



Instruction Manual

Series G Model “B” Pump

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SECTION 1

DESCRIPTION

GENERAL

The Series G Model " B " pumps are reciprocating, chemical dosing pumps capable of producing controlled flows up to 1800 liters per hour at pressures up to 10 BAR (depending on the model). These pumps feature a mechanically actuated diaphragm, which eliminates the need for contour plates, and a stroke adjustment mechanism based on the variable eccentric principle instead of the traditional lost motion design. This design substantially reduces pressure and flow pulsations contributing to an increase in the life of system components and more continuous chemical injection. It is designed for industrial service and offers an accuracy of $\pm 1.5\%$ of 100% rated flow between 10% and 100% of its flow range.

PRINCIPLE OF OPERATION

The pump consists of two major assemblies; the drive and the liquid end. Pump delivery is a function of the drive's stroke rate, liquid end size and stroke length. Stroke length can be adjusted while the pump is running or stopped by turning the stroke adjusting knob.

The drive motor transmits rotary motion to a worm gear speed reduction unit which in turn drives the variable eccentric crank. The adjustable crank imparts reciprocating motion to the diaphragm through an interposing connecting rod. The stroke length is adjusted by changing the position of the variable eccentric crank in the connecting rod assembly.

As the diaphragm starts back on the suction stroke, the pressure immediately drops inside the liquid end. When the liquid end pressure drops below the suction line pressure, the suction ball check is " pushed "upward and the process fluid in the suction line flows into the liquid end chamber. When the suction stroke ends, the diaphragm movement momentarily stops. The pressure in the liquid end equalizes with the pressure in the suction line and the suction ball check seats.

NOTE:

It is important that the pressure in the liquid end remain above the vapor pressure of the process fluid during the suction stroke. If the fluid pressure drops below the vapor pressure, cavitation will occur, negatively impacting the performance of the pump. If you suspect the possibility of cavitation, contact your Milton Roy Representative for assistance.

As the diaphragm starts forward on the discharge stroke, the pressure immediately rises inside the liquid end. When the liquid end pressure rises above the discharge line pressure, the discharge ball check is " pushed "upward and the process fluid in the liquid end flows into the discharge line. When the discharge stroke ends, the diaphragm momentarily stops again. The pressure in the liquid end equalizes with the discharge line pressure and the discharge ball check reset. The cycle then starts again.

GENERAL SPECIFICATIONS

Flow Rate

Up to 1800 L/H

Pressure

Up to 10 BAR

Design

Mechanically Actuated Diaphragm

Drive

Variable Eccentric

Accuracy

±1.5% of 100% rated flow between 10% and 100% of rated flow

Adjustment

Lockable micrometer is adjustable from 0% to 100% while pump is running or stopped

Lubrication

Oil bath

Temperature

Ambient and Liquid: 50°C Maximum

-10 °C Minimum (Metal Liquid End)

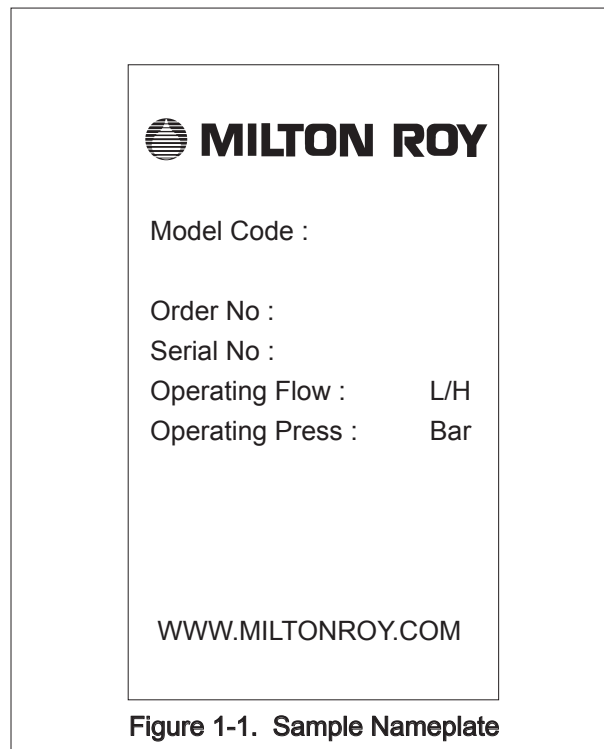
10 °C Minimum (Plastic Liquid End)

Suction Lift

2.5 meters of water column maximum.

PRODUCT CODE

Series G pumps are available in a variety of different configurations. For a breakdown of the options included in a specific pump, compare the pump model number and product code found on the pump nameplate with the model/product code breakdown. A sample nameplate is shown in Figure 1-1.



SECTION 2 INSTALLATION

UNPACKING

Pumps are shipped f.o.b. factory or representative warehouse and the title passes to the customer when the carrier signs for receipt of the pump. In the event that damages occur during shipment, it is the responsibility of the customer to notify the carrier immediately and to file a damage claim.

Carefully examine the shipping crate upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully so accessory items fastened to the inside of the crate will not be damaged or lost. Examine all material inside the crate and check against packing list to be sure that all items are accounted for and intact.

SAFETY PRECAUTIONS

When installing, operating, and maintaining the Series G pump, keep safety considerations foremost. Use proper tools, protective clothing, and eye protection when working on the equipment and install the equipment with a view toward ensuring safe operation. Follow the instructions in this manual and take additional safety measures appropriate to the liquid being pumped. *Be extremely careful in the presence of hazardous substances (e.g., corrosives, toxins, solvents, acids, caustics, flammables, etc.).*

STORAGE

Temporary Storage (Less than 6 Months)

It is preferable to store the material under a shelter in its original package to protect it from adverse weather conditions. In condensing atmospheres, follow the long term storage procedure.

Long Term Storage (Longer than 6 Months)

Primary Considerations

The primary consideration in storage of pump equipment is to prevent corrosion of external and internal components. This corrosion is caused by natural circulation of air as temperature of the surroundings change from day to night, day to day, and from season to season. It is not practical to prevent this circulation which carries water vapor and other corrosive gasses, so it is necessary to protect internal and external surfaces from their effects to the extent possible.

When the instructions given in this section are completed, the equipment is to be stored sheltered; protected from direct exposure to weather. The prepared equipment should be covered with a plastic sheet or a tarpaulin, but in a manner which will allow air circulation and prevent capture of moisture. Equipment should be stored 12 inches or more above the ground.

If equipment is to be shipped directly from Milton Roy into long term storage, contact Milton Roy to arrange for factory preparation.

Pump Drive

1. Flood the gearbox compartment with a high grade lubricating oil/rust preventative such as Mobile Oil Corporation product "Mobilarma 524." Fill the compartment completely to minimize air space and water vapor condensation. After storage, drain this material and refill the equipment with the recommended lubricant for equipment commissioning.
2. Remove drive motor and liquid end, and brush all unpainted metal surfaces with multipurpose grease (NLGI grade 2 or 3). Store these unattached.

Electrical Equipment

1. Motors should be prepared in the manner prescribed by their manufacturer. If information is not available, dismount and store motors as indicated in step 3 below.
2. Dismount electrical equipment (including motors) from the pump.
3. For all electrical equipment, place packets of Vapor Phase Corrosion Inhibitor (VPCI) inside of the enclosure, then place the entire enclosure, with additional packets, inside a plastic bag. Seal the bag tightly closed. Contact Milton Roy Service Department for recommended VPCI materials.

HANDLING OF PUMP

To avoid damaging the pump while moving or installing a Series G pump, follow the instructions below. Refer to Figure 2-1

1. Place a sling under the motor flange.
2. Cross the two ends of the sling and close the loop.
3. Place the other end of the sling under the liquid end mounting flange.
4. Make sure the entire unit is well balanced before attempting to move the pump.

CAUTION:

To avoid possible damage to either pump or personnel, bolt pump down as soon as it is in position.

MOUNTING

Support the pump firmly in a level position on a solid, vibration-free foundation, preferably with the base above floor level to protect the pump from wash downs and to provide easier access for service. Be sure to allow enough space around the pump for easy access during maintenance operations, pump adjustments, and/or oil filling or draining procedures.

Series G pumps are provided with mounting holes to accommodate anchor bolts. Refer to figure 2-2 for mounting hole dimensions.

Some Series G pumps are shipped with motors dismounted. After anchoring pump in position, install motor, referring to Figure 6-1. **Make sure spring (360) provided with pump is installed in worm shaft prior to motor installation.**

Pumps installed outdoors should be protected by a shelter.

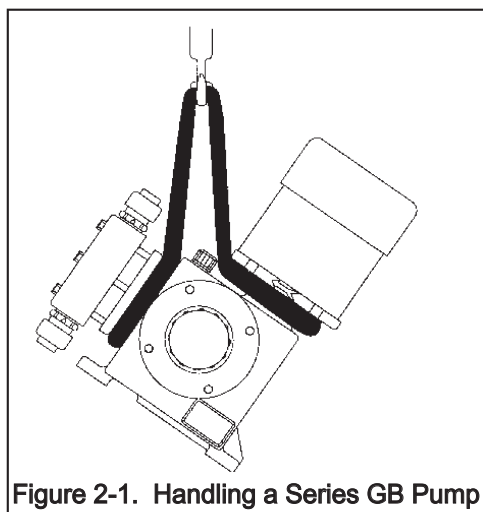


Figure 2-1. Handling a Series GB Pump

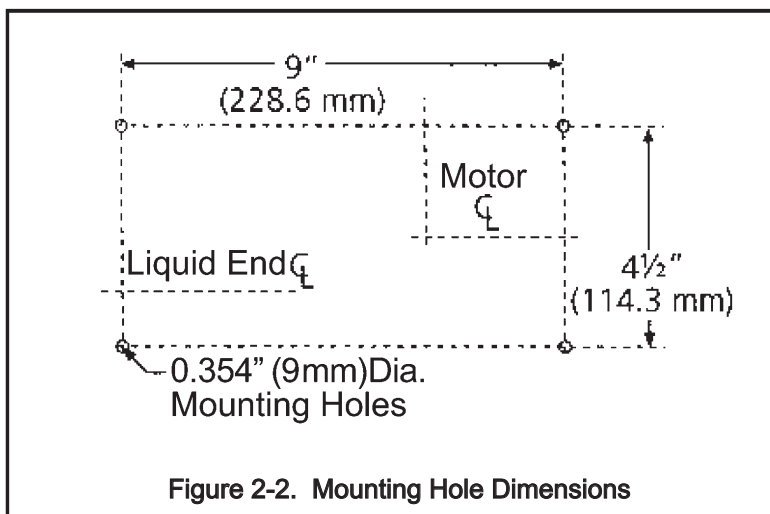


Figure 2-2. Mounting Hole Dimensions

PIPING

NPSH Considerations

Size piping to accommodate peak instantaneous flow. Because of the reciprocating motion of the pump diaphragm, pump delivery follows an approximate sine curve with a peak instantaneous flow $\pi(3.14)$ times the average flow. Therefore, piping must be designed for a flow 3.14 times the pump capacity; this means that a pump rated for 100 liters per hour requires piping sufficient for 3.14×100 L/hr (314 L/hr).

To minimize viscous flow losses when handling viscous liquids, it may be necessary to use suction piping up to four times larger than the size of the suction connection on the pump. If in doubt, contact your nearest Milton Roy representative to determine the necessary pipe size.

General Piping Considerations

- Use extreme care in piping to plastic liquid end pumps with rigid pipe such as PVC. If excessive stresses or vibration is unavoidable, flexible connections are recommended.
- Use piping materials that will resist corrosion by the liquid being pumped. Use care in selecting materials to avoid galvanic corrosion at pump liquid end connections.
- Use piping heavy enough to withstand maximum pressures.

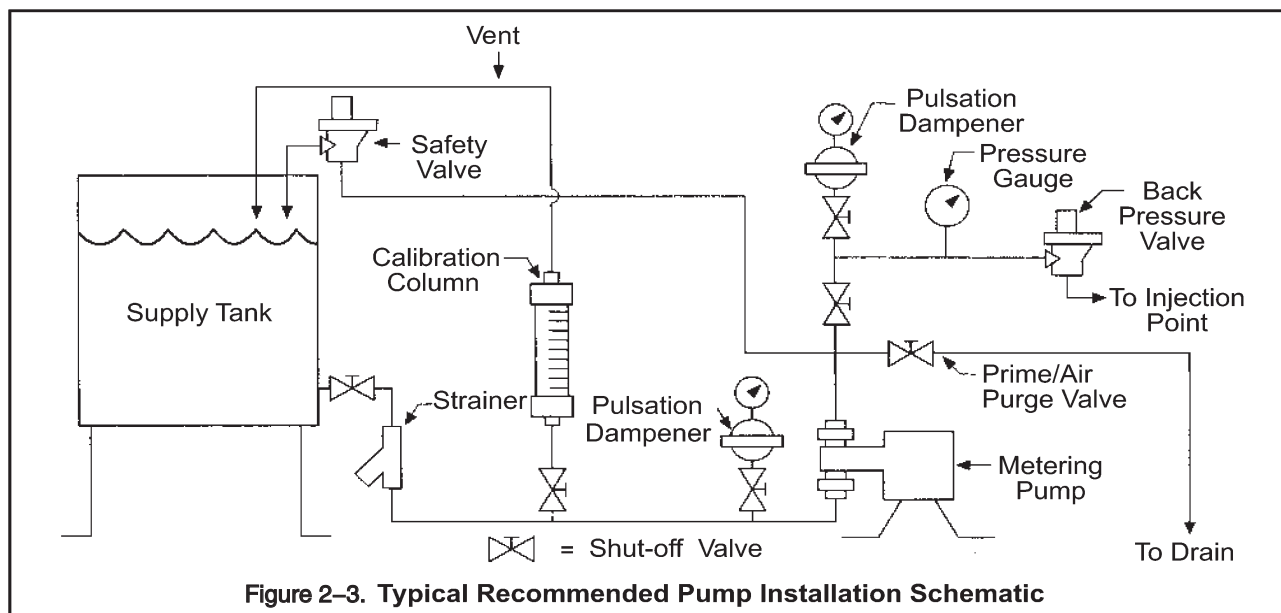


Figure 2-3. Typical Recommended Pump Installation Schematic

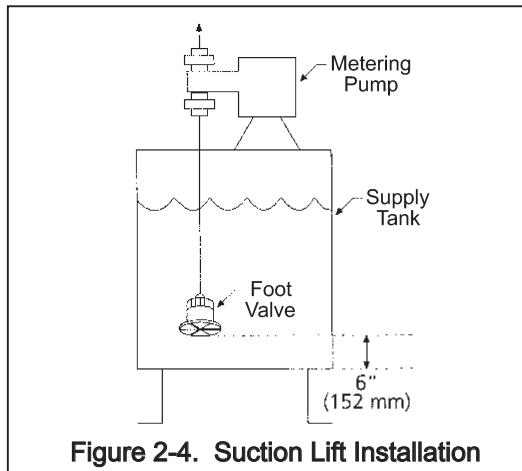
- Remove burrs, sharp edges, and debris from inside piping. Blow out all pipe lines before making final connections to pump.
- Because vapor in the liquid end will cause inaccurate pump delivery, piping should be sloped to prevent vapor pockets
- When pumping suspended solids (such as slurries), install plugged crosses at all 90° line turns to permit line cleaning without dismantling piping.
- See Figure 2-3 for a typical recommended pump installation scheme.

Suction Piping Considerations

- It is preferable to have the suction of the pump flooded by locating the liquid end below the lowest level of the liquid in the supply tank. Installing the supply vessel on the suction line close to the pump can help

ensure a flooded suction line. (Consult Milton Roy for assistance in such applications.).

- Avoid negative suction pressure conditions (suction lift), as such conditions adversely affect metering accuracy. A lift of 2.5 meters of water column is the maximum suction lift permissible.
- Series G pumps are designed to operate with process liquid supplied at or above atmospheric pressure. Although these pumps can move liquids supplied at less than atmospheric pressure, in these negative pressure applications it is important that all connections be absolutely drip free and vacuum tight, and that a foot valve be installed at the bottom of the suction line (see Figure 2-4).
- When pumping a liquid near its boiling point, provide enough suction head to prevent the liquid from " flashing " into vapor when it enters the pump liquid end on the suction stroke.



- If possible use metal or plastic tubing for the suction line because tubing has a smooth inner surface and can be formed into long, sweeping bends to minimize frictional flow losses.
- A strainer should be used in the suction line to prevent foreign particles from entering the liquid end. This and any other measures which prevent debris from entering and fouling the ball-checks will give increased maintenance-free service. Check strainer frequently to prevent blockage which could lead to cavitation.
- Keep suction piping as short and straight as possible.
- Piping size should be larger than the liquid end suction fitting to prevent pump starvation.
- If long suction lines are unavoidable, install a stand pipe near the pump in the suction line.
- Suction piping must be absolutely airtight to ensure accurate pumping. After installation, test suction piping for leaks with air and soap solution.

Discharge Piping Considerations

Install pipe large enough to prevent excessive pressure losses on the discharge stroke of the pump. Maximum pressure at the discharge fitting on the liquid end must be kept at or below the rated pressure (Max. allowable working pressure shown on the pump nameplate).

The pump will not deliver a controlled flow unless the discharge line pressure is 10 psi greater than the suction line pressure. There are a number of ways to create an artificial pressure, such as by installing a back pressure valve. (Please contact Milton Roy for recommendations to increase back pressure in slurry applications.).

When pumping water-treatment chemicals directly into boiler drums, use one liquid end assembly for each boiler drum. Discharging into a manifold having the slightest pressure difference between its several discharge connections can diminish metering accuracy as the outlet with the lowest pressure will receive more liquid than the other outlets.

Back Pressure Valves

A Milton Roy Back Pressure Valve should be installed in the discharge line near the pump to ensure sufficient discharge head pressure for proper pump metering action. Normally, the valve should be located near the pump; however, back pressure valves for large pumps with long and extremely small discharge lines may have to be installed near the point of discharge into the process (to minimize siphoning tendencies).

Pulsation Dampeners

An accumulator, surge chamber, surge suppressor, or pulsation dampener should be used with the back pressure valve in the discharge line to absorb the flow peaks between the pump and the back pressure valve. Without the pulsation dampener the valve mechanism will snap open and closed with the surge from each pump stroke. The pulsation dampener will allow the back pressure valve to oscillate about a partly-closed position, thus minimizing wear on the valve. Discharge line pulsation dampeners offer the further advantage of limiting the flow and pressure variations characteristic of this kind of pump. Installing a properly sized pulsation dampener will improve pump performance and may reduce system costs dramatically by permitting the substitution of smaller piping. Please contact Milton Roy Company for further information on pulsation dampeners.

Safety valves

Motor-driven positive displacement pumps can develop excessive discharge pressures long before thermal overload devices interrupt the motor electrical circuit. To prevent a blocked discharge line from causing damage to the pump, piping, or process equipment, install a Milton Roy Safety Valve in the pump discharge line. This valve is designed and sized to handle system flow rates and pressures safely while resisting corrosion by the process liquid.

Install the safety valve in the discharge line between the pump and the nearest shut-off valve. (This will prevent pump damage from accidental valve closure.) Pipe the safety valve outlet back to the suction tank or to drain, but in either case ensure that the pipe end is continuously visible so safety valve leakage may be detected. Milton Roy safety valves must be installed at top of supply tank in order to function properly (see Figure 2-3).

Check Valves

A check valve should be installed at the point where the discharge line enters a boiler or other high-pressure vessel. This will prevent back flow through the discharge piping and will isolate the pump discharge from system pressures (a safety consideration).

Shut-off Valves

Provide shut-off valves in both suction and discharge lines next to the pump. Locate discharge line shut-off valve downstream from the inlet connection of the safety valve. Figure 2-3 shows recommended valve locations.

LEAK DETECTION

Without switch or gauge

Series G Model B pumps are equipped with a leak detection port. For ease of installation, each pump has a plastic tubing connector installed in the leak detection port (see item 448 in Figure 6-2). In the event of a failure of the oil seal (70 in Figure 6-1) or diaphragm assembly (see item 261 in Figure 6-2), pump drive oil or process fluid will escape from this leakage port. During pump installation, actions should be taken to insure that this leakage is safely collected by installing tubing between the leak detection port and an appropriate containment vessel.

With switch and gauge

Series G Model B pump also is available with an option that includes tubing to a pressure gauge and switch as shown in figure 6-18. In the event of a diaphragm leak the process fluid is trapped inside the system and pressure switch (760) is tripped to set an alarm or shutdown.

This leak detection system is not filled with any fluid and will only be pressurized in the event of a seal failure. A drain (790) is provided for pressure relief prior to system disassembly.

ELECTRICAL CONNECTIONS

Ensure that the electrical supply matches the pump motor nameplate characteristics.

Before operating the pump, check the direction of rotation of the motor to be sure it matches the direction of the arrow stamped on the motor (rotation should be clockwise when viewed from the top of the motor). If motor rotation is incorrect, refer to the motor data plate or motor manufacturer's instructions for reversing.

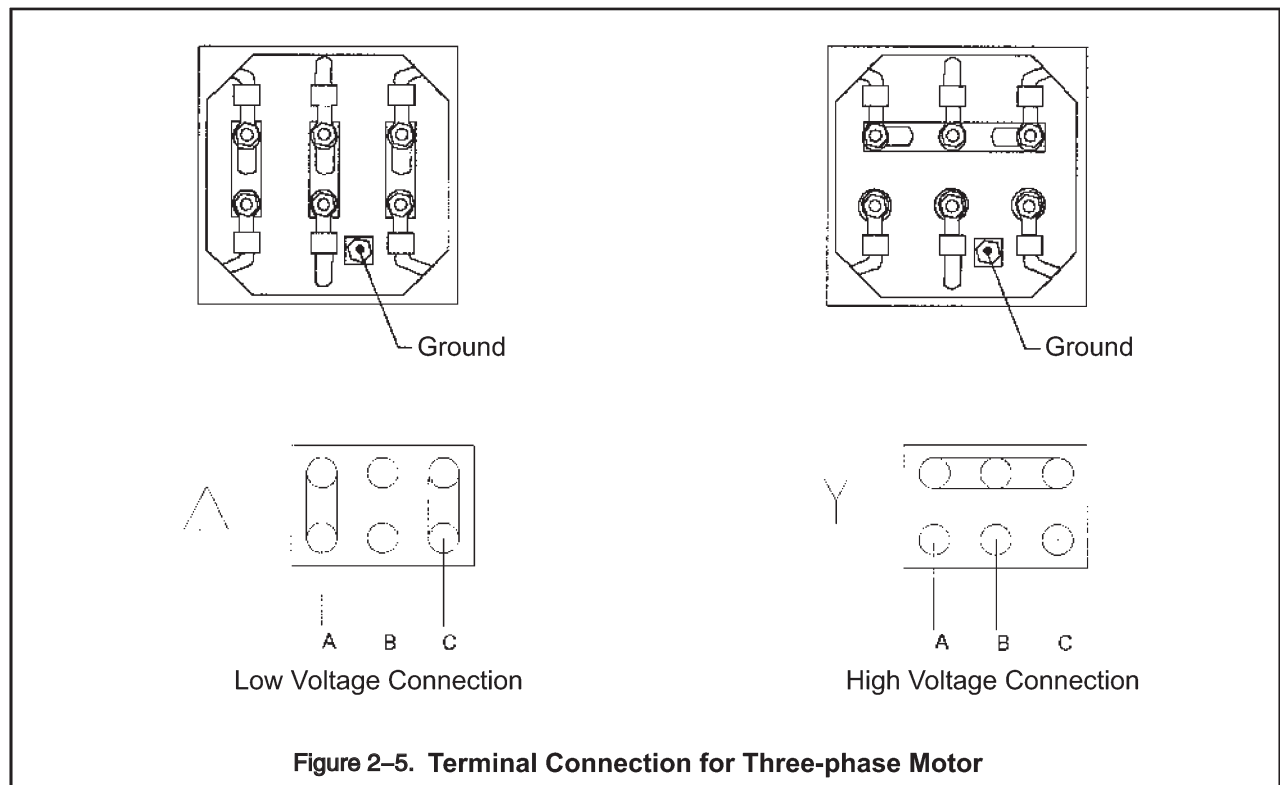
CAUTION:

Operation with the wrong motor rotation will damage the pump and motor and void the warranty.

CAUTION:

Do not forget to connect the pump to an earth ground!

Electric protection of the motor (fuses, overload meters or relays) should correspond to the rated current indicated on the motor data plate.



SECTION 3 OPERATION

INITIAL START-UP

Check that all mounting bolts are tight, piping is installed properly, and the discharge line is open.

Check oil drain plug for tightness. Remove the oil fill cap and fill the pump casing until level is between the markings on the oil fill cap dipstick, (approximately 3 quarts (2.8 Liters)).

Recommendation oil:

GB1200

	Surround Temp. > - 5°C	Surround Temp. -10°C to - 5°C
Model	MOBILGEAR 600 XP 220	MOBILGEAR 600 XP 68
	Great Wall L-CKD220	

GB1500 and GB1800

	Surround Temp. > - 5°C
Model	MOBILGEAR 600 XP 460
	Great Wall L-CKD460

Note: Equivalent oil of other brand is allowed.

CAUTION:

Pump is required to stop running if the surround temperature is below -10°C.

Before switching on power to the pump, turn the capacity adjustment knob to zero.

Check that all shut-off valves in the suction and discharge lines are open before increasing the capacity adjustment from zero.

Manual Capacity Control

To adjust pump capacity, loosen the stroke locking screw located in the pump side cover. Pump capacity is adjusted by turning the micrometer type stroke adjustment knob clockwise to decrease capacity or counterclockwise to increase capacity as required. The adjustment scale is marked in percent (%) of full stroke, with calibration lines on the knob at 1% intervals. After adjusting the knob to the desired capacity setting, hand tighten the stroke locking screw to maintain the capacity setting.

Filling Pumping system

It is especially important that pump suction and discharge lines be free of entrained air. To ensure this condition, operate the pump without any discharge pressure and fill the entire pumping system with liquid before starting pressure tests. A simple method to assure priming of the pump is to install a tee and a shut-off valve at the discharge connection of the pump.

If the pump is idle for long periods, temperature changes in the process liquid may produce air in the system. To discharge the air, install a valve in the discharge line which will allow the process liquid to be pumped to exhaust when starting the pump.

Capacity Calibration

After the first 12 hours of operation, the pump may be tested and calibrated to find the exact pump capacity under specific operating conditions.

Usually, calibrating the pump at only 100, 50, and 10 percent capacity settings is enough to indicate pump performance throughout the adjustment range.

The pump can be calibrated by measuring the decrease in liquid level pumped from a calibrated vessel. This method is recommended for hazardous liquids because it eliminates operator contact with the liquid. Milton Roy test-tube Calibration Columns are available for convenient and accurate calibration of any pump.

The pump can also be calibrated by collecting and measuring pumped liquid at the pump discharge port. It may be necessary to create discharge head at the liquid take off point so that the pump will operate properly.

(See Section 2 for recommended ways to do this.).

CAUTION:

This method is not generally recommended as it may expose operating personnel to hazardous liquids. Furthermore, the pump may over pump dramatically and the position of the capacity adjustment knob may have little effect on measuring flow rate.

SECTION 4 MAINTENANCE

SPARE PARTS

The following spare parts should be stocked for each pump to prevent serious delays in repairs. Refer to Figures 6-1~ 6-18 and to the accompanying parts lists.

Parts orders must include the following:

1. Quantity required
2. Part number
3. Part description
4. Pump serial number (found on nameplate)
5. Pump model number (found on nameplate)
6. Pump product code (found on nameplate)

Always include the serial number, model number, and product code in all correspondence regarding the unit.

SHIPPING PUMPS FOR REPAIR

Pumps can not be accepted for repair without a Return Material Authorization. Pumps should be clearly labeled to indicate the liquid being pumped. Process liquid should be flushed from the pump liquid end and oil should be drained from the pump housing before the pump is shipped.

NOTE:

A completed Material Safety Data Sheet (MSDS) must be packed in the shipping crate with any pump shipped for repair. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in pump liquid end. A Materials Safety Data Sheet must accompany all returns.

All inquiries or parts orders should be addressed to your local Milton Roy representative or distributor.

PREVENTIVE MAINTENANCE

Milton Roy pumps are carefully designed, manufactured, assembled, and quality tested to give reliable service with minimal maintenance. However, a weekly maintenance check is recommended to visually confirm proper operation of the pump.

Drive

Initially, change gear drive oil after the first 250 hours of operation. Then change drive oil after every 4000 hours of operation or every six months, whichever comes first.

Diaphragm Assembly

The Series G diaphragm assembly should be replaced every 4000 hours of operation to avoid the possibility of failure. Refer to the instructions in the "Corrective Maintenance" section.

Oil Seal

The Series G oil seal should be replaced every 4000 hours of operation to avoid the possibility of failure. Oil seal replacement requires the removal of the diaphragm assembly, so it is recommended that the oil seal and diaphragm assembly be replaced at the same time. Refer to the instructions in the "Corrective Maintenance" section.

Check Valves

Milton Roy Company recommends that check valve balls, seats, gaskets, and o-rings be replaced on an annual basis. If highly corrosive material (acids, slurries, etc.) is being pumped, some applications may require more frequent replacement.

To determine if check valves need maintenance, disassemble the check valves following the instructions in the "Corrective Maintenance" section. Inspect the ball check and seat for chemical or physical damage. The ball should be perfectly round and free of pits, mars, or scratches. The seat should retain a sharp edge where the ball contacts for proper sealing. If the seat edge is worn or damaged, or has any pits, mars, or scratches, it should be replaced. If the ball and/or seat is excessively damaged, the replacement schedule should be shortened accordingly. If the ball and seat are both in good condition, the replacement schedule can be lengthened.

Complete instructions for replacing worn check valve parts are given in the "Corrective Maintenance" section.

CORRECTIVE MAINTENANCE

CAUTION:

Before carrying out any servicing operation on the metering unit or pipes, disconnect electrical power from the pump, and take the necessary steps to ensure that the harmful liquid they contain cannot escape or come into contact with personnel. Suitable protective equipment must be provided. Check that there is no pressure before proceeding with dismantling.

Cleaning Fouled Check Valves

Check valve assemblies are designed to be self cleaning and should seldom need servicing. Fouled check valves can usually be cleaned by pumping a solution of mild detergent and warm water (if compatible with liquid being pumped) for 15 minutes, followed by flushing with water.

Check Valve Replacement

General

Before beginning work on the valve assemblies, make sure the shut-off valves are closed and that pressure has been bled from the system. When replacing the valves, take care to systematically change their O-rings and /or gaskets. Take care to properly assemble the valve assemblies; the ball must be placed on the sharp edge of the seats.

Check valves are supplied in two different configurations: plastic and stainless steel. Be sure to refer to the appropriate instructional set below.

CAUTION:

Be sure to follow instructions carefully and refer to the appropriate figure when reassembling check valves. If check valve cartridges are installed incorrectly, one of the following will occur: (a) immediate severe damage to pump mechanism, (b) no pumping, (c) reverse pumping action (from discharge line into suction line).

GB0080~GB1500 Liquid End Plastic Check Valves: Disassembly

Refer to Figure 6-3 ~ 6-10

1. Unscrew the union nut (435). The union end (445) is held in place by the union nut and will separate

easily from the other liquid end parts.

2. Unscrew the ball guide (424) from the liquid end.
3. Screw the union nut part way (one or two turns) onto the end of the ball guide that has the seat in it. Be sure the union nut is on loosely. This will allow a gap for the seat (420) to fall into as it is removed from the ball guide.
4. Set the ball guide/union nut onto a flat surface with the union nut down. Looking into the top of the ball guide, you will see four large holes surrounding one small hole. Insert a thin, blunt instrument such as a hex head screwdriver into the small center hole until it rests on the top of the ball (422).
5. Tap screwdriver gently with a hammer until the ball and seat are released from the ball guide.

CAUTION:

If you are disassembling unit for inspection only, be sure to use a blunt instrument and tap gently to avoid damaging the ball. If the ball and/or seat are damaged during disassembly they will have to be replaced. If available, to avoid damage, it is advisable to use gentle air pressure (applied at end opposite the seat - 420) for ball and seat removal.

6. Carefully remove the two or three o-rings (depending on liquid end style) from the ball guide and seat.
7. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

GB0080~GB1500 Liquid End Plastic Check Valves: Reassembly

Refer to Figure 6-3 ~ 6-10

1. Fit new o-rings into position on the ball guide and seat.

NOTE:

To assure a tight, leak free seal, new o-rings should be used each time the check valves are disassembled.

2. Drop the ball into the curved inner chamber end of the ball guide.
3. Sit the ball guide on a flat surface so that the side with the ball faces upwards. Position seat on the ball guide, trapping the ball inside. When the seat is pressed into the ball guide, the beveled edge of the seat must be facing outward. The bevel should not face the inside of the check valve (refer to Figure 6-3 ~ 6-10). Use a flat surface such as a board to press the seat into the ball guide with firm, even pressure.

CAUTION:

If the seat is improperly positioned, the ball will not create a tight seal and poor pumping performance will result.

4. Position the union end (445) onto the correct end of the ball guide. Refer to Figure 6-3 ~ 6-10 as the correct end is determined by whether the valve is intended for the suction or discharge port of the liquid end. Slip the union nut (435) over the union end and screw tightly (hand tight only) onto the ball guide.

CAUTION:

The order of Assembly of the suction and discharge check valves is different. Refer to Figure 6-3 ~ 6-10 for proper Assembly order. If check valve cartridges are installed incorrectly, one of the following will occur: (a) immediate severe damage to pump mechanism, (b) no pumping, (c) reverse pumping action (from discharge line into suction line).

5. Screw the valve Assembly into the liquid end body (hand tight only). **DO NOT OVER TIGHTEN.**

GB0080~GB0450 Liquid End Stainless Steel Check Valves: Disassembly

Refer to Figure 6-12

GB0080~GB0450 stainless steel check valves differ from the plastic versions in that the ball seat is integral to the ball guide. The seats can not easily be inspected for damage or wear. If you suspect that the check valve may be damaged or worn, replace the entire check valve assembly as per the instructions below.

1. Unscrew the coupling (445)
2. Unscrew the ball guide (424) from the liquid end.
3. Remove and discard the o-rings (419).
4. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

GB0080~GB0450 Liquid End Stainless Steel Check Valves: Reassembly

1. Screw the correct end of the check valve assembly into the liquid end (refer to Figure 6-12), trapping a new o-ring between the liquid end and the check valve assembly.

NOTE:

To assure a tight, leak free seal, new o-rings should be used each time the check valves are disassembled.

CAUTION:

The order of assembly of the suction and discharge check valves is different. Refer to Figure 6-4 for proper assembly order. If check valve cartridges are installed incorrectly, one of the following will occur: (a) immediate severe damage to pump mechanism, (b) no pumping, (c) reverse pumping action (from discharge line into suction line).

2. Screw the coupling (445) onto the check valve assembly, trapping a new o-ring (419, 423) between the coupling and the check valve assembly.

GB0500~GB1500 Liquid End Stainless Steel Check Valves: Disassembly

Refer to Figure 6-13 ~ 6-15

1. Unscrew the three screws (441 & 442) and remove them and their three washers (439).
2. Remove the connection(445)(applied to GB1500)or valve clamp (437)(applied to GB0500~GB1200).
3. The connection (435) (applied to GB0500~GB1200), seat (420), ball (422) and ball guide (424) should all now slip apart easily.
4. Remove and discard the three gaskets (419).
5. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

NOTE:

Two different type of screws are applied in GB0500~GB1200 Liquid end check valves, and the screw coded 441 are shorter. Only one type used in GB1500 Liquid end check valves

GB0500~GB1500 Liquid End Stainless Steel Check Valves: Reassembly

Refer to Figure 6-13 ~6-15

1. Drop the ball into the curved inner chamber end of the ball guide.
2. Place a new gasket on the rim of the ball guide, and sit the seat on top of the ball guide, trapping the ball and gasket between the seat and ball guide.

CAUTION:

Do not reuse old gaskets (419). Even if ball and seat are not worn and do not need replacing, new gaskets must be used any time the check valves are disassembled.

3. Position the connection (435) onto the correct end of the ball guide with a gasket trapped between the two metal surfaces. Refer to Figure 6-13 ~ 6-15 as the correct end is determined by whether the valve is intended for the suction or discharge port of the liquid end.

CAUTION:

The order of assembly of the suction and discharge check valves is different. Refer to Figure 6-13~6-15 for proper assembly order. If check valve cartridges are installed incorrectly, one of the following will occur: (a) immediate severe damage to pump mechanism, (b) no pumping, (c) reverse pumping action (from discharge line into suction line).

4. Position the check valve assembly onto the liquid end, trapping a gasket between the two metal surfaces. (Seat and pump head).
5. Slide the valve clamp (437) over the connection (435) and screw into the liquid end using the three screws (441, 442) and their split washers (439). Since one screw (441) is shorter than the others, be sure that it is screwed into the appropriate hole.

GB1800 Liquid End Plastic Check Valves: Disassembly

Refer to Figure 6-11

1. Unscrew nut (435)
2. Remove the connection(445)
3. Tight the connection nut(445) with the disassembled flexible tie-in on one side, Don't screw down and keep some clearance so that the valve seat(421), valve sheath(426), limited position plate(421) and valve flat(420) and the spring(422) can come off from the valve body.

Note:

The processes of assembly of suction check valve and discharge check valve are different.

4. Put the check valve body and flexible connection nuts on a work table with the nuts pointing down. With a blunt tool like hex head screwdriver on top of the limited position plate(point to the suction check valve) or on top of the valve body (point to discharge check valve).
5. Using a hammer to knock the screwdriver gently until the parts inside the valve body separate from the valve body.
6. Take out all the o-rings(419) from valve body, valve sheath and limited position plate.
7. Be careful to clean all the parts that will be reused. If chemical reagent is used during cleaning process

please make sure the reagent and the transported process liquid are compatible with each other.

GB1800 Liquid End Plastic Check Valves: Reassembly

Refer to Figure 6-11

1. Fit new o-rings into the relevant position of valve body, valve seat and limited position plate.

NOTE:

To assure a tight, leak free seal, new o-rings should be used each time the check valves are disassembled.

2. Refer to Figure 6-11, fit the valve seat, valve body, limited position plate and spring into the valve assembly.

CAUTION:

The order of assembly of the suction and discharge check valves is different.

3. Sit the ball guide on a flat surface so that the side with the ball faces upwards. Position seat on the ball guide, trapping the ball inside. When the seat is pressed into the ball guide, the beveled edge of the seat must be facing outward. The bevel should not face the inside of the check valve. Use a flat surface such as a board to press the seat into the ball guide with firm, even pressure.
4. Position the union end (445) onto the correct end of the ball guide. Slip the union nut (435) over the union end and screw tightly (hand tight only) onto the ball guide.
5. Screw the valve assembly into the liquid end body (hand tight only). **DO NOT OVER TIGHTEN.**

GB1800 Liquid End Stainless Steel Check Valves: Disassembly

Refer to Figure 6-16

1. Unscrew the three screws (441) and remove them and their three washers (439)
2. Remove the connection(445)
3. The seat (420), plate (422) and valve guide (424) should all now slip apart easily.
4. Remove the three gaskets (419).
5. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

GB1800 Liquid End Stainless Steel Check Valves: Reassembly

Refer to Figure 6-16

1. Unscrew the three screws (441) and remove them and their three washers (439)
2. Remove the connection(445)
3. The connection (435), seat (420), plate (422) and valve guide (424) should all now slip apart easily.
4. Remove the three gaskets (419).
5. Carefully clean any parts to be reused. If any chemicals are used in the cleaning process, ensure that they are compatible with the process liquid.

Diaphragm Assembly Replacement

It is recommended that the oil seal and diaphragm assembly be replaced at the same time. The instructions given under "Replacing the Oil Seal" are complete instructions for replacing both the oil seal and

the diaphragm assembly. If you plan to replace both, refer to the "Replacing the Oil Seal" instructions, and disregard the instructions below. These instructions are intended for use only if the diaphragm assembly is being replaced independent of the oil seal.

Before beginning diaphragm replacement, make sure that all shut-off valves are closed and all pressure is bled from the liquid end.

Diaphragm Assembly Identification & Limitations

Diaphragm assemblies with spanner wrench holes in the cap must be replaced as a unit, however hex head cap (240) style may be disassembled for diaphragm replacement.

Diaphragm Assembly Removal (Refer to Figure 6-1 and 6-2)

1. Set the stroke adjusting knob to 100%.
2. Disconnect the suction and discharge piping.
3. Unscrew the six diaphragm head bolts.
4. Remove the diaphragm head assembly from the pump body.
5. Turn the motor fan by hand (remove the motor shroud if necessary) until the end of the diaphragm assembly (261) is fully forward, and unscrew the diaphragm assembly from the connecting rod (60).

Disassembly (Only those units with a hex head diaphragm cap design)

1. Secure the hex cap (240) in a vise, and loosen the support nut (270) using a 30mm hex socket.
2. After complete disassembly inspect the support nut (270). It should be free of corrosion and clean. The angled surface must be smooth to protect the diaphragm from damage. If the support nut does not meet these requirements, replace it.

Reassembly (Only those units with a hex head diaphragm cap design)

1. Mount the hex cap (240) in a vise (do not over tighten), and with surfaces cleaned place a new diaphragm (260) onto the cap as shown in figure 6-2 (contour toward the support nut).
2. The set screw (250) hand tight in the cap with the hex end visible.
3. Snug the support nut (270) onto the set screw, hand tight.
4. **DO NOT OVERTIGHTEN** the support nut. Use a 30mm hex socket and torque wrench to tighten the support nut. The torque depends on diaphragm diameter.

Diaphragms less than 5" O.D. (127mm): Torque is 20 inch pounds.

Diaphragm over 5" O.D.; Torque is 30 inch pounds

Reinstallation of Assembly (Refer to Figure 6-1,6-2)

1. With the stroke adjusting knob at 100% and the diaphragm fully forward as in steps 1 and 5 above, screw the diaphragm assembly into the connecting rod until it reaches its natural mechanical stop.
2. Turn the motor fan by hand until the diaphragm rests properly on the diaphragm support (230). Reinstall the motor shroud if previously removed.
3. Fit the diaphragm head back into place on the pump body.
4. Torque the six diaphragm head bolts to 90 in.lb. (10Nm) in a crisscross pattern.

Replacing the Oil Seal

Before beginning oil seal replacement, make sure all shut-off valves are closed and all pressure has been

bled from liquid end.

When replacing the oil seal, the diaphragm assembly must be removed first. For ease of service, it is recommended that the oil seal be replaced in conjunction with the diaphragm assembly. Therefore, the instructions below include the "Diaphragm Assembly Replacement " instructions, and can be used for oil seal replacement and diaphragm assembly replacement.

Disassembly

Steps 2-6 below correspond to the five "Diaphragm Replacement----Disassembly" steps. (Refer to Figures 6-1, 6-2).

1. Drain oil from the pump by unscrewing the drain plug (20) and O-ring (19).
2. Set the stroke adjusting knob to 100%.
3. Disconnect the suction and discharge piping.
4. Unscrew the six diaphragm head bolts.
5. Remove the diaphragm head assembly from the pump body.
6. Turn the motor fan by hand (remove the shroud if necessary) until the end of the diaphragm assembly (261) is fully forward, and unscrew the diaphragm from the connecting rod (60).
7. Remove the diaphragm support ring (230).
8. Remove the retaining ring (220) from the connecting rod.
9. Slide the small oil seal clamp (210) off the connecting rod.
10. Remove the large oil seal clamp (80) by unscrewing the four slotted screw (90).
11. Pull the oil seal (70) off of the connecting rod.

Reassembly

Steps 5-8 below correspond to the four "Diaphragm Replacement----Disassembly " steps. Refer to Figures 6-1, 6-2.

1. Install a new oil seal (70) onto the connecting rod.
2. Slide small oil seal clamp (210) onto the end of the connecting rod and secure in place with the retaining ring (220). A drive socket large enough to fit over the end of the connecting rod should be used to push the retaining ring until it snaps into place in the retaining ring groove in the connecting rod.
3. Secure the large oil seal clamp (80) over the oil seal with the four slotted screws (90).
4. Place the diaphragm support ring (230) into position making sure beveled side (for diaphragm support) is facing up (refer to Figure 6-2 if necessary).For GB0700~GB1800 liquid ends, the support ring (230) has stepped diameters. Make sure that the larger diameter is installed into the metal adapter ring (225 in Figure 6-7).
5. With the stroke adjusting knob at 100% and the diaphragm fully forward as in steps 2 and 6 of disassembly instructions, screw the diaphragm assembly into the connecting rod until it reaches its natural mechanical stop.
6. Turn the motor fan by hand until the diaphragm rests properly on the diaphragm support ring (230) Reinstall the motor shroud if previously removed.
7. Fit the diaphragm head back into place on the pump body.
8. Torque the six diaphragm head bolts to 90 in.lb. (10 Nm) in a crisscross pattern.
9. Add oil to pump, following directions given in "Initial Start-up " in Section 3.

SECTION 5

TROUBLESHOOTING GUIDE

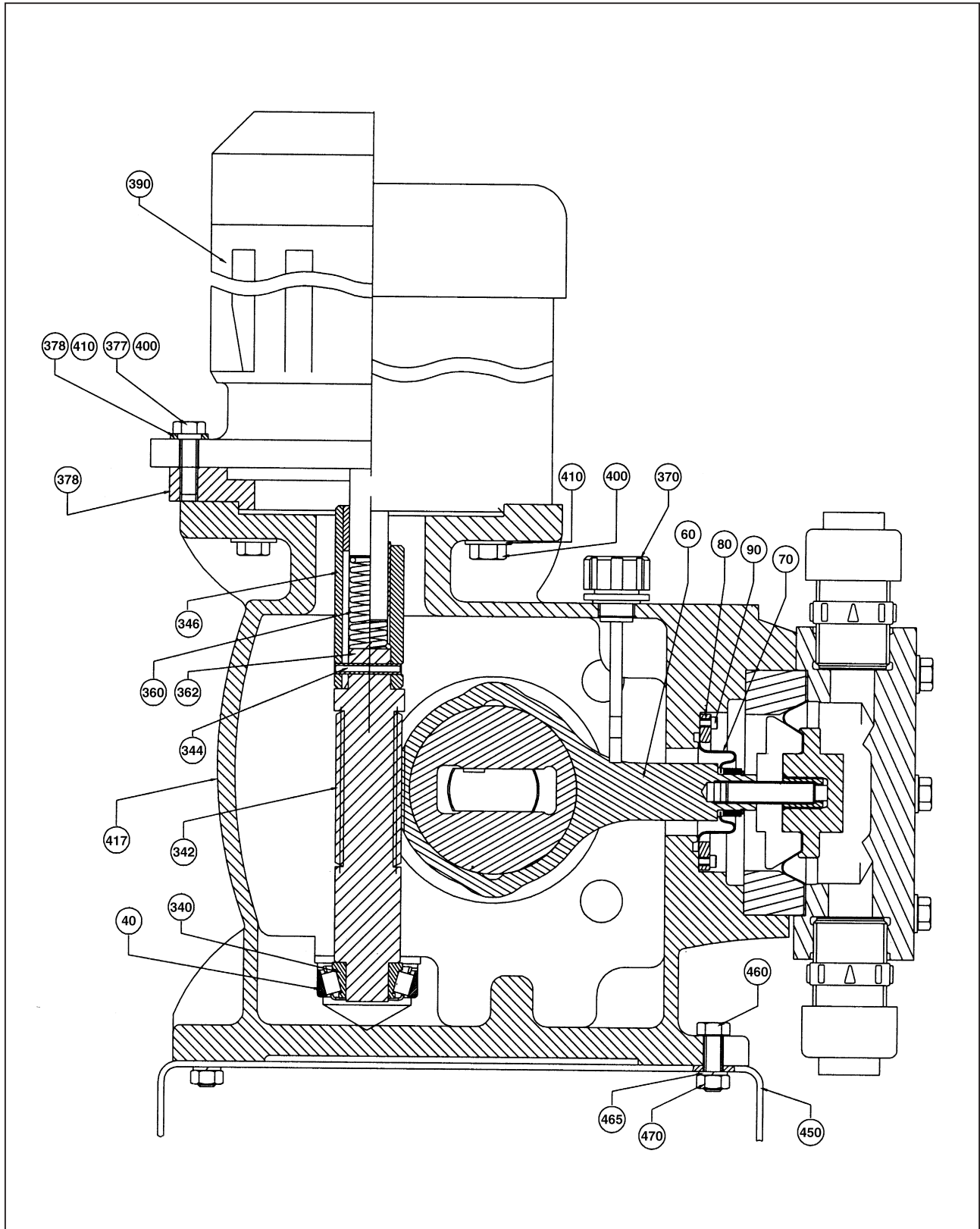
SYMPTOMS & REMEDIES

- | | |
|----------------------------|--|
| Pump will not operate..... | <ul style="list-style-type: none"> ● Low process liquid level in the tank. Add liquid. ● Worn or dirty check valves. Clean or replace. ● Blocked discharge line. Clear line. ● Frozen liquid. Thaw liquid throughout pumping system. ● Blown fuse. Replace fuse. ● Open thermal overload device in motor starter. Reset device. ● Broken wire. Locate and repair. ● Low voltage. Investigate and correct (wiring may be too light). ● Pump not primed. Allow suction line and pump head to fill with liquid before pumping against pressure. Refer to "Filling Pumping System" in Section 3. ● Capacity adjustment set at zero. Readjust capacity. |
| Insufficient delivery..... | <ul style="list-style-type: none"> ● Incorrect capacity adjustment. Readjust capacity setting. ● Incorrect pump speed. Match line voltage and frequency to pump motor data plate. ● Starved suction. Increase piping size or suction head. ● Leaky suction piping. Repair piping. ● High suction lift. Rearrange equipment to decrease lift. ● Liquid near boiling. Cool liquid or increase suction head. ● Leaky safety valve in discharge line. Repair or replace safety valve. ● High liquid viscosity. Reduce viscosity (e g, heat or dilute liquid). ● Worn or dirty check valve seats. Clean or replace. |
| Erratic delivery..... | <ul style="list-style-type: none"> ● Leaky suction piping. Repair piping ● Leaky safety valve. Repair or replace safety valve. ● Insufficient suction head. Raise suction tank level or pressurize tank. ● Liquid near boiling. Cool liquid or increase suction head. ● Worn or dirty check valves. Clean or replace. ● Clogged or dirty line strainer. Clean strainer. |

- Motor and pump body hot.....
- Normal operating temperature of both motor and pump body is frequently uncomfortable to the touch. However, neither should exceed 200°F (93°C).
 - Power supply does not match electrical requirement of motor. Insure proper matching of power supply and motor.
 - Pump is being operated at greater than rated performance. Reduce pressure or stroke speed. If this is not practical, contact service facility.
 - Pump improperly lubricated. Drain oil and refill with proper amount of recommended lubricant.
- Pump still pumps even at zero capacity setting.....
- Misadjusted micrometer knob. Readjust capacity setting.
 - Insufficient discharge pressure. Correct condition (e g, install a back pressure valve).
- Gear noise.....
- Excessive backlash. Consult service facility.
 - Worn bearings. Consult service facility.
 - Wrong or insufficient lubricant. Replace or replenish lubricant.
- Loud knock with each stroke.....
- Excessive gear set wear. Consult service facility.
 - Worn bearings. Consult service facility.
- Noisy operation in liquid end.....
- Noise in check valves. Ball checks move up and down with some force. A distinct "clicking" noise is normal, especially in metal piping systems.
- Inspection hole at the bottom of
pump head Material leakage
- Diaphragm rupture. Diaphragm change required
- Inspection hole at the bottom of
pump head lubricating oil leakage
- Oil seal rupture. Oil seal change required

SECTION 6 PARTS

Figure 6-1. Series GB Basic Parts - Side View



This technical drawing is a cross-sectional view of a complex mechanical assembly, possibly a pump or engine component. The drawing is labeled with numerous callouts (e.g., 10, 20, 30, 100, 110, 120, 130, 140, 150, 160, 170, 171, 172, 173, 174, 175, 180, 190, 200, 205, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 332, 335, 448, 50) and includes a circular feature labeled 'OIL'. The drawing shows the internal structure of the assembly, including various chambers, passages, and components. The 'OIL' label is located in a circular feature on the right side of the drawing. The drawing is a technical illustration, likely from a patent document, showing the internal structure of a mechanical assembly. The drawing is a cross-sectional view, showing the internal components and their arrangement. The drawing is labeled with numerous callouts (e.g., 10, 20, 30, 100, 110, 120, 130, 140, 150, 160, 170, 171, 172, 173, 174, 175, 180, 190, 200, 205, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 332, 335, 448, 50) and includes a circular feature labeled 'OIL'. The drawing shows the internal structure of the assembly, including various chambers, passages, and components. The 'OIL' label is located in a circular feature on the right side of the drawing. The drawing is a technical illustration, likely from a patent document, showing the internal structure of a mechanical assembly.

Parts List for GB Drive Assembly (Refer to Figure 6-1 & 6-2)

Item Number	Description	Material	Part Number	Qty.
10	Drive Housing Assembly	–	H60900	1
19	O-ring, 14 × 2.65	NBR	S4080068031	1
20	Drain Plug. 3/8" –19 BSP	–	S60086	1
50	Gear, 40:1 (36/43 SPM)	HT 300	S60011	1
	Gear, 20:1 (72/86 SPM)	HT 300	S60009	1
	Gear, 14:1 (102/122 SPM)	HT 300	S60829	1
	Gear, 10:1 (144/173 SPM)	HT 300	S60007	1
	Gear, 8:1 (180 SPM)	HT 300	S60050	1
	Gear, 7:1 (206 SPM)	HT 300	H60776	1
60	Connecting Rod	QT450–10	S60654	1
70	Oil Seal	Rubber	60048	1
80	GB Oil Seal Clamp (outer) ,Aluminum	LY12	H60755	1
90	Slotted Pan Head Screw, M3 × 10	–	S60294	1
100	Sliding Crank Assembly(GB0080~GB1200)	40Cr	S60002	1
	Sliding Crank Assembly(GB1500~GB1800)	40Cr	H60777	1
110	Eccentric	40Cr	S60003	1
120	Shoe	Cr12MoV	S60052	1
140	Single Row Bearing, SKF 6303	–	S4099994000	1
150	Truarc Retaining Ring	–	S4040107231	1
160	Seal, Side Cover	NBR	60766	1
171	Stroke Adjustment Screw	2Cr13	H60768	1
172	Bearing Retainer	45	H60757	1
173	Washer	A140	S4040037029	4
174	Socket Head Screw, M4 × 8	–	S4050204034	4
175	Stroke Scale	–	S2530046062	1
190	O-ring, Side Cover	NBR	S4080095371	1
200	Side Cover	ZL107	H60767	1
205	Hex Head Screw. M8 × 16	–	S4350001622	1
210	GB Oil Seal Clamp (inner) ,Aluminum	LY12	H60756	1
220	Truarc Retaining Ring	–	S4040133060	1
310	Ball, 5/16"	Nylon	S60152	1
320	Stroke Lock Knob	304 SS	S60398	1
322	O-ring, 9.5 × 1.8	NBR	S4080109091	1
330	Stroke Adjustment Knob	–	70066	1
332	Pan Head Screw, M5x12–4.8	–	H65525	2
335	Logo Decal	304 SS	H60020	1

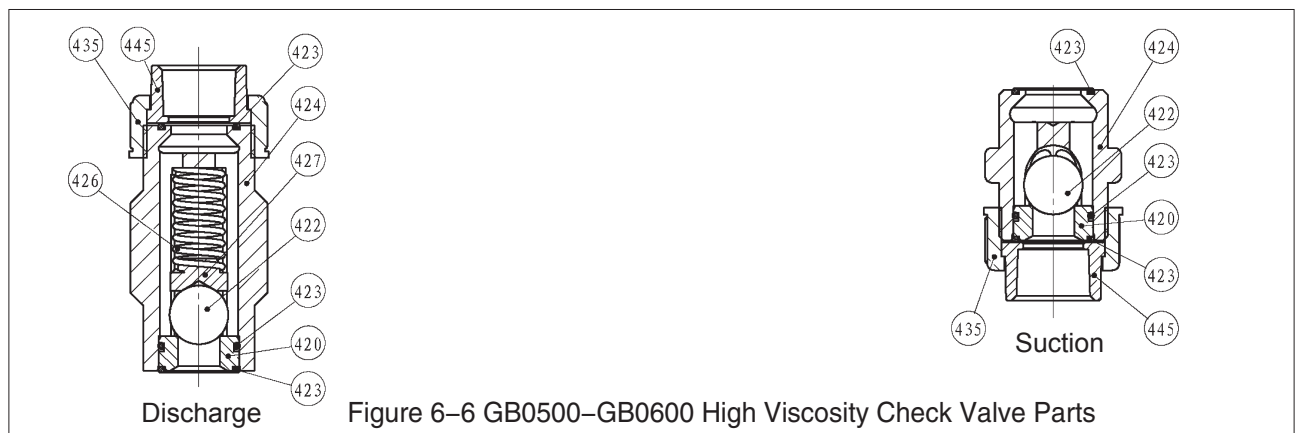
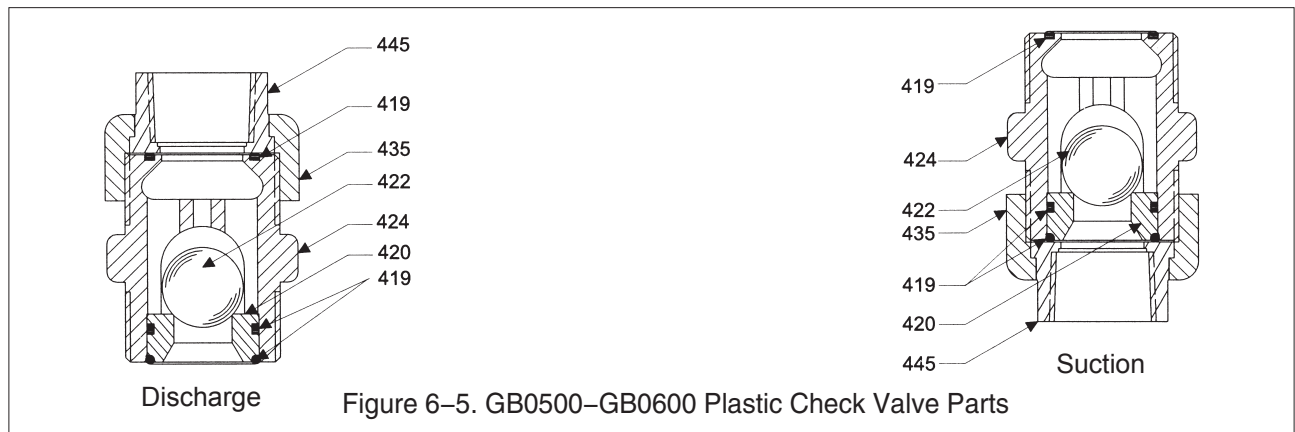
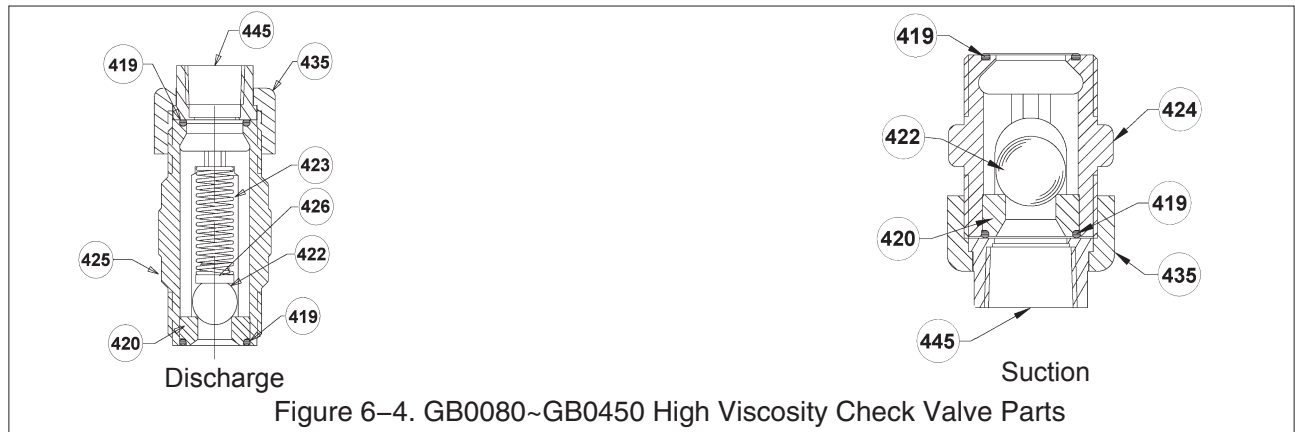
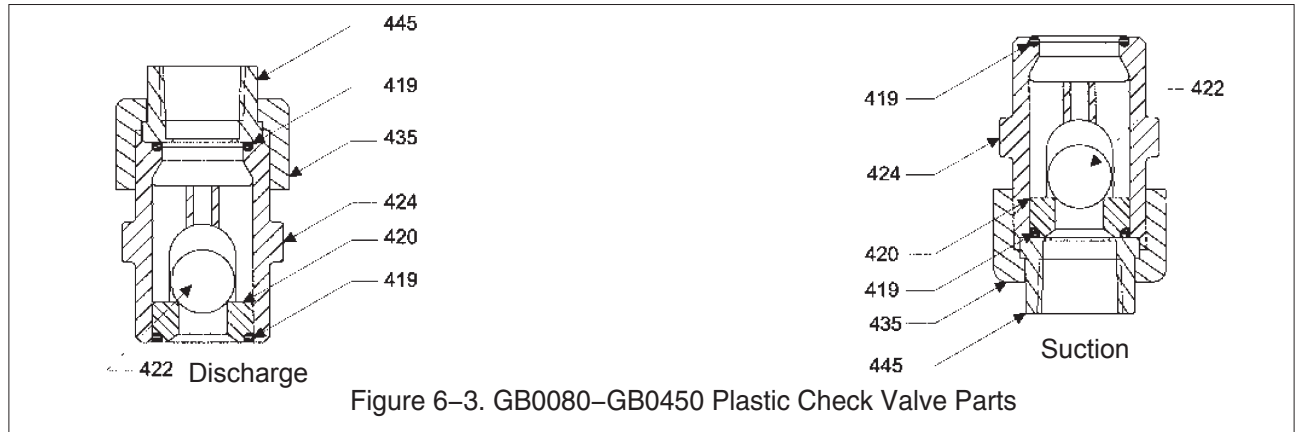
Parts List for GB Drive Assembly - continued (Refer to Figure 6-1 & 6-2)

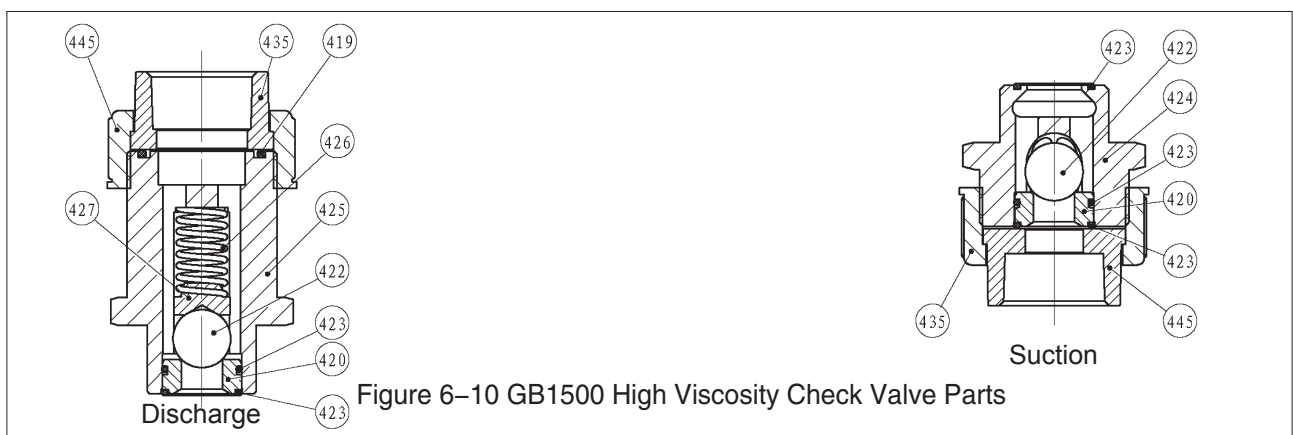
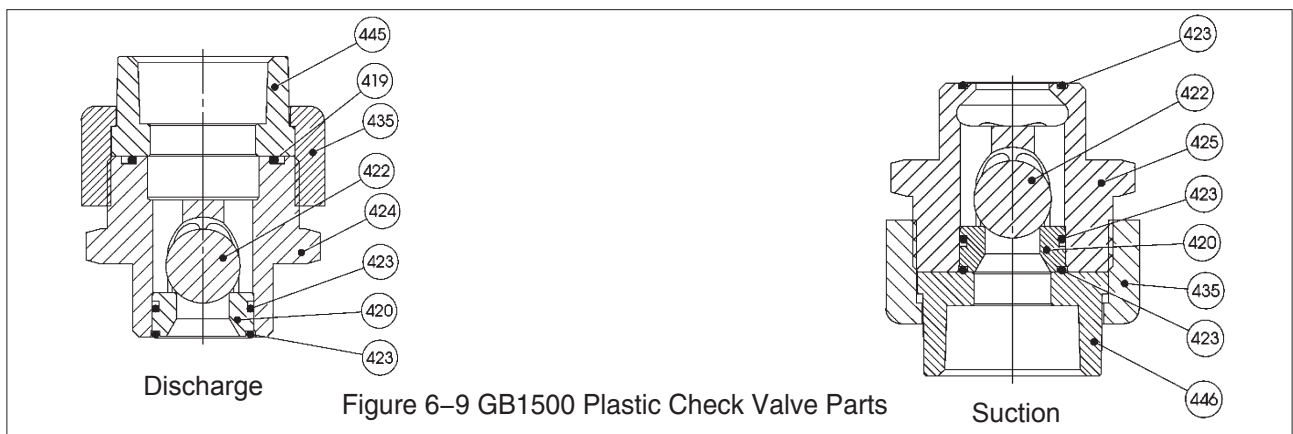
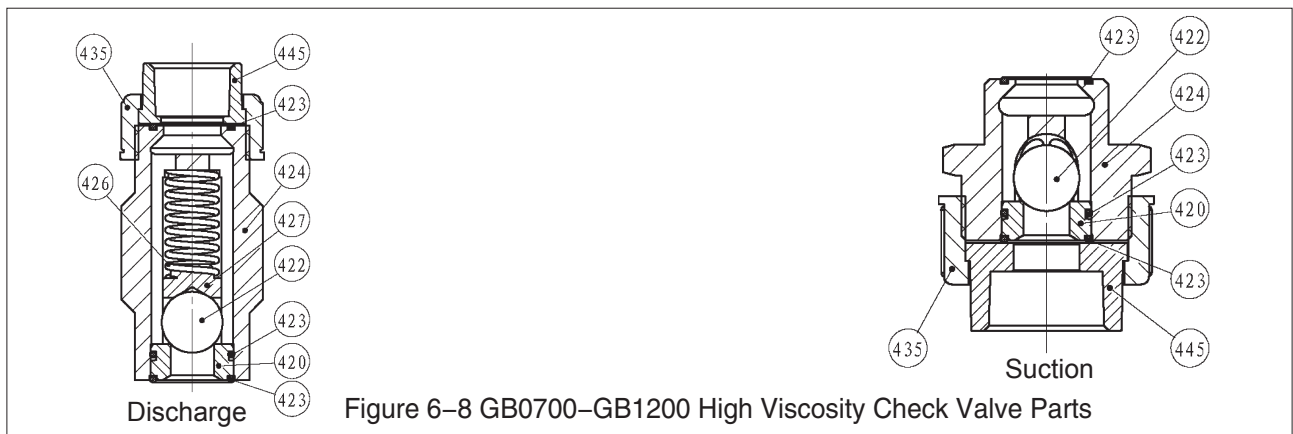
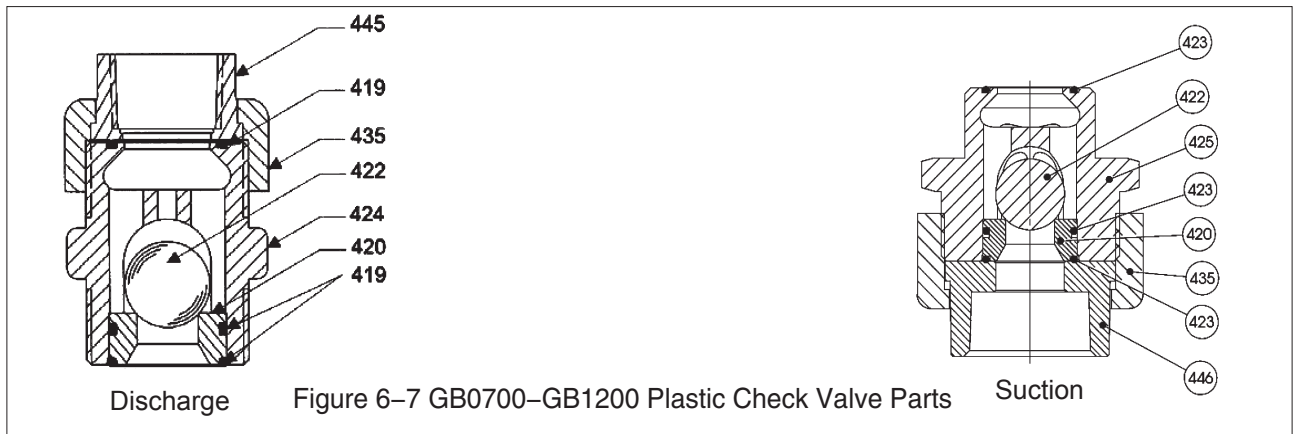
Item Number	Description	Material	Part Number	Qty.
342	Worm Assembly , 40:1, (IEC 71)	–	H60903	1
	Worm Assembly, 40:1, (IEC 80)	–	H60909	1
	Worm Assembly, 40:1, (NEMA 56C)	–	H60915	1
	Worm Assembly, 20:1, (IEC 71)	–	H60904	1
	Worm Assembly, 20:1, (IEC 80)	–	H60910	1
	Worm Assembly, 20:1 ,(NEMA 56C)	–	H60916	1
	Worm Assembly, 14:1, (IEC 71)	–	H60905	1
	Worm Assembly,14:1, (IEC 80)	–	H60911	1
	Worm Assembly, 14:1, (NEMA 56C)	–	H60917	1
	Worm Assembly, 10:1, (IEC 71)	–	H60906	1
	Worm Assembly, 10:1, (IEC 80)	–	H60912	1
	Worm Assembly, 10:1 ,(NEMA 56C)	–	H60918	1
	Worm Assembly, 8:1, (IEC 71)	–	H60907	1
	Worm Assembly, 8:1, (IEC 80)	–	H60913	1
	Worm Assembly, 8:1, (NEMA 56C)	–	H60919	1
	Worm Assembly, 7:1, (IEC 71)	–	H60908	1
	Worm Assembly,7:1, (IEC 80)	–	H60914	1
	Worm Assembly, 7:1 ,(NEMA 56C)	–	H60920	1
370	Vent w/Dip Stick	–	S70067	1
375	Direction Decal	–	S2530077000	1
376	Motor Adapter (IEC 80)	Aluminum	H60758	1
377	Bolts, M 8 × 25 (IEC 71)	–	S4350003473	4
378	Washer (IEC 71)	–	S4340009002	4
390	Motor, 550W–220/380V–50Hz–3phase, IEC 71, B5, 1440rpm, TEFC, IP55, F	–	H67516	1
	Motor, 1hp–220/380V–50Hz–3phase, NEMA 56C, 1450rpm, TEFC NEMA 3, F	–	H67502	1
	Ex–proof Motor, 550W–220/380V–50Hz–3Phase, dIIBT4, IEC 80, B5, 1440rpm, TEFC, IP 55, F	–	H67519	1
	Motor, 750W–220/380V–50Hz–3phase, IEC 80, B5, 1440rpm, TEFC, IP 55, F	Q235–A	H67520	1
400	Blots, M10 × 25 (IEC 80)	–	S4350001732	8
410	Washer (IEC 80)	–	S4340005152	8
417	Caution Decal	–	S60148	1
450	Base		60071	1
460	Bolts, M8 × 35	–	S4350035542	4
465	Washer	–	S4340009002	4
470	Nut, M8	–	S4340000042	4
500	Gear Lubricant, 1 Liter		H60019	3
600	Nameplate		H60013	1
610	Screw, 5/32"		4050280000	2
700	GB Instruction Manual		HE339–0049–000	1

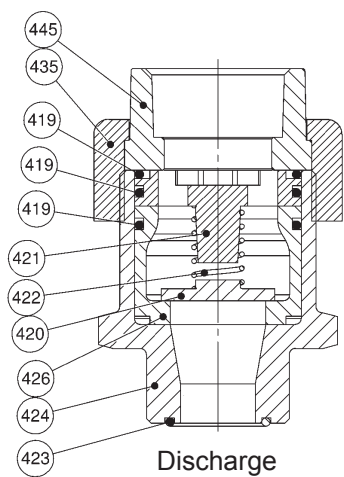
Note:

1. Replacement of housing assembly(10), only as assembly of drive housing(10), thrust bearing(30), bearing cup(40), tubing connector(448).
2. Replacement of worm assembly(342), only as assembly of conical bearing(340), worm(342), spring pin(344), coupling(346) ,spring(360).

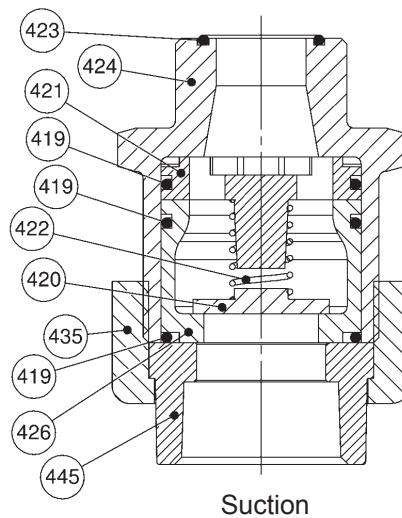
CHECK VALVE PARTS







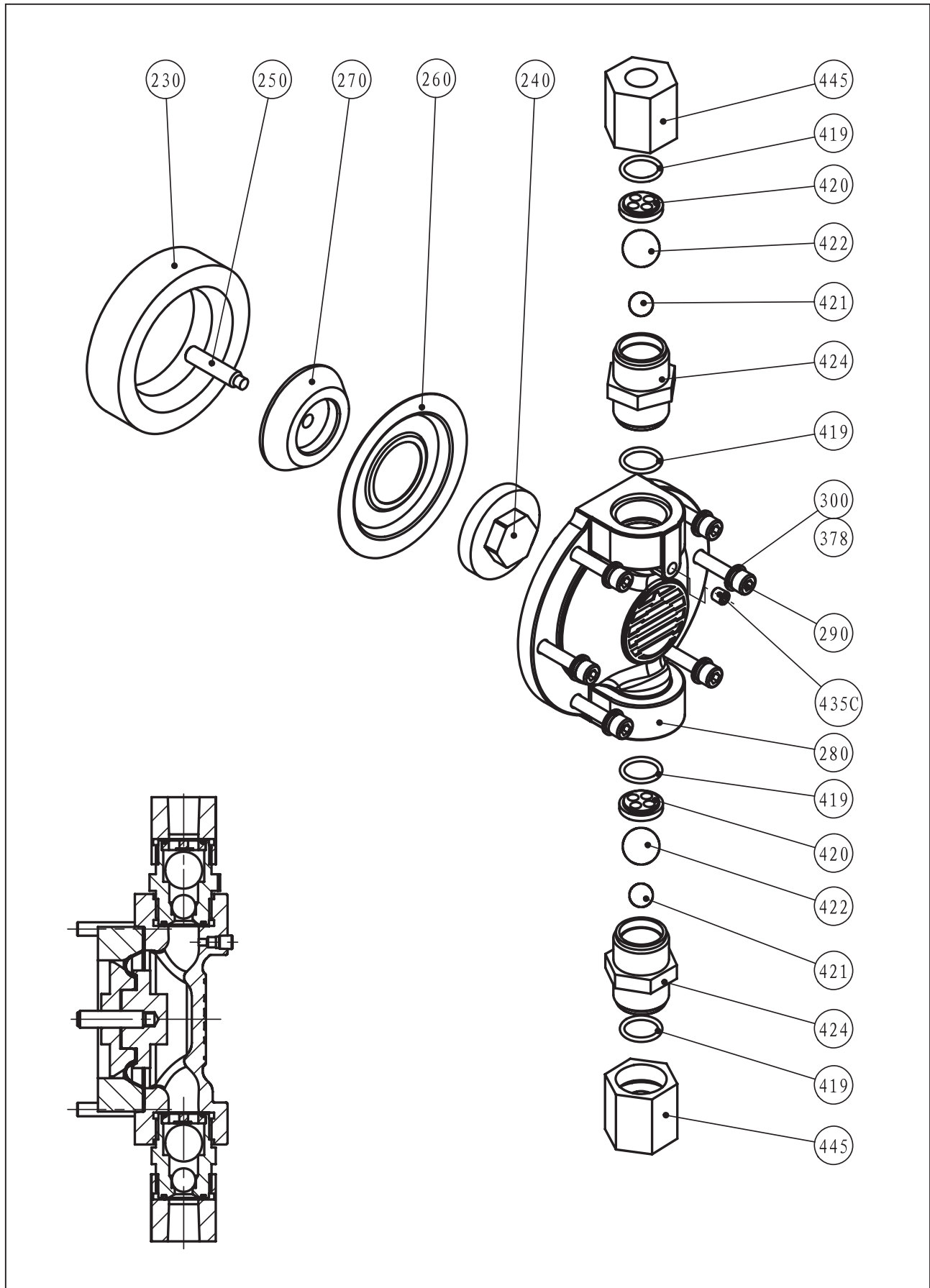
Discharge



Suction

Figure 6-11 GB1800 Plastic Check Valve Parts

Figure 6-12 GB0080~GB0450 Stainless steel liquid End



Parts List for GB0080 ~ GB0450 Liquid End (Refer to Figure 6-2, 6-3 ,6-4,6-12)

Item Number	Description	Material	Part Number	Qty.
	Check Valve Assembly(PVC LE)	–	H60921	2
	Check Valve Assembly(PVDF LE)	–	H60817	2
	Check Valve Assembly (316SS LE)	–	H60922	2
	Suction Check Valve Assembly (High Viscosity)	–	H60965	1
	Discharge Check Valve Assembly (High Viscosity)	–	H60966	1
240	Diaphragm Cap (PVC LE)	–	S60628	1
	Diaphragm Cap (PVDF LE)	–	S60030	1
	Diaphragm Cap (316 SS LE)	–	S60631	1
270	Support Nut	304SS	S60632	1
260	Diaphragm D82	Gylon	60618	1
250	Screw M10 × 45	A2–70	S4350071284	1
230	Diaphragm Support Ring	PP	S60035	1
280	Head (PVC LE)	PVC	S60033	1
	Head (PVDF LE)	PVDF	S0210780078N	1
	Head (Metallic LE)	316 SS	H60977	1
	Head (316 SS LE)	316 SS	S210760016	1
435C	Plug 1/16" NPT	316 SS	H69817	1
290	Socket Head Cap Screw M8 × 50 (316SS LE)	A2–70	H65599	6
290 300 378	Bolts subassembly, M8 × 90(included bolts and washer) (PVC, PVDF LE)	stainless steel	H65281	6
300	Washer 8(316SS LE)	A2	S4340005085N	6
378	Washer 8(316SS LE)	A2	S4340009002	6
435	Nut, 1/2" (PVC, PVDF LE)	PVC	S4320236038	2
445	Union End (PVC LE)	PVC	S60117	2
	Union End (PVDF LE)	PVDF	S60119	2
	Coupling,1" BSP × 1/2" NPT (316 SS LE)	316 SS	S60135	2

Note:

- 1.Check valve assembly, including O-ring(419), seat(420), ball check (421/422), ball guide(424).
- 2.High viscosity discharge check valve assembly, including O-ring(419), Seat(420), ball check (421/422), ball guide(424/425), spring(419), spring seat(426).
High viscosity suction check valve assembly, including O-ring(419), Seat(420), ball check (422), ball guide(424).

Figure 6-13 GB0500~GB0600 Stainless steel liquid End

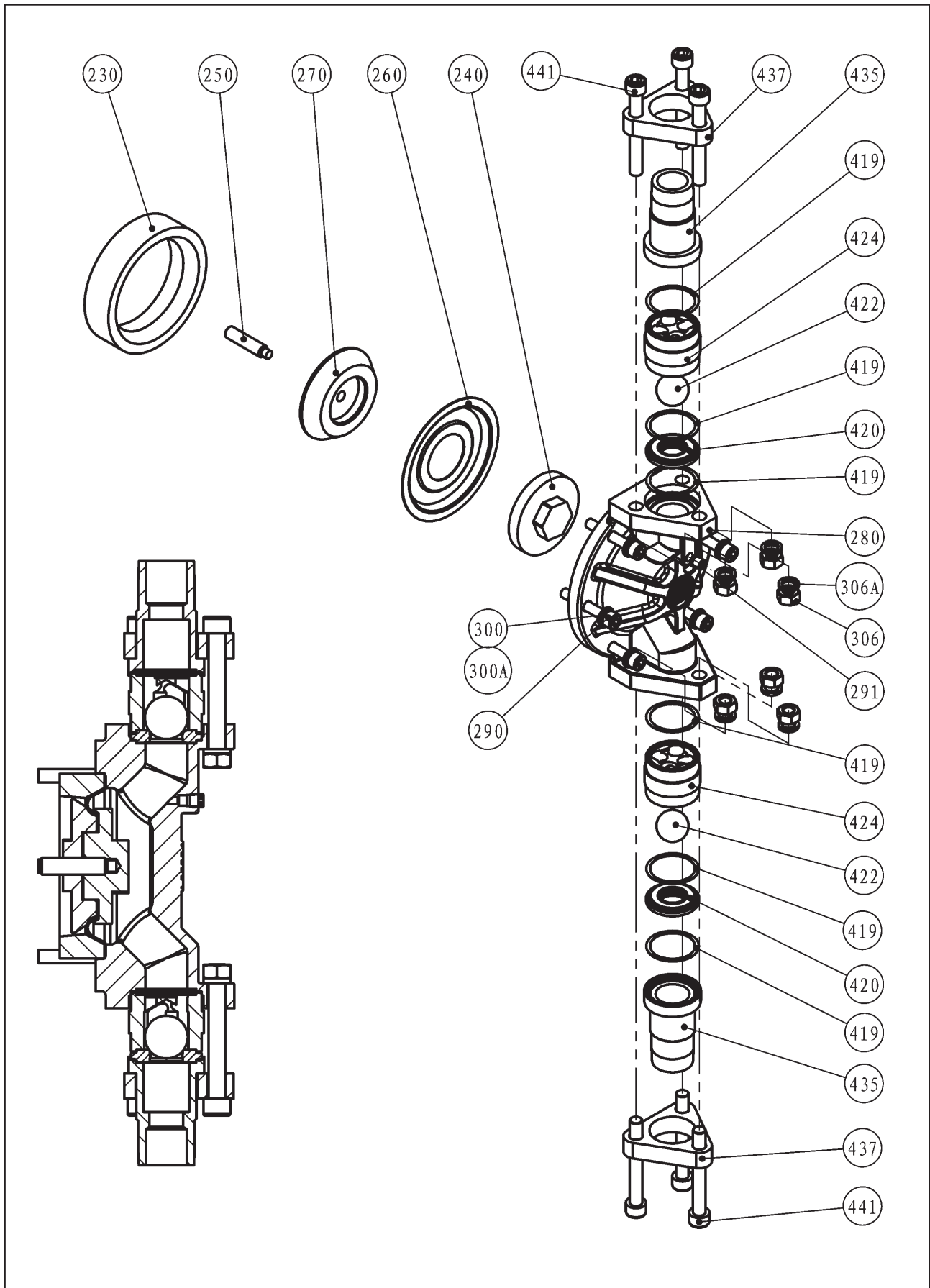
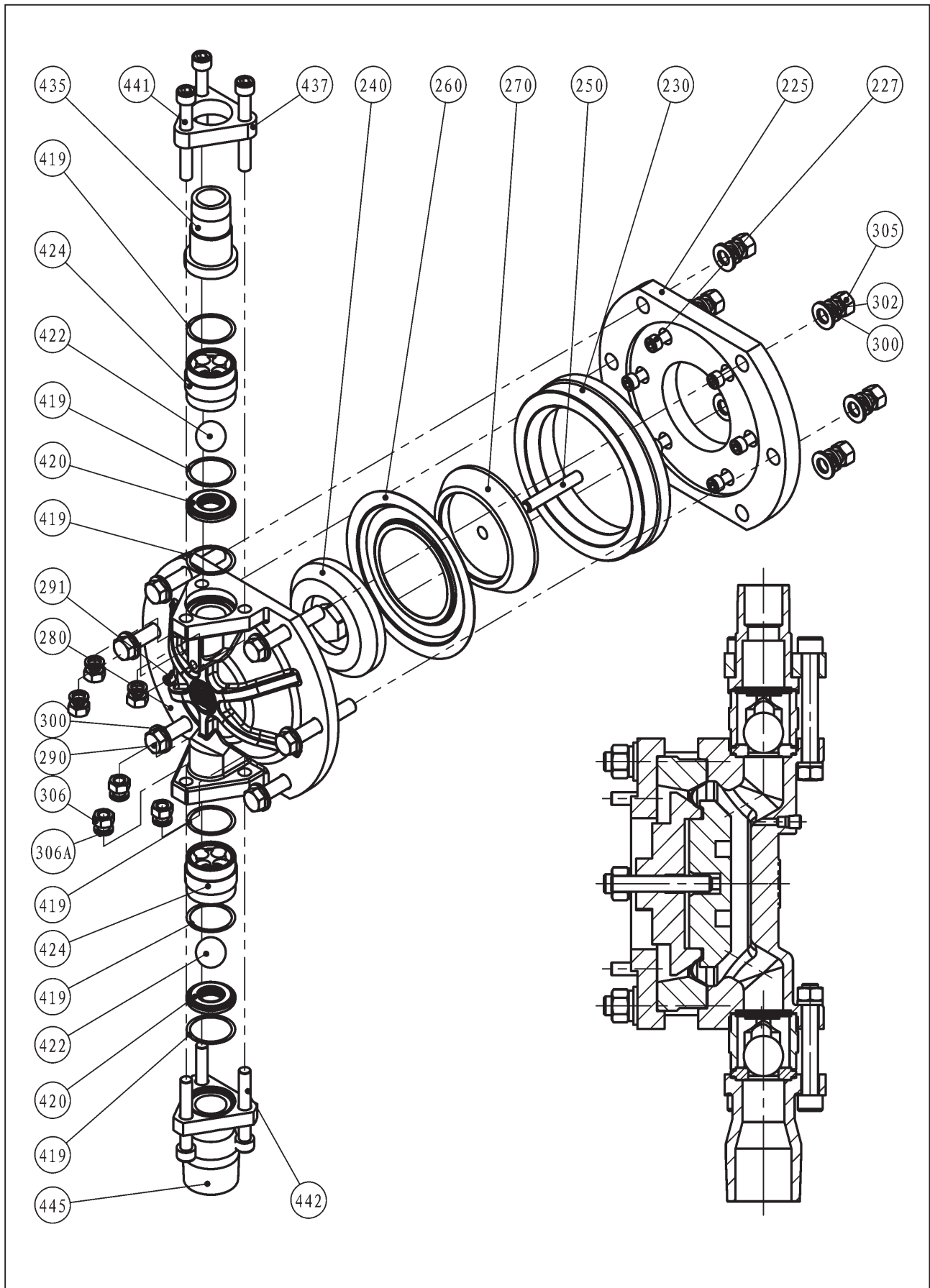


Figure 6-14 GB0700~GB1200 Stainless Liquid End



Parts List for GB0500 ~ GB0600 Liquid End (Refer to Figure 6-2, 6-5 ~ 6-8, 6-13)

Item Number	Description	Material	Part Number	Qty.
GB0500~ GB0600	Check Valve Assembly, (PVC LE)	–	H60926	2
	Check Valve Assembly, (PVDF LE)	–	H60927	2
	Check Valve Assembly, (316SS LE)	–	H60928	2
	Suction Check Valve Assembly (High Viscosity)	–	H60961	1
	Discharge Check Valve Assembly (High Viscosity)	–	H60962	1
240	Diaphragm Cap (PVC LE)	PVC	S60633	1
	Diaphragm Cap (PVDF LE)	PVDF	S60635	1
	Diaphragm Cap (316SS LE)	316 SS	S60636	1
270	Support Nut	304SS	S60637	1
260	Diaphragm	Gylon	60624	1
250	Screw M10 × 45	A2–70	S4350071284	1
230	Diaphragm Support Ring	PP	S60070	1
280	Head (PVC LE)	PVC	S60130	
	Head (PVDF LE)	PVDF	S60068	1
	Head (Metallic LE)	316 SS	H60978	1
	Head (316 SS LE)	316 SS	S210761016	1
290	Bolts, M8 x110 (PVC/PVDF LE)	A2–70	S4350001655	6
	Bolts, M12x130 (316SS LE only)	A2–70	H65599	6
300	Washer, M8	A4	S4340005085N	6
302	Washer, M8	A2	S4340009002	6
435	Nut, 1" (PVC/PVDF LE)	PVC	S4320236058	2
	Connection, 1" NPT (316 SS LE)	316 SS	S450128116	2
437	Valve Clamp (316SS LE)	Steel	S040215010	1
306	Washer M10	A2	S4350010065N	6
306A	Washer 10	–	H66351	6
441	Bolts, M10x80 (316SS LE)	A2–70	FTM10080S1	6
445	Union End, 1" NPT(PVC LE)	PVC	S60132	2
	Union End, 1" NPT (PVDF LE)	PVDF	S60133	2

Notes:

1. Check valve assembly, including O-ring/gasket (419), seat(420), ball check (421/422), ball guide(424).
2. High viscosity discharge check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(424), spring(426), spring seat(427).
High viscosity suction check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(424).

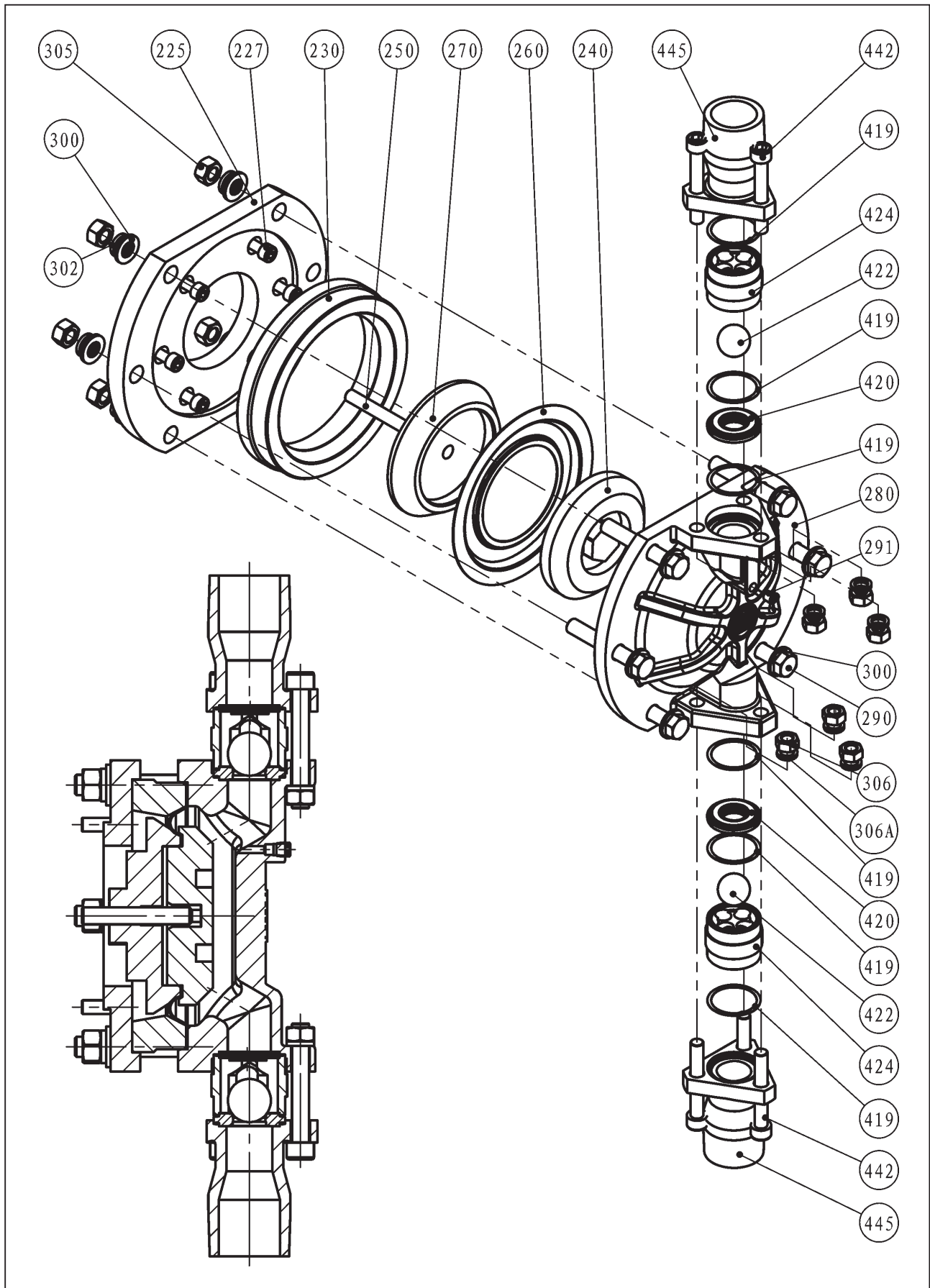
Parts List for GB0700 ~ GB1200 Liquid End (Refer to Figure 6-2, 6-5 ~ 6-8, 6-14)

Item Number	Description	Material	Part Number	Qty.
GB0700~ GB1200	Suction Check Valve Assembly (PVC LE)	-	H60944	1
	Discharge Check Valve Assembly (PVC LE)	-	H60926	1
	Suction Check Valve Assembly (PVDF LE)	-	H60954	1
	Discharge Check Valve Assembly (PVDF LE)	-	H60927	1
	Check Valve Assembly (316SS LE)	-	H60928	1
	Suction Check Valve Assembly (High Viscosity)	-	H60956	1
	Discharge Check Valve Assembly (High Viscosity)	-	H60962	1
240	Diaphragm Cap (PVC LE)	PVC	S60638	1
	Diaphragm Cap (PVDF LE)	PVDF	S60640	1
	Diaphragm Cap (316SSLE)	316 SS	S60641	1
270	Support Nut	304SS	S60642	1
260	Diaphragm	Gylon	60162	1
250	Screw M10×70	A2-70	S4350071334	1
225	Adapter Ring (PVC/PVDF LE)	Aluminum	H60759	1
	Adapter Ring (316SS LE)		H60982	1
227	Screw, M8×20	-	H60760	6
230	Diaphragm Support Ring	PP	S60159	1
280	Head (PVC LE)	PVC	S60171	1
	Head (PVDF LE)	PVDF	S60174	1
	Head (Metallic LE)	316 SS	S60979	1
	Head (316 SS LE)	316 SS	S60180	1
290	Bolts, M12x130(PVC/PVDF LE)	A2-70	S4350036035	6
	Bolts, M12x75 (316SS LE)	A2-70	H65242	6
300	Washer, M12	A350	S4340055073	12
302	Washer, M12	A2	S4340009095N	6
305	Nut, M12	A2-70	S4350000085	6
435	Nut, 1" (PVC/PVDF LE Discharge only)	PVC	S4320236058	1
	Nut, 1-1/2" (PVC/PVDF LE Suction only)	PVC	H60781	1
	Connection, 1" NPT (316 SS LE Discharge only)	316 SS	S450128116	1
437	Valve Clamp	Steel	S0040215010	1
306	Washer M10	A2	S4350010065N	6
306A	Washer 10	A2	H66351	6
441	Bolts, M10x80 (316 SS LE Discharge only)	A2-70	FTM10080S1	3
442	Bolts, M10x70(316 SS LE Suction only)	A2-70	H65602	3
445	Union End 1-1/2" NPT(PVC LE Suction only)	PVC	H60782	1
	Union End 1" NPT(PVC LE Discharge only)	PVC	S60132	1
	Union End 1-1/2" NPT(PVDF LE Suction only)	PVDF	H60788	1
	Union End 1" NPT(PVDF LE Discharge only)	PVDF	S60133	1
	Connector, 1-1/2" NPT(316SS LE Suction only)	316SS	H60784	1

Notes:

1. Check valve assembly, including O-ring/gasket (419), seat(420), ball check (421/422), ball guide(424).
2. High viscosity discharge check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(424), spring(426), spring seat(427).
High viscosity suction check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(424).

Figure 6-15 GB1500 316SS Liquid End



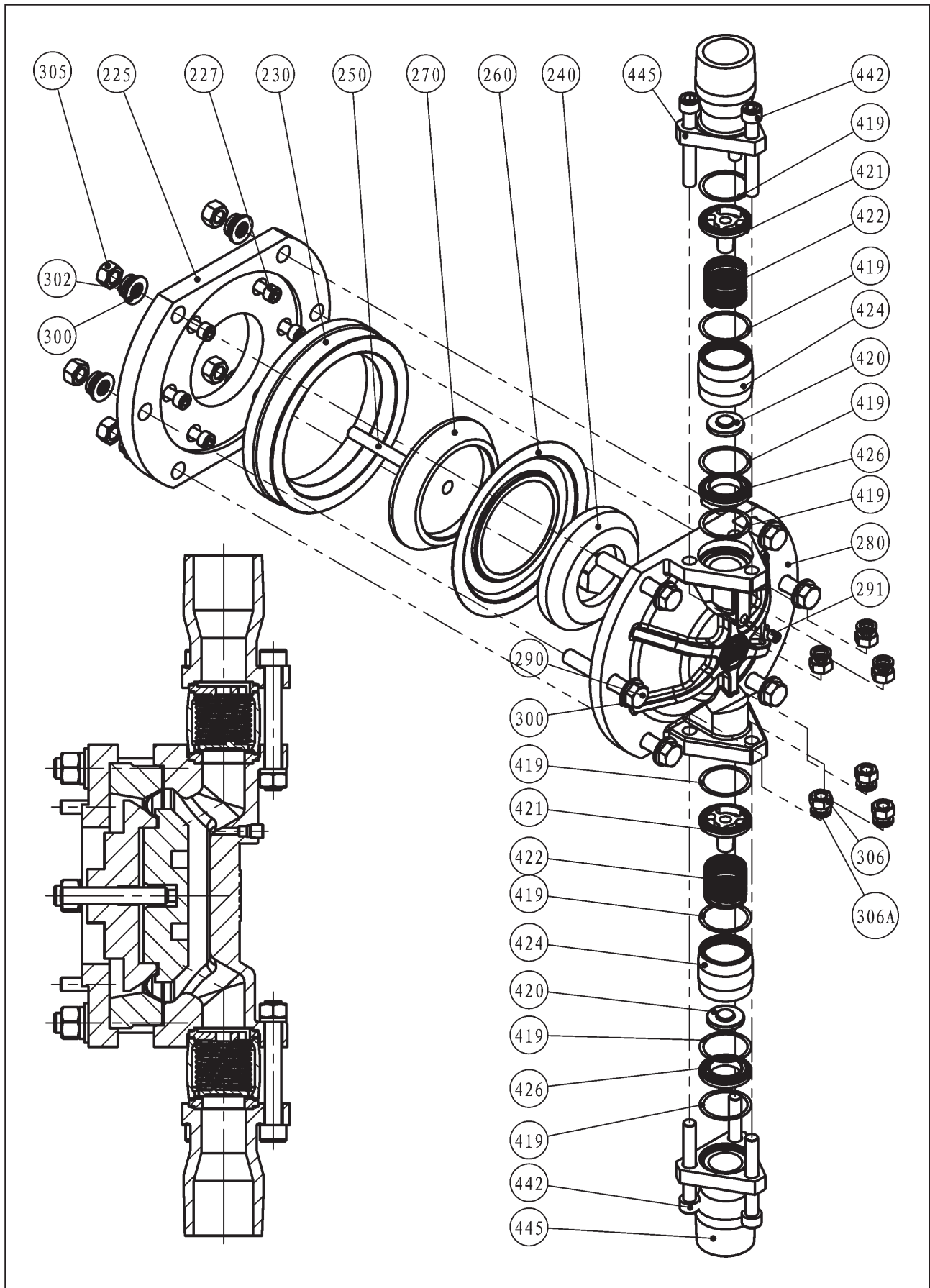
Parts List for GB1500 Liquid End (Refer to Figure 6-2, 6-12 ~ 6-14)

Item Number	Description	Material	Part Number	Qty.
	Suction Check Valve Assy.	PVC	H60944	1
	Discharge Check Valve Assy	PVC	H60945	1
	Suction Check Valve Assy	PVDF	H60954	1
	Discharge Check Valve Assy	PVDF	H60955	1
	Check Valve Assy	316SS	H60928	2
	Suction Check Valve Assy (High Viscosity)	-	H60956	1
	Discharge Check Valve Assy (High Viscosity)	-	H60957	1
240	Diaphragm Cap PVC	PVC	S60638	1
	Diaphragm Cap PVDF	PVDF	S60640	1
	Diaphragm Cap 316SS	316SS	S60641	1
270	Support Nut 304SS	304SS	S60642	1
260	Diaphragm Gylon	Gylon	60162	1
250	Screw M10X70,A2-70	A2-70	S4350071334	1
225	Adapter (PVC/PVDF LE only)	Aluminum	H60759	1
	Adapter (316SS LE only)		H60982	1
227	Screw M8X20	-	H60760	6
230	Diaphragm Support Ring	PP	S60159	1
280	Head (PVC LE)	PVC	S60171	1
	Head (PVDF LE)	PVDF	S60174	1
	Head (316SS LE)	316SS	H60979	1
290	HEX HD SCR M12 X 130 (PVC/PVDF LE only)	A2-70	S4350036035	6
	HEX HD SCR M12 X 130 (PVC/PVDF LE only)	A2-70	H65121	6
300	Flat Washer M12 Regular	A350	S4340055073	12
302	Spring Lockwasher 12mm	18.8SS	S4340009095N	6
305	Hex Nut M12 304SS COARSE	A2-70	S4350000085	6
435	Nut	PVC	H60781	2
445	Union End, PVC, Discharge	PVC	H60780	1
	Union End, PVDF, Discharge	PVDF	H60787	1
	Connection 316SS,GB1500	316SS	H60784	2
446	Union End, PVC, Suction	PVC	H60782	1
	Union End, PVDF, Suction	PVDF	H60788	1
306	Washer M10	A2	S4350010065N	6
306A	Washer 10	-	H66351	6
441	Screw GB70-85 M10X60, A2-70	A2-70	H65602	6

Note:

1. Check valve assembly, including O-ring/gasket (419), seat(420), ball check (421/422), ball guide(425).
2. High viscosity discharge check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(425), spring(426), spring seat(427).
High viscosity suction check valve assembly, including O-ring(419), seat(420), ball check (422), ball guide(424).

Figure 6-16 GB1800 316SS Liquid End



Parts List For GB1800 Liquid End (Refer to Figure 6-2, 6-15 ~ 6-17)

Item Number	Description	Material	Part Number	Qty.
	Suction Check Valve Assy	PVC	H60947	1
	Discharge Check Valve Assy	PVC	H60963	1
	Suction Check Valve Assy	PVDF	H60948	1
	Discharge Check Valve Assy	PVDF	H60964	1
	Check Valve Assy	316SS	H60949	2
240	Diaphragm CAP PVC	PVC	S60638	1
	Diaphragm CAP PVDF	PVDF	S60640	1
	Diaphragm CAP 316SS	316SS	S60641	1
270	Support Nut 304SS	304SS	S60642	1
260	Diaphragm Gylon	Gylon	60162	1
250	Screw M10X70	A2-70	S4350071334	1
225	Adapter (PVC/PVDF LE only)	Aluminum	H60759	1
	Adapter (316SS LE only)	Aluminum	H60982	1
227	Screw M8x20	-	H60760	6
230	Diaphragm Support Ring	PP	S60159	1
280	Head (PVC LE)	PVC	S60171	1
	Head (PVDF LE)	PVDF	S60174	1
	Head (316SS LE)	316SS	S60979	1
290	HEX HD SCR M12 X 130 (PVC/PVDF LE only)	A2-70	S4350036035	6
	HEX HD SCR M12 X 130 (PVC/PVDF LE only)	A2-70	H65121	6
300	Flat Washer	A350	S4340055073	12
302	Spring Lock washer 12mm	18.8SS	S4340009095N	6
305	Hex Nut M12	A2-70	S4350000085	6
435	NUT / PVC,GB1500	PVC	H60781	2
445	Union End	PVC	H60780	2
	Union End	PVDF	H60787	2
	Connection 316SS,GB1500	316SS	H60784	2
306	Washer M10	A2	S4350010065N	6
306A	Washer 10	-	H66351	6
441	Screw GB70-85 M10X60	A2-70	H65021	6

Note:

1. Check valve assembly, including O-ring/gasket (419), seat (420), limitation board (421), spring (422), ball guide(424),bushing(426).

Figure 6-17. Double Diaphragm (Standard, All Liquid End Sizes)

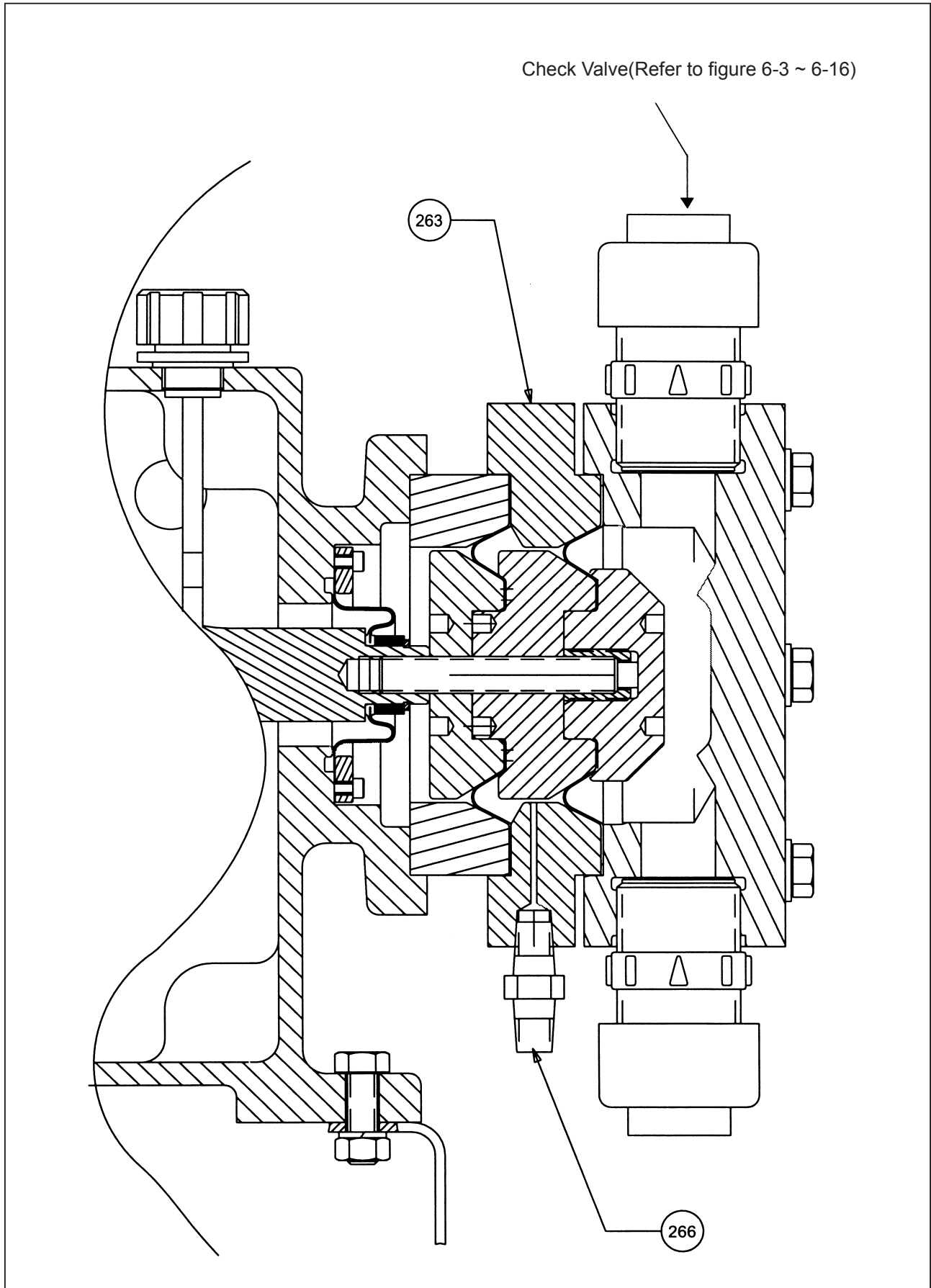
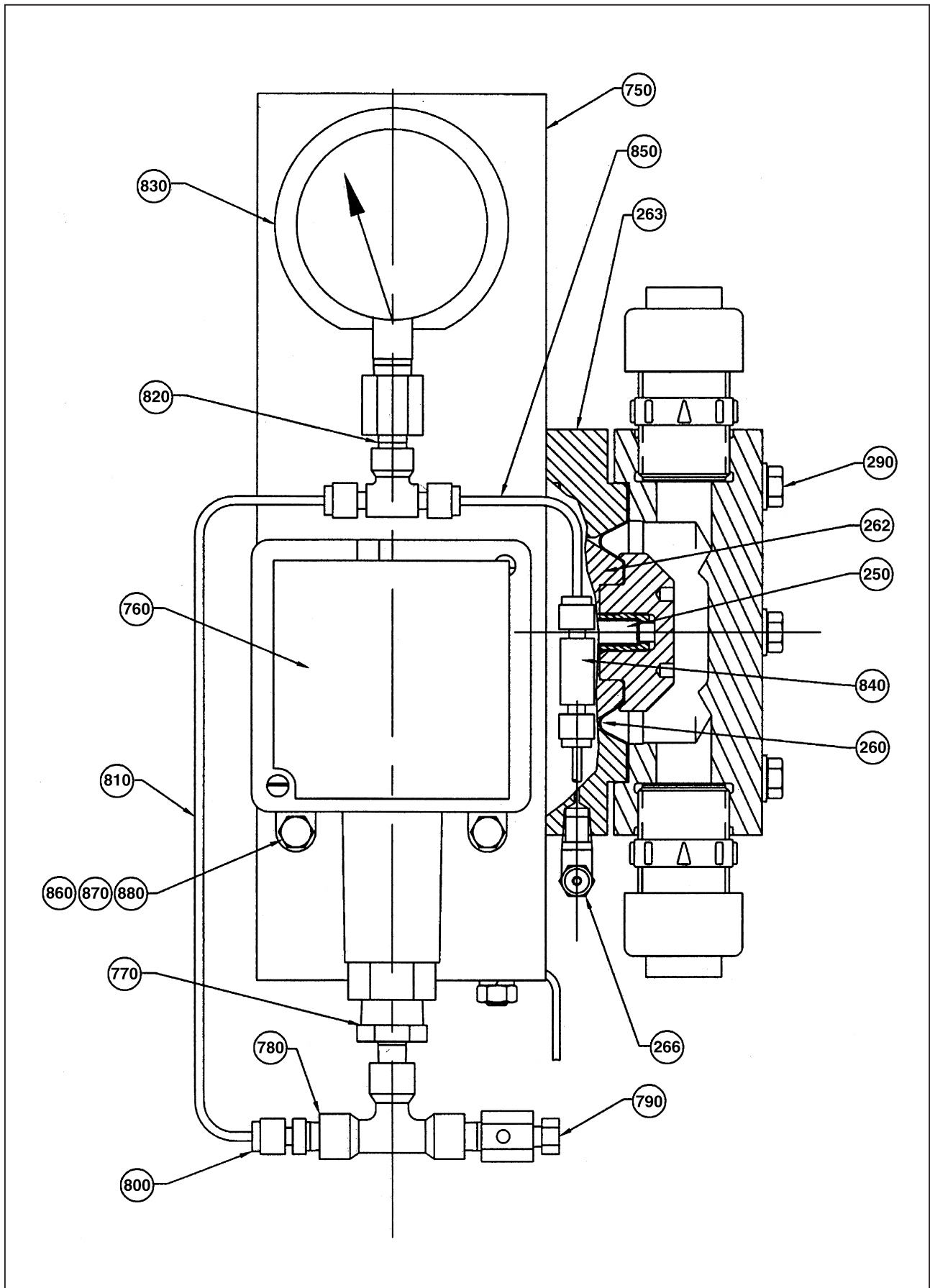


Figure 6-18. Leak Detection, Switch and Gauge (Standard, All Liquid End Sizes)



Parts List for GB Double Diaphragm Liquid End with Switch and Gauge (Refer to Figure 6-2,6-17,6-18)

Item Number	Description	Material	Part Number	Qty.
	Double Diaphragm Assy (GB0080 ~GB0450,PVC LE)	PVC	H60935	1
	Double Diaphragm Assy (GB0080 ~GB0450,PVDF LE)	PVDF	H60936	1
	Double Diaphragm Assy (GB0080 ~GB0450,316SS LE)	316 SS	H60937	1
	Double Diaphragm Assy (GB0500 ~GB0600,PVC LE)	PVC	H60938	1
	Double Diaphragm Assy (GB0500 ~GB0600,PVDF LE)	PVDF	H60939	1
	Double Diaphragm Assy (GB0500 ~GB0600,316SS LE)	316 SS	H60940	1
	Double Diaphragm Assy (GB0700 ~GB1200,PVC LE)	PVC	H60941	1
	Double Diaphragm Assy (GB0700 ~GB1200,PVDF LE)	PVDF	H60942	1
	Double Diaphragm Assy (GB0700 ~GB1200,316SS LE)	316 SS	H60943	1
290	Hex Head Screw, M8x75 (GB0080 ~GB0600 316SS LE only)	A2-70	H65600	6
	Hex Head Screw, M8x120 (GB0080 ~GB0450 PVC/PVDF LE)	A2-70	H65078	6
	Hex Head Screw, M8x140 (GB0500 ~GB0600 PVC/PVDF LE only)	A2-70	H65050	6
	Hex Head Screw, M8x100 (GB0700 ~GB1800 316SS LE only)	A2-70	4350006693N	6
	Hex Head Screw, M8x160 (GB0700 ~GB1800 PVC/PVDF LE only)	A2-70	H65081	6
750	Bracket	-	S2040199006	1
760	NEMA 4 Pressure Switch, 5-30 PSI	-	S4060388001	1
770	Reducing Hex Nipple, 1/2"x1/8"NPT	316 SS	S40064	1
780	Tee 1/8"NPT Female	316 SS	S40062	2
790	Bleed Valve, 1/8"NPT	316 SS	S40063	1
800	Tubing Connector, 1/8"x1/8"NPT	316 SS	S40061	3
810	Tubing, Gauge to Nema 4 Switch	316 SS	S2490136016	1
820	Reducing Adapter, 1/4"Fx1/4"M NPT	316 SS	40067	1
830	Pressure Gauge 0-400 PSI (Dual Face) Flange M+	316 SS	40066	1
840	Check Valve, 1/8"Tube (1/3 PSI)	316 SS	40065	1
850	Tubing, Pump to Gauge	316 SS	S2490137116	1
860	Hex Head Screw	A2-70	S4050016095	2
870	Spring Lock Washer, 1/4"	A2	S4040039022	2
880	Hex Nut,1/4"-20	A2	S4050064012	2
705	Fitting	316SS	H60804	1
706	Fitting	316SS	H69023	2

Note:

1. Replacement of double diaphragm, only as assembly of item diaphragm cup (240), screw (250), diaphragm(260), leak detector spacer(262), leak detector intermediate ring(263),mole elbow(266), diaphragm support nut(270).