



Ligao Air-operated Diaphragm Pump

Operating Instructions

1. Overview

The Ligao series air-operated diaphragm pump of our company is the latest model of fluid transportation equipment, which is currently one of the most innovative pumps in china. Using compressed air as the power source, it can pump various fluids drastically, whether corrosive, volatile, flammable, poisonous liquid even fluids with particles and high viscosity.

Our diaphragm pumps have totally six specifications. The sizes for import/export are 1/4", 1/2", 3/4", 1", 1.5", 2", 3" and 4". The components which contact with the fluids are usually made of aluminum alloy, nodular cast iron, polypropylene, stainless steel. Because of the varied applications, the materials of diaphragm can be styrene rubber, neoprene, polythene, polyether rubber, fluorine rubber, Teflon and PVDF, so that it can meet the requirements of different fluid mediums.

2. Working principle:

The Ligao series air-operated diaphragm pumps are based on the following working principle: two flexible diaphragms are fitted into two symmetrical chambers of the diaphragm pump severally and connected as a whole part by a link rod. The compressed air enters the central body through the in-suck terminal and impels the diaphragms in two chambers to drive consequently the link rod to move synchronously. At the same time, the air in the other chamber is expelled from the back side of the diaphragm. When piston reaches the end of the stroke, the air-distributing valve guide compressed air is expelled into the other chamber automatically and drive diaphragm pump to rotate reversely, so that the synchronous reciprocating movement is realized.

Ligao series air-operated diaphragm pumps are distinguished obviously by the structure of the air-distributing valve from other diaphragm pumps. This air-distributing valve replaces the traditional O-ring and cylindrical structure with a three-direction pilot-operated structure, eliminating consequently the dead center of valve and shutdown phenomenon of pumps. It provides an accurate and reliable reversing signal to avoid downtime and realize more faster reversing, so that the pumps have greater flow and the transportation is more stable, while lower pulse.

Ligao series air-operated diaphragm pump has a simple design and highly reliable reversing valve. It can ensure non-stop operation and therefore reduces the expensive downtime cost. All components of the valve can be replaced without disassembly. Aluminum parts have been specially processed, so it can resist the corrosion resulted from unclean air. The slide block made of plastic material is robust and anti-tampered, and needn't be lubricated also It can ensure a straightway air way and flexible reversing.

3. Main Applications:

1. Chemical industry: Acids, alkalis, solvents, suspended solids, decentralized system.
2. Petrochemical industry: crude oil, heavy oil, grease, mud, sludge, etc.
3. Coatings Industry: resins, solvents, coloring agent, paint, etc.
4. Cosmetic industry: detergent, shampoo, lotion, emulsion, camphor ice, surface active agents.
5. Ceramics: mud, slurry pottery, lime milk, clay slurry.
6. Mining industry: coal slurry, magma, mud, mortar and explosives, lubricant, etc.
7. Water treatment: lime milk, soft sediments, sewage, chemicals, waste water.
8. The food industry: liquid semi-solid, chocolate, salt water, vinegar, syrup, vegetable oil, soybean oil, honey, animal blood.
9. Beverage industry: yeast, sugar syrup, concentrations, gas-liquid mixture, wine, fruit juice, corn pulp, etc.
10. Pharmaceutical industry: solvents, acids, alkalis, plant extract liquid, cream, plasma and other liquid drugs.
11. Paper industry: adhesives, resins, paints, inks, paints, hydrogen peroxide, etc.
12. Electronics industry: solvent, electroplating fluid, cleaning fluid, sulfuric acid, nitric acid, waste acid, corrosive acid, polishing liquid.
13. Textile solution: chemical dyes, resins, rubber, etc.
14. Construction industry: grout, ceramic tile adhesives, rock slurry, ceiling finish, etc.
15. Automotive industry: polishing emulsion, oil, coolant, automotive priming, oil emulsion paint, varnish, varnish additives, degreasing fluid, paint, etc.
16. Furniture industry: adhesives, varnishes, decentralized system, solvents, color agent, sapwood glue, epoxy resins, starch binder.
17. Metallurgy, casting and dyeing industry: metal slurry, hydroxides and carbide slurry, dust cleaning slurry.

4. Performance Introduction:

Ligao pneumatic diaphragm pump can not only pump fluid liquids and dry powders, but also some other mediums which usually hard to flow. It takes advantages over some transportation machines. Such as self-priming pump, submerged pump, shielding pump, slurry pump, impurity pump .

1. Need not pilot water, suction lift up to 7m, pump head up to 80m, outlet pressure \geq 0.8 MPa.
2. Spacious flowing way with good through-pass performance, the largest size of particles allowed can be up to 9.4mm. While pumping slurry and impurity, the abrasion is more lower.

3. The pump head and capacity can be adjusted via the pressure of air source (between 0.1~0.84 MPa).
4. Temperature ranged by working environment: 5~65°C
5. The pump has no rotating parts and shaft seals. The diaphragms separate the pumped medium from moving part and working medium absolutely, so that the pumped medium does not leak to outside. So there are no risks of environment pollution and personal injury while pumping poisonous, volatile or corrosive media.
6. It can works without electricity and be safe and reliable in inflammable and explosive conditions.
7. Can immerge into the medium.
8. Easy to use and works reliably. when turn on/off the pump, just open and close the air valve. Even in cases of unexpected long-term operation without medium or sudden shutdown, it will not be damaged. Once overloaded, it has self-protecting function and will shut down automatically. As long as the load goes back to normal, it starts up automatically again.
9. Simple structure, less vulnerable parts. The pump own a simple structure design and become more easy to install and maintain. The pumped medium does not contact with moving parts such as air-distributing valve and link rod, so the performance will not go worse with the abrasion of rotors, pistons, gears and vanes as other types of pumps.
10. Can pump the viscous liquids (viscosity below 10000cm)
11. No need of lubrication. There are no effects to the pump in dry operation mode. This is a key feature of the pump.

Symbols

Warning Symbol





This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol



This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

|  | |
|---|--|
|  INSTRUCTIONS | <p>EQUIPMENT MISUSE HAZARD</p> <p>Any misuse of the equipment can cause them to rupture and failure, and result in serious injury.</p> <ul style="list-style-type: none">● This equipment is for professional use only.● Read and understand all instruction manuals, warning labels, and tags before you operate the equipment.● This equipment can be used for specified purpose. Please contact with the distributor of Ligao Company if you are not sure about it.● Never alter or modify any part of this equipment. Use only genuine Ligao parts and accessories.● Check the equipment daily and repair or replace worn or damaged parts immediately.● Do not exceed the maximum working pressure of the lowest rated component during the operation of your system.● This equipment has a maximum working pressure of 0.8MPa when the maximum incoming air pressure is 0.8MPa.● Be sure that all fluids and solvents used are chemically compatible with the wetted parts. Always read the content about technical data in equipment instructions, and acquaint yourself with the warning of the manufacturer about relevant fluid or solvent.● Never use 1.1.1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in aluminum pressure equipments. Such use could result in a serious chemical reaction, with the possibility of explosion.● Never use a hose to pull the equipment.● The hose should be secured away from traffic areas, sharp edges and hot surface.● Never move or lift a pump under pressure.● Observe all relevant national regulations about fire, electrical and safety. |

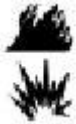
WARNING



TOXIC FLUIDS HAZARDS

Improper handling of hazardous fluids or inhaling toxic vapors can cause extremely serious injury or death from splashing in the eyes, ingestion, or bodily contamination.

- Know what fluid you are pumping and its specific hazards.
- Store hazardous fluid in an appropriate, approved container. Dispose of it according to national guidelines.
- Always wear appropriate clothing and equipment, such as eye protection and breathing apparatus recommended by manufacturer of fluids and solvents.
- Pipe and dispose of the exhaust air safely, away from people, animals, and food handling areas. If the diaphragm fails, the fluid is exhausted along with the air. See Air Exhaust Ventilation on page 8.



FIRE AND EXPLOSION HAZARDS

If the equipment is not properly grounded and ventilated, sparking may occur and cause a fire or explosion and serious injury.


- Ground all equipment. Refer to Grounding on page 6
- If you experience any static sparking or even a slight shock while using this equipment, stop pumping immediately. Do not use the system again until the problem has been identified and corrected.
- Provide ventilation of fresh air. Avoid accumulating flammable gases in solvents and fluids to be pumped.
- Pipe and dispose of the exhaust air safely, away from all sources of ignition. If the diaphragm fails, the fluid is exhausted along with the air. See Air Exhaust Ventilation on page 8.
- Keep the working place clean and without any waste, including solvents, clouts and gasoline.
- Disconnect all equipments in working place from electrical connection.
- Extinguish all flames and indicating lamps in working place.
- Do not smoke in the work area.
- Do not switch on and off any lamp switches during operation or if there exists flammable gases.
- Never use gasoline engine in working place.

Installation

General Information

- The typical installation information shown in Fig. 2 is only used to guide you to select and install system components. If you want to plan a system to suit your need, please contact your Ligao distributor.
- Always use genuine parts and accessories of Ligao Company.
- Hold the upper cover to lift the pump safely.

⚠ WARNING



TOXIC FLUIDS HAZARDS

Inbreathing toxic vapors, ingesting toxic liquids or splashing them in the eyes or on the skin may result in extremely serious injury or death.


1. Read the Toxic Fluid Hazards on page 5.
2. Use fluids and solvents that compatible with the wetted parts in equipment. Refer to the content about technical data in equipment instructions, and acquaint yourself with the warning of the manufacturer about relevant fluid or solvent.

Grounding

⚠ WARNING

FIRE AND EXPLOSIVE HAZARD

This pump must be grounded.



Observe the following instructions to ground the system before you operate the pump. Read the instructions about Fire and Explosive Hazards on page 5.

To reduce the risk of static sparking, ground the pump and all other equipment used or located in the pumping area. Check your local electrical code for detailed grounding instructions for your area and type of equipment.

Ground all of this Equipment:

Diaphragm Pump: Connect a ground wire and clamp as shown in Fig.1. Loosen the grounding lug locknut (W). Insert one end of a 1.5mm² minimum ground wire (Y) into the slot in the locknut, and tighten the locknut securely. Connect the clamp end of the ground wire to a true earth ground.



Tightening Screws before First Use

After unpacking the diaphragm pump, please check and

re-torque all fasteners on the surface.

Adjust the torque of screws of left and right fluid covers first, and then the top/bottom fluid covers.

In this way, pump is guaranteed not affected by the fastened fluid covers. For technical specifications and torques, refer to Maintenance section.

After the first day of operation, re-torque the fasteners. Although pump use varies, a general guideline is to re-torque fasteners every two months.

Air compressor: Follow the manufacturer's recommendations.

Air and fluid hoses: Use only conductive hoses.

All solvent pails used when flushing: Follow the local code. Use only metal pails, which are conductive. Do not place the pail on a non-conductive surface, such as paper or cardboard, which interrupts grounding

Installation

Installation

CAUTION

The pump exhaust air may contain contaminants. Ventilation distance should get further if contaminants affect the fluid supply. See Air Exhaust Ventilation on Page 8.

1. Be sure the mounting can support the weight of the pump, hoses, and accessories, as well as the stress during operation progress.
2. During installation, make sure that the pump has been fixed with bolts on the mounting feet.

3. In order to facilitate the operation and maintenance, the maintenance space should be enough during installing the pump.
4. While fastening the pump, rubber pad can be padded to reduce the noise and vibration during operation.

Air Line

WARNING

A bleed-type master air valve (B) is required on your system, to relieve air trapped between itself and the pump. Trapped air can cause the pump to cycle unexpectedly, which could result in serious bodily injury, including splashing liquid into eyes or skin, injury caused by moving parts, or contaminants, hazardous fluids. Refer to Fig 2

Fluid Suction Line

1. Use grounded fluid hose (G). Pump fluid suction (R). Attach fluid hose terminal to inlet of pump with screws.
2. If the inlet pressure to the pump is more than 25 percent of the outlet working pressure, the ball check valves do not close fast, which results in inefficient pump operation.
3. At input fluid pressures over 0.1 MPa, diaphragm life will be shortened.
4. About the max suction height (wet & dry), refer to the technical data on P30.

1. As shown on Fig.2, hang all the air line accessories on the wall or on a bracket. Ensure that the air line accessories are on the ground.
 - a. Install & control an air regulator (C) .
The output pressure of fluid should be equal to the value set in air regulator.
 - b. Install a copper ball valve (B) near the pump, and use it to relieve trapped air. See the WARNING above. Another copper (B) valve ball should be located above all air line accessories, and be used to isolate the accessories during cleaning and repair.
 - c. The air line filter (C) can be used to remove harmful dirt and moisture in the air .
2. Install a flexible air hose between the accessories and the pump 1/2npt (f) air inlet (F). The air hose with minimum inner diameter of 1/2" (13 mm) should be used. Screw the air line connector (D) at the end of the air hose (A), and secure

the hose terminal at the connecting stub with screw.
Before operating the pump, do not connect the hose
terminal to connector (D).

Installation

Air Exhaust Ventilation

WARNING



FIRE OR EXPLOSION HAZARD

Be sure to read and follow the USING HAZARDOUS FLUID and FIRE OR EXPLOSION HAZARD

warnings on page 5, before you operate this pump.

Be sure the system is properly ventilated for your type of installation. You must vent the exhaust to a safe place, away from people, animals or food handling areas when pumping flammable or hazardous fluids.

If the diaphragm ruptures, the fluid being pumped will be exhausted with the air. Place a container at the end of the air exhaust line to catch fluid in case the diaphragm ruptures.

The size of air exhaust port is 3/4npt (f). Do not restrict the air exhaust port. Excessive restriction can cause pump wording unstably.

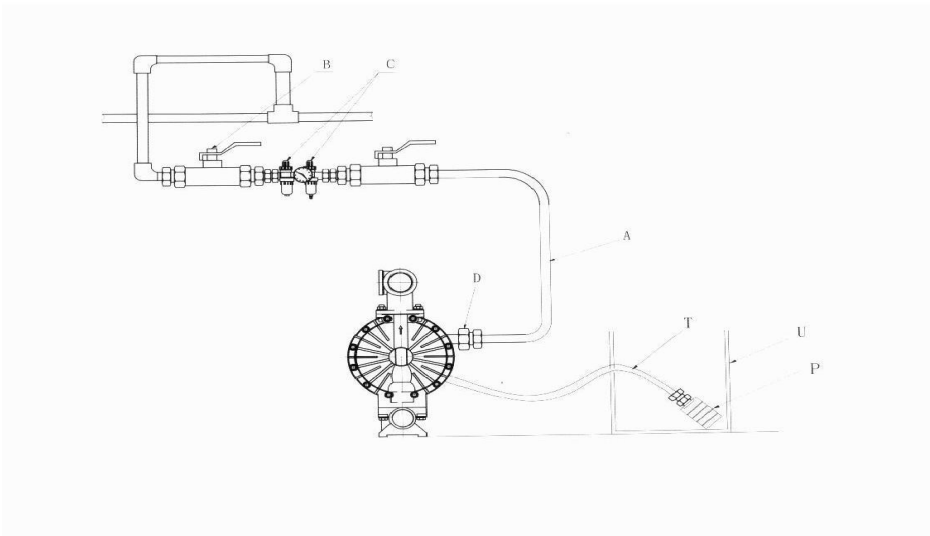
When need remote control emission

1. Remove the muffler (P) from the pump air exhaust port.

2. Install a grounded air exhaust hose (T) and connect the muffler (P) to the other side of the hose. The minimum size for the air exhaust hose is 3/4 in. (19 mm). If a hose longer than 15 in. (4.57 m) is required, use a larger diameter hose. Avoid sharp bends or kinks in the hose. See Fig5

3 Place a container (U) at the end of the air exhaust line to catch fluid in case a diaphragm ruptures.

VENTING EXHAUST AIR



INDEX:

- A Air supply line
- B Cooper ball valve
- C Air regulator
- D Air Line quick disconnect
- E Leak cooper ball valve
- F Air line filter
- P Muffler
- T Air exhausts hose
- U Container for air exhaust

Operation

Pressure Relief Procedure

⚠ WARNING

PRESSURE EQUIPMENT HAZARDS

Before manual pressure relief, the equipment is in pressure state. In order to reduce the risk of extremely serious injury from pressure fluids, spray gun or splashing fluid, during the following operation, specified procedures should be observed:

- Request to relief pressure.
- Stop pumping.
- Check, clean and repair any system equipment.
- Install and clean the fluid spray gun.

Starting and Adjusting the Pump



⚠ WARNING

TOXIC FLUIDS HAZARDS

To reduce the risk of serious injury, splashing in the eyes or on the skin, and toxic fluid spills, never move or lift a pump under pressure. If the pump is dropped, the fluid section could rupture. Always follow the Pressure Relief Procedure above before you move or lift the pump.

1. Shut off the air to the pump.
2. Open the dispensing valves if exist.
3. Open any available outbound fluid valves to relieve fluid pressure from the pump, and prepare the container for discharged fluid.

KEY

R 1" fluid inlet port

S 1" fluid outlet port

V Pressure relief valve

Part No. 110134 (aluminum)

Part No. 112119 (stainless steel)

Connect fluid outlet line here.

⚠ Install valve between fluid inlet and outlet ports.

⚠ Connect fluid inlet line here

⚠ Connect fluid outlet line here

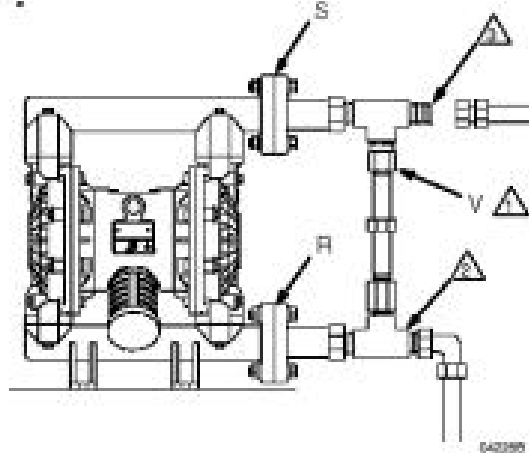


Fig 5

1. Be sure the pump is properly grounded. Refer to the instructions in Grounding section on page 6.
 2. Check all fittings and make sure they are tight. Be sure to use a compatible liquid thread sealant on all male threads. Make sure the fittings at inlet and outlet are reliably secured.
 3. Place the suction tube (if used) in the fluid to be pumped.
NOTE: If the inlet pressure to the pump is more than 25 percent of the outlet working pressure, the ball check valves will not close fast enough, resulting in inefficient pump operation.
 4. Place the end of the outlet hose (L) into an appropriate container.
 5. Close the fluid drain valve. Refer to Fig. 2.
 6. With the air regulator closed, open all bleed-type master air valves.
 7. If the outlet hose has a dispensing device, hold it open while continuing with step 8.
 8. Slowly open the air regulator until the pump starts to cycle. Allow the pump to cycle slowly until all air is pushed out of the lines and the pump is primed.
- If you are flushing, run the pump long enough to thoroughly clean the pump and hoses, close the air regulator, and remove the suction hose from the solvent and place it in the fluid to be pumped.

Maintenance

Lubrication

The air valve is designed to operate un-lubricated. If lubrication is desired, every 500 operation hours (or monthly), just add several drops of machine oil to container below in air regulator (C).

CAUTION

Do not over-lubricate the pump. Excess oil is exhausted through the muffler, which could contaminate your fluid supply or other equipment. Over-lubrication may also result in operation failure.

Flushing and Storage

WARNING

To reduce the risk of serious injury whenever you are instructed to relieving pressure procedure, and always follow the Pressure Relief Procedure on page 9.

Flush the pump often enough to prevent the fluid you are pumping from drying or freezing in the pump and damaging it. The fluid for flushing should be compatible with the pumped fluid, and doesn't affect the wetted parts. For recommendation on flushing fluids and periods, please contact with the provider and manufacturer. Always flush the pump and relieve the pressure before storing it for any length of time.

Troubleshooting

WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the Pressure Relief Procedure on page 9.

- Be sure to relieve pressure before checking and repairing.
- Check all possible problems and causes before you disassemble the pump.

| Problem | Cause | Solution |
|--|--|--|
| Pump cycles at stall or fails to hold pressure . | Check valve balls (01), seats (02) or o-rings (03). | Replace. |
| Pump does not cycle, or cycle once and stops | Air valve is stuck or dirty. | Disassemble and clean air valve. Use filtered air. |
| | Valve ball (01) severely worn, and wedged in seat (02) or manifold (1 or 3). | Replace ball and seat. |
| | Valve ball (01) is wedged into seat (02) due to overpressure. | Install a pressure relief valve |
| | Dispensing valve is clogged. | Relieve pressure and clear valve. |
| Pump operates erratically. | Suction line is clogged. | Inspect and clear. |
| | Sticky or leaking check valve balls (01). | Clean or replace. |
| | Diaphragm is ruptured. | Replace. |
| | Restricted exhaust. | Remove restriction. |

| Problem | Cause | Solution |
|---|--|---|
| Air bubbles in fluid. | Suction line is clogged. | Tighten. |
| | Diaphragm is ruptured. | Replace. |
| | Loose inlet manifold (3), damaged seal between manifold and seat (02), or damaged O-ring (03). | Tighten manifold bolts, or replace seats or O-ring (03). |
| | Loose diaphragm shaft bolt. | Tighten or replace. |
| | Damaged O-ring. | Replace. |
| Fluid in exhaust air. | Diaphragm is ruptured. | Replace. |
| | Loose diaphragm shaft bolt | Tighten or replace. |
| | Damaged o-ring. | Replace. |
| Pump discharge excess air during standstill | Worn air valves, O-ring, valve plate, position block, U-seals, or position pin O-ring. | Inspect; replace. |
| | Worn shaft seals. | Replace. |
| Pump leaks air externally. | Air valve cover (6) or screws are loose. | Tighten manifold bolts |
| | Air valve gasket or air cover gasket is damaged. | Inspect; replace. |
| | Air cover screws are loose. | Tighten manifold bolts |
| Pump leaks fluid externally from ball check valves. | Loose manifolds (1 or 3), damaged seals between manifold and seat (02). Damaged O-ring (03) | Tighten manifold bolts, or replace seat (02) or O-rings (03). |

FLOOR MOUNT TYPICAL INSTALLATION

KEY

- A Air supply hose
- B Bleed-type master air valve (required for pump)
- C Air regulator
- D Air line quick disconnect
- E Master air valve (for accessor
- F Air line filter
- G Fluid suction line
- H Fluid supply
- J Fluid drain valve (required)
- K Fluid shutoff valve
- L Fluid line
- N 1/2 npt(f) air inlet port
- R 1" fluid inlet port

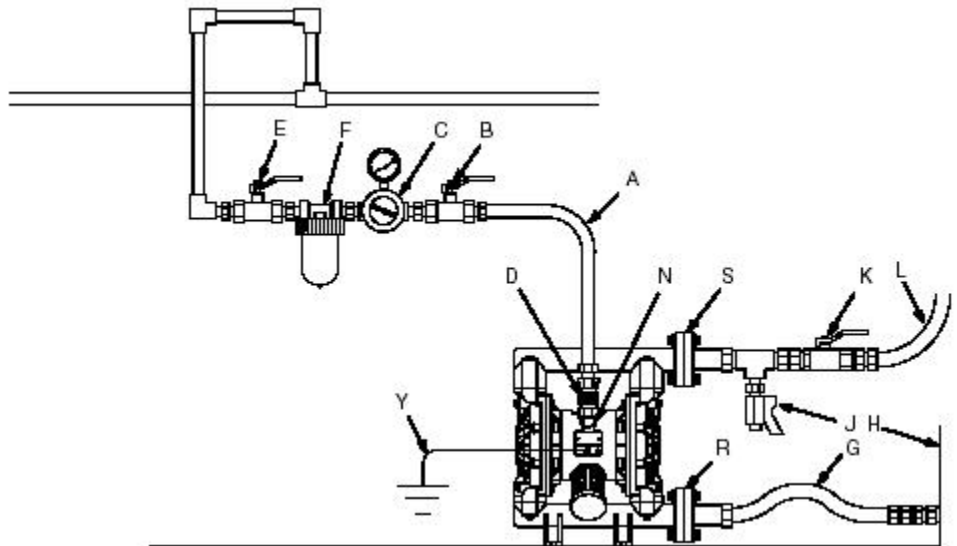
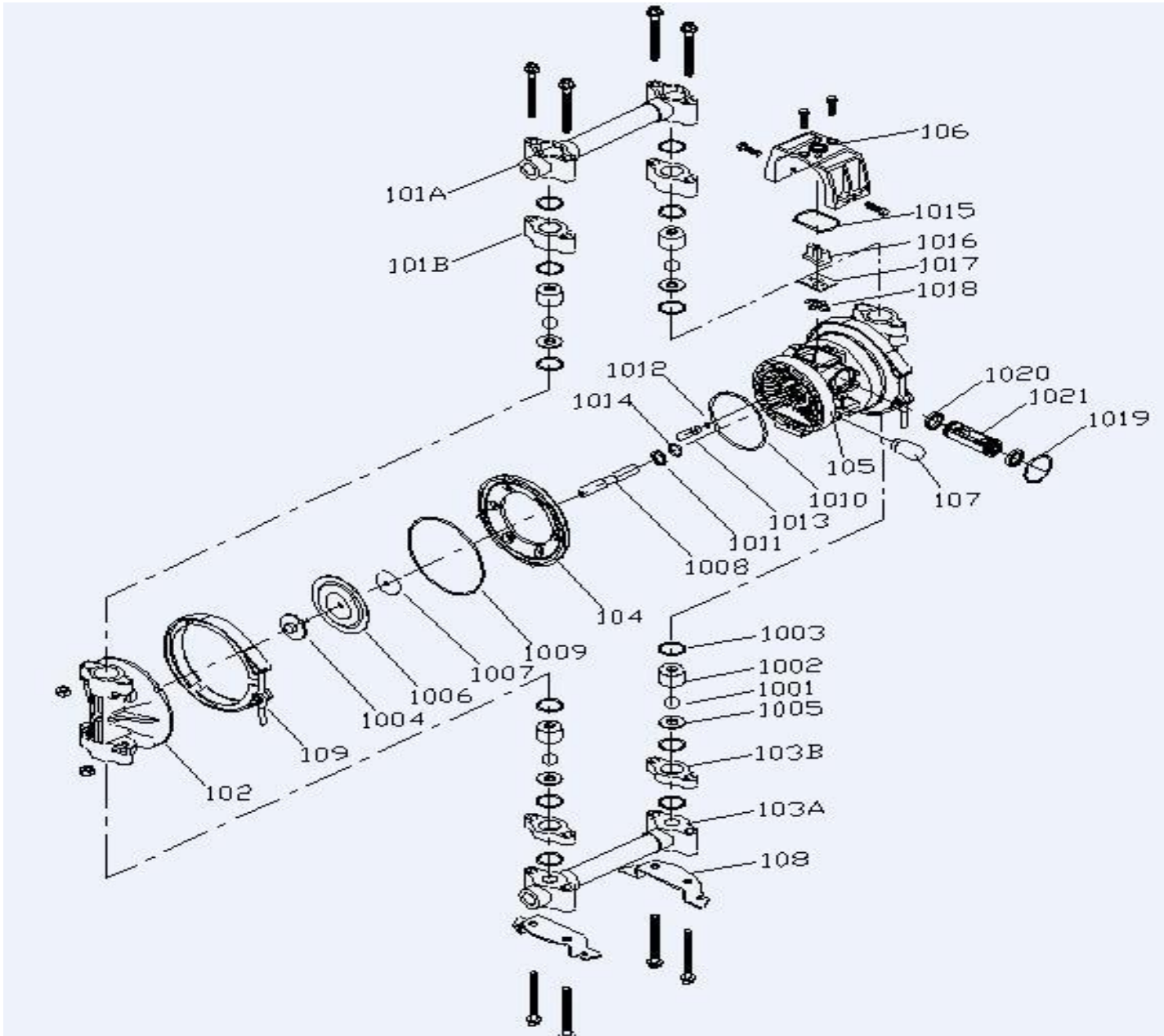


Fig 2

S 1" fluid outlet port

Y Ground wire (required; see page 6) for installation instructions)

Parts Drawing of JQ06&JQ10 Polypropylene Pump



Parts List

| No. | Parts Name |
|------|-------------------------------|
| 101A | Upper Manifold |
| 101B | Import Connect Block |
| 102 | Cover |
| 103A | Bottom Manifold |
| 103B | Export Connect Block |
| 104 | Inner Splint |
| 105 | Air Valve House |
| 106 | Air Valve Cover |
| 107 | Silencer |
| 108 | Base |
| 1001 | Valve Ball |
| 1002 | Valve Seat |
| 1003 | Seat O-Ring |
| 1004 | Plate |
| 1005 | Tailgate |
| 1006 | Diaphragm |
| 1007 | Inner Plate |
| 1008 | Central Axis |
| 1009 | O-Ring |
| 1010 | O-Ring |
| 1011 | O-Ring Tailgate |
| 1012 | Commutation Pin O-ring |
| 1013 | Commutation Pin |
| 1014 | O-Ring |
| 1015 | Air Valve Cover Gasket |
| 1016 | Air-guided Switch |
| 1017 | Air-guided Valve Board |
| 1018 | Air-guided Valve Board Gasket |
| 1019 | O-Ring |
| 1020 | V-Ring |
| 1021 | Piston |

Table for Choosing Models of Ligao Pump

Pump models has been marked on nameplates. It is composed of 8 letters and numbers. The first two digits from left to right are always Ligao, and remaining six digits represent the materials. For example, the models of a 1-inch pump with aluminum-alloy wetted parts, polypropylene valve seat, Teflon valve ball and Teflon diaphragm is JQ25-APFF. When you order the replacement parts, please refer to the parts lists. The table below shows the 8 digits letters and numbers:

| Ligao diaphragm pump | Import and Export Size | Fluid Component Materials | Valve Seat Material | Valve ball Material | Diaphragm Material |
|----------------------|------------------------|---------------------------|---------------------|---------------------|--------------------|
| JQ | 06=1/4in(8diameter) | M=Acetal | M=Acetal | M=Acetal | H=Hytrell |
| | 10=3/8in(10 diameter) | P=Poly | P=Poly | P=Poly | T=Santoprene |
| | 15=1/2in(15diameter) | A=Aluminum | A=Aluminum | A=Aluminum | F-PTFE |
| | 20=3/4in(20diameter) | S=304SST | S=304SST | S=304SST | B=Buna N |
| | 25=1in(25diameter) | K=PVDF | L=316SST | L=316SST | V=Viton |
| | 40=1.5in(40diameter) | D=Cl | H=Hytrell | H=Hytrell | G=Geolast |
| | 50=2in(50diameter) | | T=Santoprene | T=Santoprene | |
| | 80=3in(80diameter) | | K=PVDF | F-PTFE | |
| | 100=4in(100diameter) | | F-PTFE | B=Buna N | |
| | | B=Buna N | V=Viton | | |
| | | V=Viton | G=Geolast | | |
| | | G=Geolast | | | |

How to identify the material of Ligao pumps:

M=Acetal (Black plastic)

P=Poly (Semi-transparent plastic)

A=Aluminum (Black & grey metal)

S=304SST (Metal with '304')

L=316SST (Metal with '316')

K=PVDF (Pearl white/ light yellow plastic)

F=PTFE (White plastic)

B=Buna N (Black rubber)

V=Viton (Grey rubber)

T=Santoprene (Blue rubber)

H=Hytrell (Rice yellow rubber)