)6-6208-3974 Fax.+81(0)6-6208-3978
URL www.tacmina.com
E-mail trade@tacmina.com

EM-155(8)-
2023/6/I--

Z1181