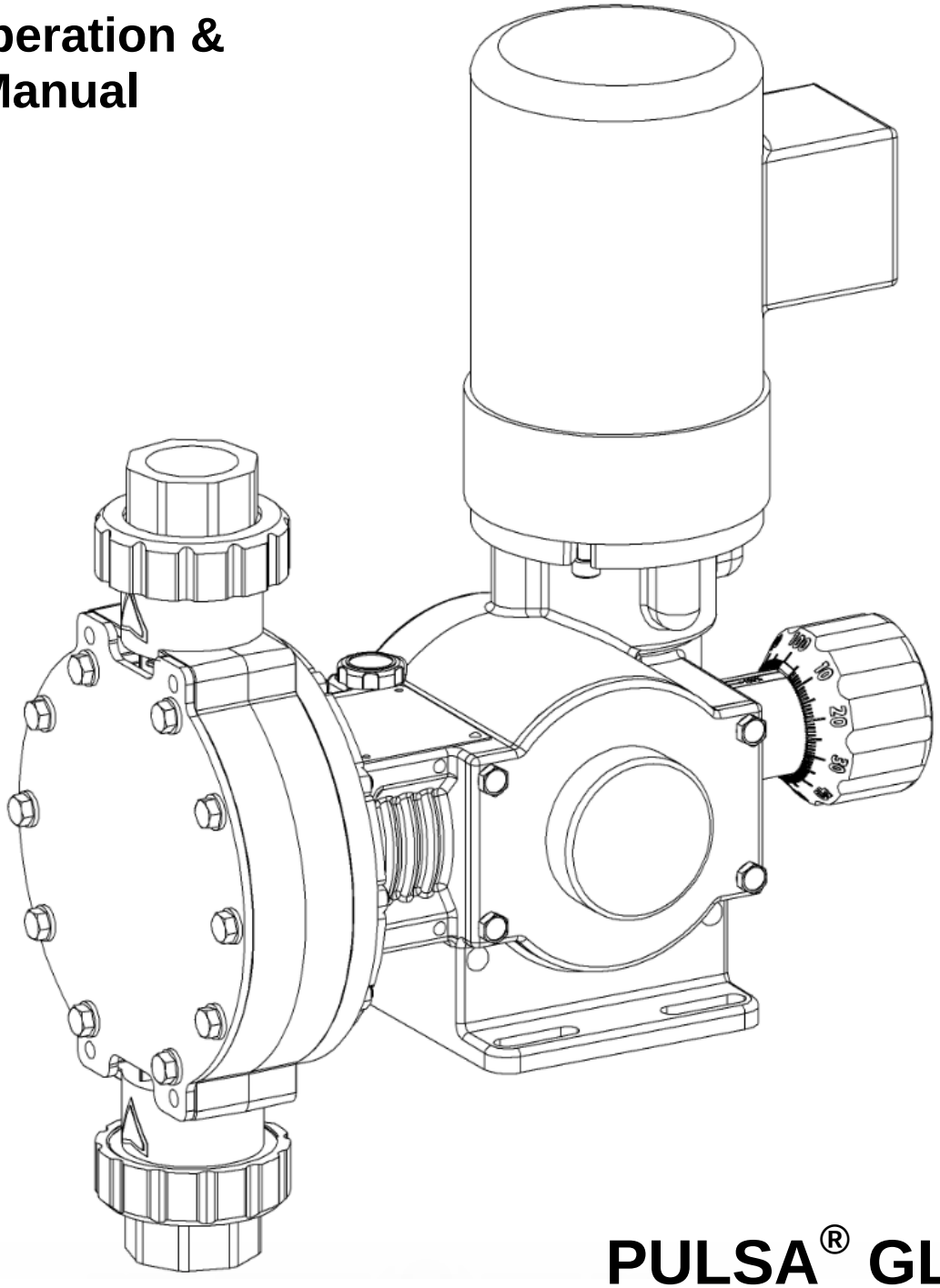
PULSAFEEDER®
ENGINEERED PRODUCTS

Installation, Operation & Maintenance Manual

Models: GLM1 – 6



PULSA® GLM

MECHANICAL DIAPHRAGM METERING PUMP

Bulletin: IOM-GLM-5000-Rev.B

Pulsafeeder Factory Service Policy

Should you experience a problem with your GLM pump, first consult the troubleshooting guide in this installation, operation and maintenance manual. If the problem is not covered or cannot be solved, please contact your local Pulsafeeder Distributor or our Technical Services Department for further assistance.

Trained technicians are available to diagnose your problem and arrange a solution. Solutions may include purchase of replacement parts or returning the unit to the factory for inspection and repair. All returns require a Return Authorization number to be issued by Pulsafeeder. Parts purchased to correct a warranty issue may be credited after an examination of original parts by Pulsafeeder. Warranty parts returned as defective, which test good, will be sent back freight collect. No credit will be issued on any replacement electronic parts.

Any modifications or out-of-warranty repairs will be subject to bench fees and costs associated with replacement parts.

Pulsafeeder's Factory Service Policy is maintained on its website. Please source this document at this URL:

http://www.pulsa.com/pulsa-docs/Pulsafeeder-EPO-Limited-Warranty-Statement.pdf

Conventions:

For the remainder of this bulletin, the following conventions are in effect.

A warning defines a condition that could cause damage to both the equipment and the personnel operating it. This manual must be consulted in all cases where the warning symbol is marked in order to find out the nature of the potential hazards and any actions which have to be taken to avoid them.

Notes are general information meant to make operating the equipment easier.

Revision History:

Rev A	Release Date February 2015 First revision
Rev B	Release Date July 2015 Introduction and Safety Considerations updated

Table of Contents

1. Introduction

1.1 General Description

The PULSA GLM metering pump is positive displacement, mechanically operated reciprocating diaphragm pump. Each pump consists of a power end and a process end separated by a composite Teflon® diaphragm. Individual pumps will vary in appearance due to various liquid ends and accessories; however, the basic principles of operation remain the same.

1.2 Safety Considerations

The PULSA GLM metering pumps yield both mechanical and hydraulic capabilities. In consideration of safety, the user should be mindful of the following considerations in regards to personal, nearby personnel, and environmental safety. Please consider the following prior to the installation and operation of a PULSA GLM pump.

1. Read and understand all related instructions and documentation before attempting to install or maintain this equipment.

2. Observe all special instructions, notes, and cautions.

3. Act with care and exercise good common sense and judgment during all installation, adjustment, and maintenance procedures.

4. Ensure that all safety and work procedures and standards that are applicable to your company and facility are followed during the installation, maintenance, and operation of this equipment.

5. As a positive displacement pump, a PULSA GLM pump will continue to build pressure if the fluid pathway is closed or blocked and can result in excessive and unsafe pressure or pump failure.

Never place fingers or hands into any part of the pump while the pump is running.

1.3 Liability Exclusions

Pulsafeeder, Inc. is unable to monitor the observance of the instructions given in this manual, nor verify the actual working conditions and installation of the equipment, the correct operation and maintenance of the equipment and accessories. An incorrect installation, or misuse of the equipment, may cause serious damage and may pose a danger to persons or property. Any anomalies must be reported to the maintenance supervisor. The user is not authorized to tamper with the machine for any reason.

Attempts to disassemble, modify or tamper in general by unauthorized personnel will void the guarantee and will release Pulsafeeder, Inc. from any liability for damage caused to persons or property resulting from such actions.

Pulsafeeder, Inc. is considered released from any liability in the following cases:

- Improper installation
- Improper use of the equipment by non-professional or inadequately trained operators
- Use not in compliance with regulations in the Country of use
- Lack of maintenance or improperly performed
- Use of non-original spare parts or incorrect parts for the model in question
- Total or partial failure to observe the instructions
- Exceptional environmental events

1.4 Handling and Lifting

Boxes, crates, pallets or cartons may be unloaded using fork lift vehicles or slings dependent on their size and construction. A crane must be used for all pumps in excess of 25 kg (55 lb). Fully trained personnel must carry out lifting, in accordance with local regulations. Slings, ropes and other lifting gear should be positioned where they cannot slip and where a balanced lift is obtained.

1.5 Recycling and End of Product Life

At the end of the service life of a PULSA GLM pump or its parts, the materials and parts should be recycled or disposed of using an environmentally acceptable method and following all local requirements. If the product contains substances that are harmful to the environment, these should be removed and disposed of in accordance with current regulations. This also includes the liquids and/or gases that may be used in the "seal system" or other utilities.

Make sure that hazardous substances are disposed of safely and that the correct personal protective equipment is used. The safety specifications must be in accordance with the current regulations at all times.

2. Equipment Inspection

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages or damage must be reported immediately to the carrier and your authorized representative or distributor of PULSA GLM pumps.

Included Items:

- PULSA GLM Metering Pump with Motor Adaptor

Optional Items:

- Motor
- Foot Valve Kit (provided on PULSA GLM models 1 and 2 only).

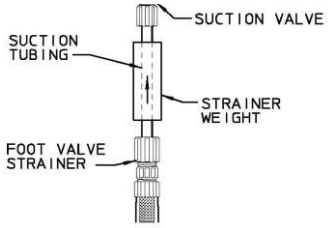


Figure 1: Foot Valve Kit

3. Installation

3.1 Location

When selecting an installation site or designing a chemical feed system, plan for operation and routine maintenance. Provide 3.25 ft (1 m) of space around the pump for this purpose.

PULSA GLM pumps are designed to operate in an environment where the pump is protected from direct sunlight, and precipitation (i.e., under shelter). The ambient temperature must be between 32°F (0°C) and 104°F (40°C). If necessary add environmental controls.

The pump must be rigidly bolted to a solid and flat foundation to minimize vibration and prevent loosening of the connections. The pump must be level within 5° to assure proper check valve operation.

3.2 Motor

The PULSA GLM is not typically shipped with the motor pre-installed. It must be mounted and wired in accordance with local and national requirements by a qualified electrician. Please refer to the motor nameplate for further manufacture specific information.

*If the PULSA GLM was purchased less motor, please refer to **Section 5.4** Motor Installation for further instructions.*

3.3 Piping System

Attention to piping detail will assure an easy startup and long life of your PULSA GLM. Please follow these guidelines:

Suction Piping

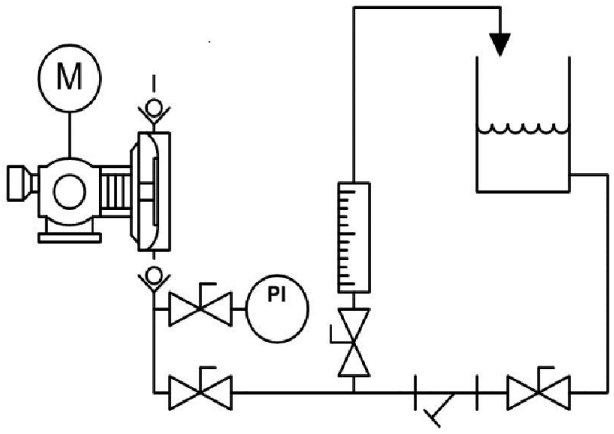


Figure 2: Suction P&ID

Isolation Valve and Unions: Isolation valves allow the system to be isolated from the process fluid to facilitate safe servicing. They also aid in the operation of Calibration columns. Valves should include good visible indications of open/closed condition. Unions assist with installation and maintenance. Valves that integrate union fittings are ideal.

Strainer: Successful installations always include a strainer on the suction side of the pump to exclude material that can cause the check valves to malfunction or the diaphragm to rupture. Select the material, size and mesh to be compatible with the fluid type, intended flow rate and service interval. A 100 mesh screen is generally recommended.

Calibration Column (Optional): Used to calibrate pump performance. Include an isolation valve and vent line back to the supply tank to facilitate safe operation.

Pressure Gage (Optional): A pressure gage should be included on the suction side of the pump when the suction pressure of the system is unknown or variable. The gage is also a good indicator of Strainer maintenance status.

Discharge Piping

Discharge Pressure Gage: Install a pressure gage no less than 2 pipe diameters from the threaded fitting on the discharge valve. A discharge pressure gage is critical to confirming proper operation of the pump and setting the pressure relief and back pressure valves.

NOTE **IMPORTANT: DO NOT Install an elbow directly into the discharge valve threaded fitting as it will create excessive back pressure that can lead to premature diaphragm failure.**

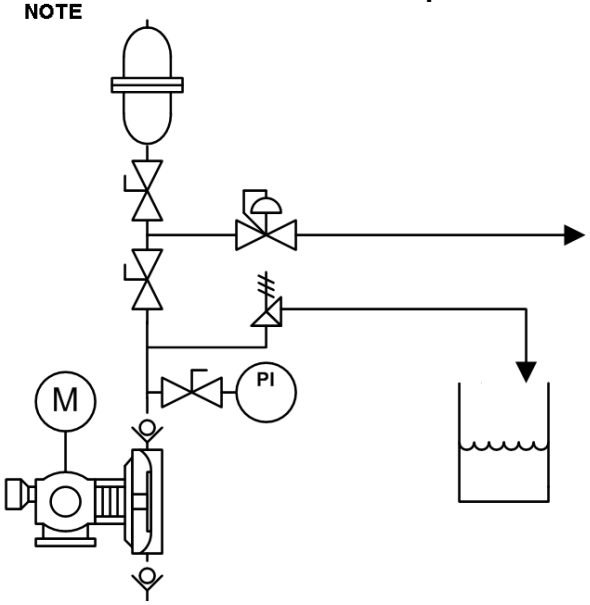


Figure 3: Discharge P&ID

Pressure Relief Valve: Install a Pressure Relief Valve as close to the pump as possible. Using the leg of a T fitting for this purpose is acceptable (with the normal discharge taking the straight path and the relief flow taking the leg). The relief pressure must be set at or below the rated pressure indicated on the pumps nameplate.

NOTE **NOTE: Failure to install and properly set a Pressure Relief Valve can lead to damage of the Pumps drive mechanism that will not be covered under warranty.**

Back Pressure Valve: Install a Back Pressure Valve to generate a consistent Back Pressure to the pump for accurate operation and to prevent siphoning.

Pulsation Dampener: Reciprocating diaphragm metering pumps only discharge fluid for ½ of a pump cycle. A Pulsation Dampener will smooth the associated flow/pressure variation to the downstream process.

Piping System Recommendations

1. When making the threaded joint to the valve cap assembly, use a sealing compound chemically compatible with the process material (for example Loctite® 8551 for water service). Do not use sealing tape. The valve cap should be tightened by hand and then tightened one additional turn (i.e., 360°) with the aid of an adjustable wrench.
2. Both new and existing piping should be cleaned, preferably by flushing with a clean liquid (compatible with process material) and blown out with air, prior to connection to the pump.

Note - Debris from manufacturing the piping system (e.g., PVC shavings, TFE Tape, dirt, etc.) can be unknowingly assembled inside the pipe. When fluid is introduced this material can be transferred to the pump and prevent proper check valve operation. This is a common startup issue.

3. Piping weight must not be supported by valve housings or other portions of the reagent head, as the resulting stresses can cause leaks. Valve loads must not exceed 10 ft-lbf (13.5 n-m) moment or 5 lbf (22 n) in any direction. When temperature variations are expected provide for thermal expansion and contraction of piping components so that force and/or moments are controlled within the allowable range.
4. When making process connections, ensure that pipe joint cement and thread sealants do not run into the check valve assemblies as this will inhibit valve operation. This is a common startup issue.

3.4 Suction Pressure Requirements

Although PULSA GLM metering pumps have some suction lift capability, a flooded suction (i.e., suction pressure higher than atmospheric pressure) is preferable whenever possible. The pump should be located as close as possible to the suction side reservoir or fluid supply source.

For fluid with a vapor pressure of 5 psia (0.35 bar) or less (at operating temperature) the wet suction lift capability is approximately 10 ft (3 m). If this requirement is not met, the pump will not provide reliable, accurate flow. In suction lift conditions, the use of a foot valve is recommended at the lowest point of the pickup tube or pipe. Pumps operating under suction lift conditions may require some liquid priming before they will operate reliably.

3.5 Discharge Pressure Requirements

All PULSA GLM metering pumps are designed for continuous service at the rated discharge pressure. If the system suction pressure exceeds the discharge pressure (a condition sometimes described as “pumping downhill”), flow will be generated in addition to that generated by the pump. This results in a reduction in accuracy and loss of control over the metering process. To prevent this flow-through condition, the discharge pressure must exceed the suction pressure by at least 5 psi (0.35 bar). This can be achieved, where necessary, by the installation of a backpressure valve in the discharge line.

Conditions where the actual discharge pressure exceeds the pumps rating are to be avoided as they will cause damage to the pump components.

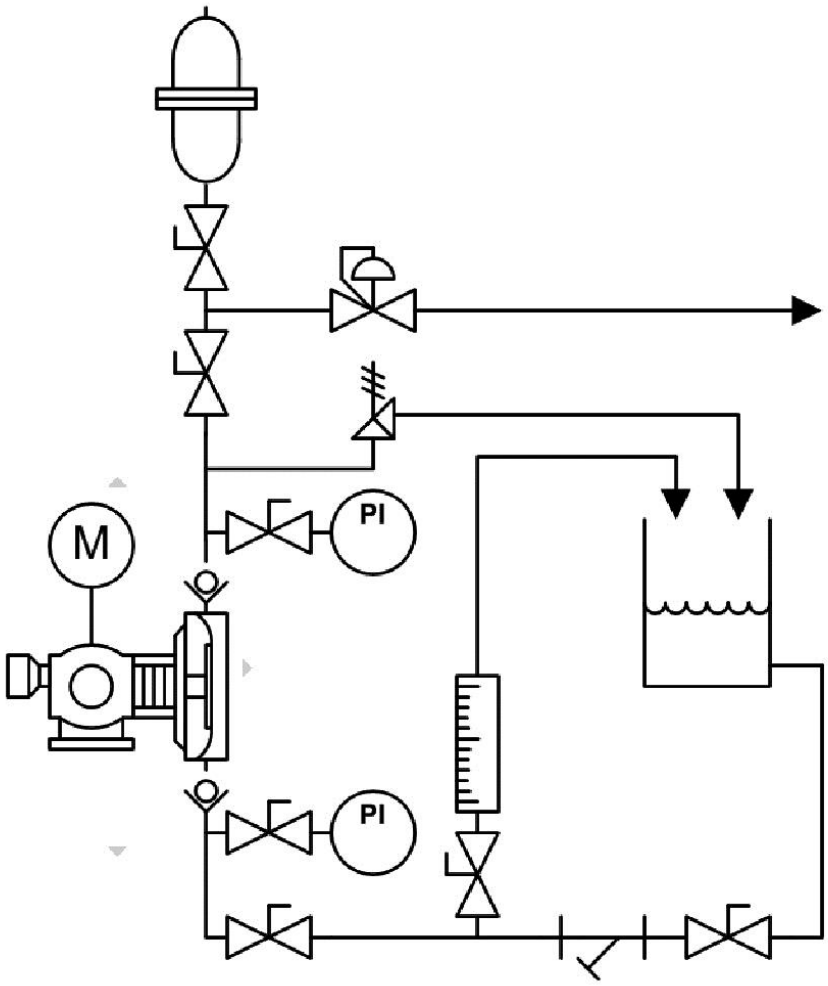


Figure 4: PULSA GLM P&ID

4. Equipment Startup

4.1 Fastener Inspection

All pump fasteners should be checked prior to pump operation, and occasionally during use. This would include reagent head mounting bolts, motor mounting bolts, and the hardware that secures the pump to its foundation.

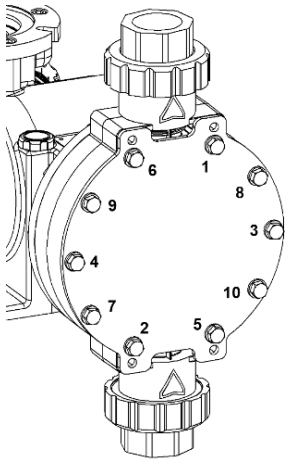


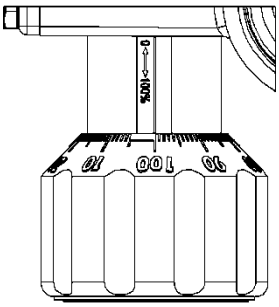
Figure 5: Reagent Head Bolt tightening sequence

Reagent head mounting bolts should be torqued to 70 in-lb. and motor bolts to 40 in-lb. Bolts should be tightened in a star pattern across the head to assure uniform clamping of the diaphragm (see recommended tightening sequence in above diagram).

4.2 Output Adjustment

All PULSA GLM pumps have a knob for manual stroke length adjustment. The knob can be adjusted to any value between 0 to 100%. The stroke length setting is directly proportional the flow rate of the pump.

1. Push the knob in towards the gearbox to release the locking mechanism.



Note - Making adjustments without releasing the lock may damage the locking mechanism.

2. Adjust the knob to the desired output.
    a. Read the setting directly from the knob marking where it aligns with the stroke barrel.
    b. The knob is labeled in 10% increments with 1% graduation marks. The knob will lock in 0.5% increments.

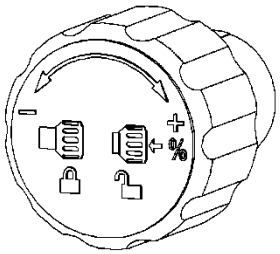


Figure 6: Stroke Adjustment Knob

Note – Do not adjust the knob beyond the indicated range.
For example, to set the pump to 75% stroke length (starting from the factory default setting of 0%) push the knob in (to unlock) and turn it approximately ¾ turn clockwise until the 75% indicator is aligned with the line on the stroke adjustment barrel.

3. Release the knob to re-engage the locking mechanism.

Note – Stroke adjustments should be made while pump is operating.

4.3 Priming the Reagent Head

1. When handling process liquids, follow all applicable personal and facility safety guidelines.
2. Ensure that the pump is ready for operation and that all process connections are secure.
3. Open the suction and discharge line shutoff valves.
4. If the piping system design and the storage tank are such that the product flows due to gravity through the pump, reduce the discharge pressure and the system will self prime when the pump is started. In the event the discharge line contains a significant amount of pressurized air or other gas, it may be necessary to lower the discharge pressure to enable the pump to self-prime.
5. If the installation involves a suction lift, it may be necessary to prime the reagent head and suction line. Operate the pump as in step 4 above - many times the pump will be capable of self priming. If it does not begin to pump fluid, remove the discharge valve assembly. Carefully fill the reagent head through the discharge valve port with process (or compatible) liquid, and then reinstall the check valve.
6. Start the pump at the 0% stroke length setting and slowly increase the setting to 100% to prime the pump. If this does not work, it will be necessary to fill the suction line.
7. Filling of the suction line will necessitate the use of a foot valve or similar device at the end of the suction line so that liquid can be maintained above the reservoir level. Remove the suction valve assembly, fill the line with fluid, replace the suction valve, then remove the discharge valve assembly and fill the reagent head as described in Step 5 above. The pump will now self-prime when started up per step 6 above.

Use appropriate precautions if handling process fluid. Ensure that any other fluid used for priming is compatible with the product that will be pumped.

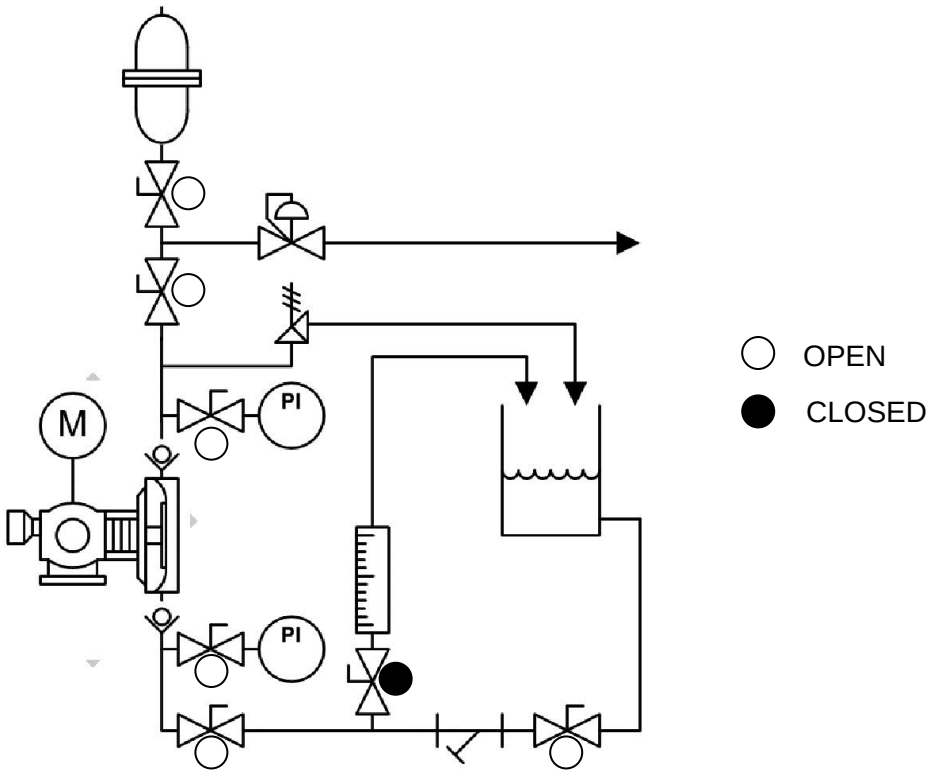


Figure 7: System Configured for Self-Priming

4.4 Calibration

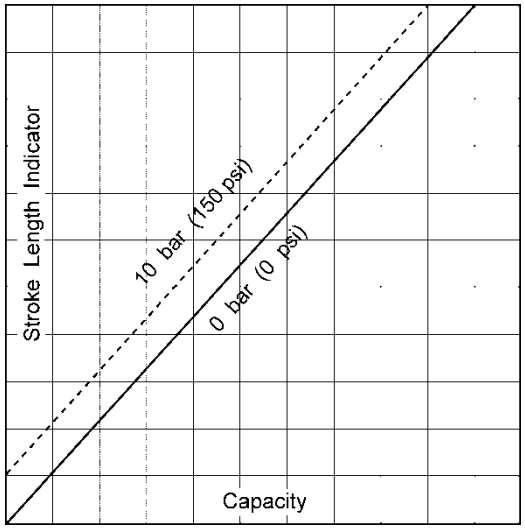


Figure 8: Sample Flow Calibration Curve

All metering pumps must be calibrated to accurately correlate stroke length settings to measured flow rates.

A typical calibration chart is shown above. Although output is linear with respect to the stroke length setting, an increase in discharge pressure decreases output uniformly, describing a series of parallel lines, one for each pressure (only two are shown).

The theoretical output flow rate at atmospheric discharge pressure is based on the displacement of the diaphragm, stroke length and the stroking rate of the pump. With increasing discharge pressure there is a corresponding decrease in output flow. Pumps are rated for a certain flow at a rated pressure (check nameplate). Whenever possible, calibration should be performed under actual process conditions (i.e., the same or a similar process liquid at system operating pressure).

To construct a calibration chart, measure the flow rate several times at three or more stroke settings (e.g., 25, 50, 75, and 100), plot these values on linear graph paper, and draw a best-fit line through the points. For stable conditions, this line should predict settings to attain required outputs.

NOTE

Note - All users are encouraged to test the flow rate of their pump once installed in their system, to ensure best accuracy and reliable operation.

5. Maintenance

WARNING

Before performing any maintenance requiring reagent head or valve (wet end) disassembly, be sure to relieve pressure from the piping system and, where hazardous process materials are involved, render the pump safe to personnel and the environment by cleaning and chemically neutralizing as appropriate. Wear protective clothing and equipment as appropriate.

Accurate records from the early stages of pump operation will indicate the type and levels of required maintenance. A preventative maintenance program based on such records will minimize operational problems. It is not possible to forecast the lives of wetted parts such as diaphragms and check valves. Since corrosion rates and operational conditions affect functional material life, each metering pump must be considered according to its particular service conditions.

The PULSA GLM KOPkit® will contain all replacement parts normally used in a preventative maintenance program. It is recommended that KOPkits and PULSAlube® 9M be kept available at all times.

5.1 Lubrication

PULSA GLM pumps have an oil bath reservoir that is pre-filled with 350 mL of PULSAlube 9M at the factory. For optimum pump performance under normal conditions, the PULSAlube 9M should be replaced every 3,000 hours. For severe service in non-temperature controlled and/or dirty environments the PULSAlube 9M should be replaced every 1,500 hours.

1. Disconnect the power source to the drive motor, and relieve all pressure from the piping system.
2. Remove the Vent/Fill cap on top of the Gear Box under the motor adaptor lip.
3. Locate the Gear Box drain plug at the bottom of the Gear Box under the Stroke Adjustment Knob (see Figure below).
4. While holding the Gear Box over a catch reservoir, remove the drain plug (be sure to retain the sealing o-ring on the plug).
5. Replace the Drain Plug and sealing o-ring.
6. Fill the Gear Box with 350 mL of PULSAlube 9M so that the level indicates in the center of the sight glass on the side.
7. Replace the Vent/Fill cap and sealing o-ring.

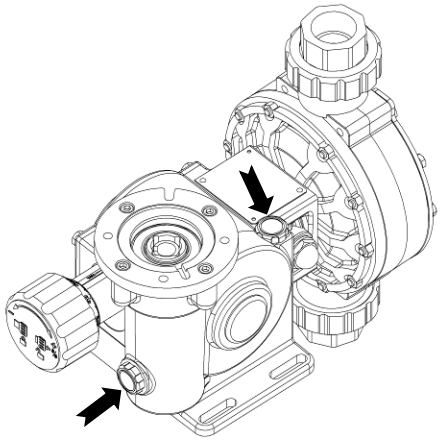


Figure 9: Gear Box Fill/Drain Points

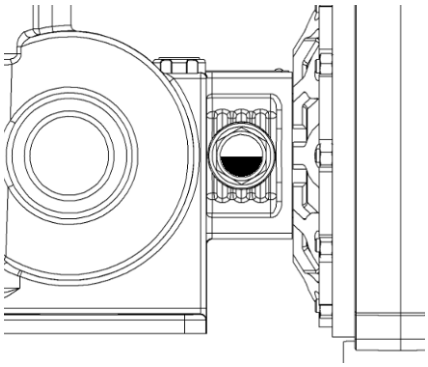


Figure 10: Gear Box PULSAlube 9M Normal Level

5.2 Wet End Removal, Inspection, & Reinstallation

WARNING

If the diaphragm has failed, process fluid may have contaminated other parts of the pump including the drive components (although normally, any process fluid behind a failed diaphragm would pass through the bottom drain hole). Handle with appropriate care.

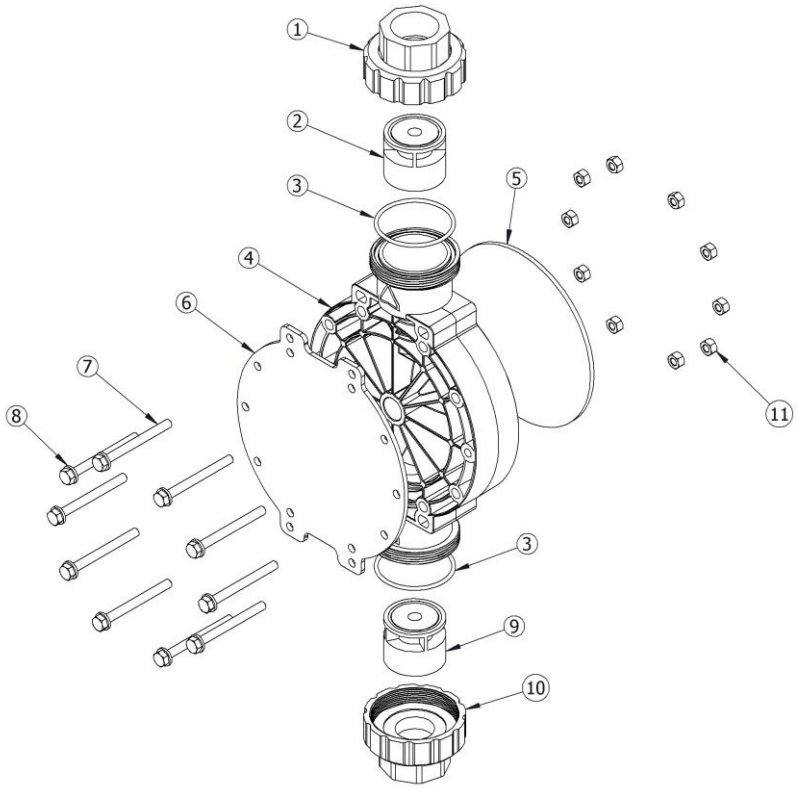


Figure 11: Wet End Components

Item	Description	Qty.		
		GLM1 and GLM2	GLM3 and GLM4	GLM5 and GLM6
1	Discharge Connection Assembly	1	1	1
2	Discharge Valve Assembly	1	1	1
3	O-ring	2	2	2
4	Reagent Head	1	1	1
5	Diaphragm	1	1	1
6	Front Cover Plate	1	1	1
7	Hex Head Bolt	8	10	12
8	Flat Washer	8	10	12
9	Suction Check Valve Assembly	1	1	1
10	Suction Connection Assembly	1	1	1
11	Hex Nuts	8	10	n/a

PULSA GLM diaphragms do not have a specific cycle life; however, the accumulation of foreign material or debris sufficient to deform the diaphragm can eventually cause failure. Failure can also occur as a result of system over pressure or chemical attack. Periodic diaphragm inspection and replacement are recommended. Each user should perform regular inspections to determine the replacement interval that is appropriate to their system conditions.

5.2.1 Diaphragm Removal & Reinstallation

1. Adjust the stroke setting to 50% and disconnect the power source to the drive motor.
2. Relieve all pressure from the piping system.
3. Close the inlet and outlet shutoff valves.
4. Place a pan underneath the pump head adaptor to catch any liquid leakage.
5. Disconnect piping to the reagent head and drain any process liquid, following all recommended material safety precautions.
6. Remove all but one top reagent head bolt. Product will leak out between the pump head adaptor and reagent head as the bolts are loosened. Use prescribed engineering controls to prevent exposure and accidental discharge to environment.
7. Tilt the head and pour out any liquids retained by the check valves into a suitable container, continuing to follow safety precautions as appropriate.
8. Remove the final bolt and rinse or clean the reagent head with an appropriate material.
9. Remove the diaphragm by turning it counter-clockwise.
10. Inspect the diaphragm. The diaphragm must be replaced if it is cracked, separated, or obviously damaged.
11. Install the diaphragm.
12. Ensure that the critical sealing areas of diaphragm, reagent head, and pump head are clean and free of debris.
13. Thread the diaphragm (clockwise) fully onto the shaft.
14. Install the reagent head bolts and tighten in an alternating pattern to ensure an even seating force. Torque bolts to 70 in-lb (8 n-m)
15. Re-prime the pump following the procedure outlined in ***Section 4.3***

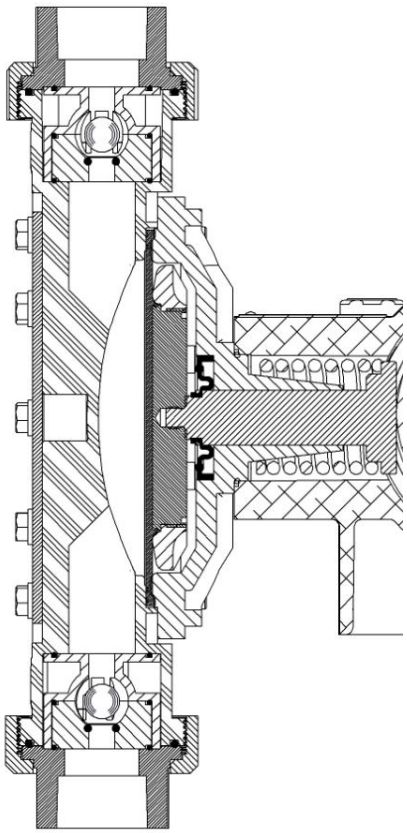


Figure 12: Reagent Head Assembly Cross Section

5.3 Check Valves

5.3.1 General Description

The valve incorporates a ball, guide, and seat. Flow in the unchecked direction lifts the ball off the seat, allowing liquid to pass through the guide. Reverse flow forces the ball down, sealing it against the bevel edge of the seat and o-ring. The guide permits the ball to rotate but restricts vertical and lateral movement in order to minimize “slip” or reverse flow. Ball rotation prolongs life by distributing wear over the entire surface of the ball. Since ball return is by gravity, the valve must be in the vertical position in order to function properly. Parts are sealed by o-rings.

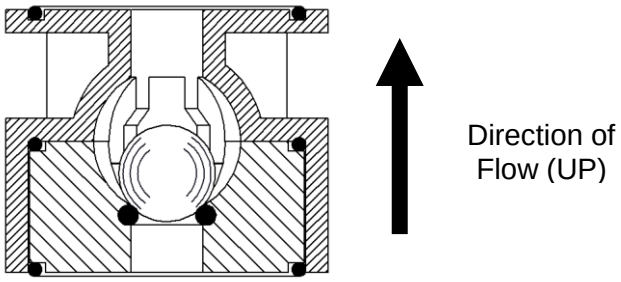


Figure 13: Cartridge Check Valve

5.3.2 Check Valve Removal & Reinstallation, Cartridge type

NOTE **Valves that are of the cartridge design are intended to be replaced as an assembly.**

1. Disconnect and Lockout the power supply to the drive motor.
2. Relieve all pressure from the piping system.
3. Take all precautions necessary to prevent contamination to the environment and personnel exposure to hazardous materials.
4. Close the inlet and outlet shutoff valves.
5. Disconnect the suction piping at the suction shut-off valve union by releasing the union retaining nut.

WARNING **Caution – Process fluid may drain from the Piping. Take necessary precautions.**

1. Disconnect the discharge piping at the discharge shut-off valve union by releasing the union retaining nut.

WARNING **Caution – Process fluid may drain from the piping. Take necessary precautions.**

2. Loosen and remove the suction valve cartridge retaining nut and drain any liquid from the reagent head.
3. Disconnect the discharge piping at the installed union near the discharge port.
4. Loosen and remove the discharge valve cartridge slowly to drain any trapped liquid.
5. Reinstall both new valve assemblies. For both the suction and discharge the valve orientation should be as shown in Figure 13.

NOTE **Take care to assure o-rings are fully seated in groves and are not displaced during assembly. A pinched o-ring can cause the assembly to leak. If necessary use a compatible o-ring retaining compound.**

5.3.3 Check Valve Removal & Reinstallation, Tie-bar type

1. Disconnect and Lockout the power supply to the drive motor.
2. Relieve all pressure from the piping system.
3. Take all precautions necessary to prevent contamination to the environment and personnel exposure to hazardous materials.
4. Close the inlet and outlet shutoff valves.
5. Loosen the suction valve tie-bar bolts (4) and spring the suction piping slightly away from the head, allowing liquid to drain. It may be necessary to loosen a union or flange.

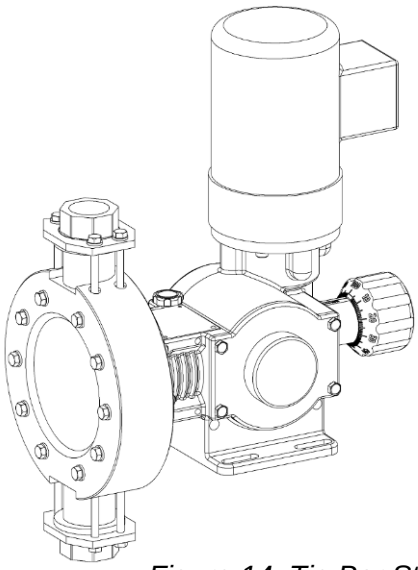


Figure 14: Tie Bar Style Metal Valves

WARNING **Caution – Process fluid may drain from the Piping. Take necessary precautions.**

6. Remove the suction check valve assembly by sliding it towards you, holding it together as a unit. Note carefully the position of the component parts, to assist in re-assembly.
7. Loosen the discharge valve tie-bar bolts (4) and spring the discharge piping slightly away from the head, allowing liquid to drain. It may be necessary to loosen a union or flange.

WARNING **Caution – Process fluid may drain from the Piping. Take necessary precautions.**

8. Remove the discharge check valve assembly by sliding it towards you, holding it together as a unit. Note carefully the position of the component parts, to assist in re-assembly.
9. Disassemble both valves and check components for wear or damage. The seats should have a sharp edge and be free from dents or nicks. Hold a ball firmly against the seat in front of a bright light and inspect for fit. Observation of light between the ball and seat is cause for replacement.
10. Reassemble both valves using new parts as required. Sealing o-rings should always be replaced.
11. Replace both valve assemblies onto the pump, taking care to ensure they are oriented correctly, with the balls above the seats, and the seats oriented with the sharp edge up and the chamfered edge down.

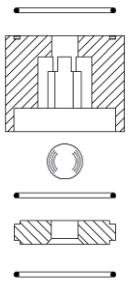


Figure 15: Metal Valve Assembly

NOTE **Inserting the check valve assmbly into the pump in the wrong directiom, or having the check seat upside down, will prevent proper seals at the o-rings, decrease pump performance, and can cause damage to the diaphragm.**

12. Carefully make sure that the check assemblies are in proper position and tighten the four tie-bar bolts, using a star pattern, to a torque of 6 ft-lbs (8 n-m).
13. Retighten any unions, flanges, or other process connections that may have been loosened previously.

5.4 Motor Removal & Reinstallation

Removal

1. Disconnect and Lockout the power supply to the drive motor.
2. Disconnect the motor wiring from the motor.
3. Remove the four bolts retaining the motor to the motor adaptor.
4. The motor shaft is keyed to a plastic coupling that slides into a splined bore in the pump input shaft. Lift the motor straight up to slide the motor shaft coupling out of the pump input shaft.

Installation

1. Install the plastic coupling over the motor key onto the motor shaft. For the 56C frame motor the coupling should be even with the end of the shaft. For the 71 frame motor the coupling should be installed over the shaft up to the collar (the end of the shaft will be slightly recessed into the coupling).

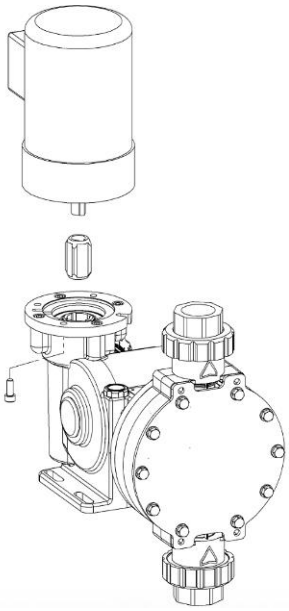


Figure 16: Motor Mounting

NOTE **Note: Assure the motor key is fully covered by the motor coupling.**

2. Reinstall the motor by sliding the motor vertically into the pump input shaft.
3. Align the motor bolts holes to the motor adaptor plate.
4. Install the 4 motor retaining bolts. Torque to 40 in-lbf (4.5 n-m).
5. Connect the motor wiring to the motor in accordance with Local, National and Motor Manufacturer requirements.
6. Restore power.

NOTE **The PULSA GLM is designed to operate with any Motor rotation direction (clockwise or counter clockwise).**

5.5 Pump Head Removal

The PULSA GLM includes a Pump Head that clamps the diaphragm to the Reagent Head. In the event of diaphragm failure process fluid can come into contact with this part (it includes a drain hole to prevent fluid accumulation). Over time, it is possible for this part to suffer some level of deterioration and need replacement.

1. Disconnect and Lockout the power supply to the drive motor.
2. Relieve all pressure from the piping system.
3. Take all precautions necessary to prevent contamination to the environment and personnel exposure to hazardous materials.
4. Close the inlet and outlet shutoff valves.
5. Remove the Valves, Reagent Head and Diaphragm as described in **Section 5.2** and **5.3**.
6. Drain the oil from the pump.
7. Set the pump stroke setting to 100%.
8. Rotate the pump motor until the Cross Head (the part that the Diaphragm threads onto) is fully retracted into the Gear Box.
9. Evenly loosen all (4) bolts that retain the Pump Head to the Gear Box.

Warning – Stored energy release possible - use caution! The pump head compresses a large spring that is used to return the diaphragm to its retracted position. Special tools may be required to reattach the pump head.

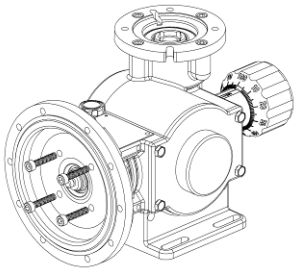


Figure 17: Pump Head Retaining Bolt Removal

10. Remove old pump head from front of Gear Box.
11. Orient replacement Pump Head with drain hole pointed down. Assure o-ring is in place on Gearbox side.

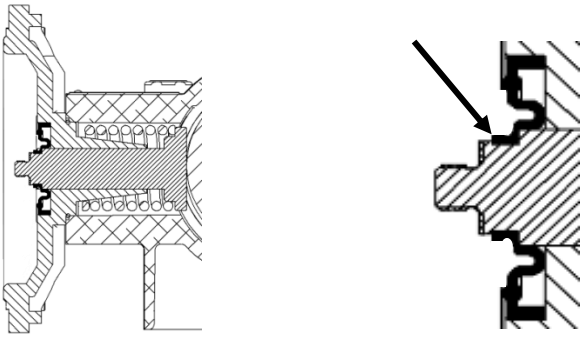


Figure 18, Pump Head Cross Section and Bellows Seal

12. Ensure the bellows oil seal is seated on the end of the cross head as shown above.
13. Insert Spring Guide of Pump Head over Cross Head and into spring. Take care to assure spring does not catch on tapered guide during installation.
14. Install the four retaining bolts. Tighten evenly. Torque to 80 in-lbf.
15. Install Diaphragm, Reagent Head and Valves as defined in **Section 5.2** and **5.3**.

6. Replacement Parts

6.1 KOPkit® Program

PULSA GLM KOPkits contain all replacement parts normally used in a preventative maintenance program. (PULSAlube is also available separately for preventative maintenance programs. Refer to ***Section 4 – Equipment Startup***). There is a specific KOPkit for every PULSA GLM pump model. Each KOPkit is vacuum-packed for extended storage. All PULSA GLM pumps have the KOPkit number identified on the pump nameplate and Pulsafeeder order documents. KOPkits can also be selected from the technical data sheet shipped with the pump or by a Pulsafeeder representative. A list of the PULSA GLM KOPkit numbers can also be found in **Section 6.2**. The kit is identified by the model number of the pump, the wetted end material, and the process connection thread type. For models with tie-bar type check valves, the appropriate components (check valve balls, seats, and o-rings) are supplied instead of the cartridges pictured.

6.2 Ordering KOPkits or Parts

When ordering replacement parts always specify:

- Pump model and serial number (from pump nameplate), e.g., Model No. (2) with Serial No. F406365-3.

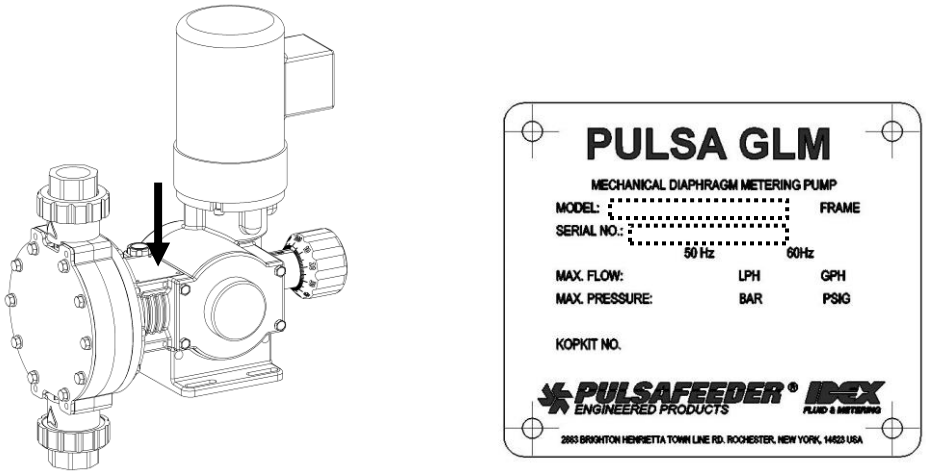


Figure 19: PULSA GLM Nameplate and Location

- Part number and description from the PULSA GLM parts list. Include the three-character suffix. (Note: PULSA GLM part numbers begin either with the letters GL, NP, or W, e.g., NP170001-THY or W210221-001.)

6.3 KOPkit numbers by model:

Pump Model	Wetted Material	Lite KOPkit (O-ring material)	Standard KOPkit (O-ring material)
GLM1	**PP**	KM1PX-LTE (Viton®)	KM1PX (Viton®)
GLM2		KM2PX-LTE (Viton®)	KM2PX (Viton®)
GLM3		KM3PX-LTE (Viton®)	KM3PX (Viton®)
GLM4		KM4PX-LTE (Viton®)	KM4PX (Viton®)
GLM5		KM5PX-LTE (Viton®)	KM5PX (Viton®)
GLM6		KM6PX-LTE (Viton®)	KM6PX (Viton®)
GLM7 & GLM7 Duplex		KM7PX-LTE (Viton®)	KM7PX (Viton®)
GLM1	**PVDF**	KM1FX-LTE (Viton®)	KM1FX (Viton®)
GLM2		KM2FX-LTE (Viton®)	KM2FX (Viton®)
GLM3		KM3FX-LTE (Viton®)	KM3FX (Viton®)
GLM4		KM4FX-LTE (Viton®)	KM4FX (Viton®)
GLM5		KM5FX-LTE (Viton®)	KM5FX (Viton®)
GLM6		KM6FX-LTE (Viton®)	KM6FX (Viton®)
GLM7 & GLM7 Duplex		KM7FX-LTE (Viton®)	KM7FX (Viton®)
GLM1	**316SS**	KM1AX-LTE (PTFE)	KM1AX (PTFE)
GLM2		KM2AX-LTE (PTFE)	KM2AX (PTFE)
GLM3		KM3AX-LTE (PTFE)	KM3AX (PTFE)
GLM4		KM4AX-LTE (PTFE)	KM4AX (PTFE)
GLM5		KM5AX-LTE (PTFE)	KM5AX (PTFE)
GLM6		KM6AX-LTE (PTFE)	KM6AX (PTFE)
GLM7 & GLM7 Duplex		KM7AX-LTE (PTFE)	KM7AX (PTFE)

7. Troubleshooting

Difficulty	Probable Cause	Remedy
Pump motor does not start	Faulty power source.	Check power source.
	Blown fuse, circuit breaker.	Replace - eliminate overload.
	Broken wire.	Locate and repair.
	Wired improperly.	Check diagram.
	Process piping blockage.	Open valves, clear other obstructions. Test by setting stroke to 0%.
No fluid delivery	Motor not running.	Check power source. Check wiring diagram (see above).
	Supply tank empty.	Fill tank.
	Line clogged.	Clean and flush.
	Closed in-line valve(s).	Open valve(s).
	Ball check valves held open with solids.	Clean – inspect, flush with clear fluid.
	Vapor lock, cavitation.	Increase suction pressure.
	Prime lost.	Re-prime, check for leak.
	Strainer clogged.	Remove and clean. Replace screen if necessary.
	Stroke adjustment set at zero.	Increase stroke length setting.
Low fluid delivery	Motor speed too low.	Check voltages, frequency, wiring, and terminal connections. Check nameplate vs. Specifications.
	Check valves worn or dirty.	Clean, replace if damaged.
	Calibration system error.	Evaluate and correct.
	Product viscosity too high.	Lower viscosity by increasing product temperature or dilution. Increase pump and/or piping size.
	Product cavitation.	Increase suction pressure.
Delivery gradually drops.	Check valve leakage.	Clean, replace if damaged.
	Leak in suction line.	Locate and correct.
	Strainer fouled.	Clean or replace screen.
	Product change.	Check viscosity and other variables.
	Supply tank vent plugged.	Unplug vent.
Delivery erratic.	Leak in suction line.	Locate and correct.
	Product cavitation.	Increase suction pressure.
	Entrained air or gas in product.	Consult factory for suggested venting.
	Motor speed erratic.	Check voltage and frequency.
	Fouled check valves.	Clean, replace if necessary.
	Inadequate backpressure	Increase discharge pressure to obtain a minimum pressure difference of 5 psi from suction to discharge.
Delivery higher than rated.	Suction pressure higher than discharge pressure.	Install backpressure valve or consult factory for piping recommendations.
	Back pressure valve set too low.	Increase setting.
	Back pressure valve leaks.	Repair, clean, or replace.
Noisy gearing, knocking	Discharge pressure too high.	Reduce pressure.
	Water hammer.	Install pulsation dampener.
	Stroke length at partial setting.	Some operating noise is characteristic of lost motion pumps.
	Low grease level.	Add or replace grease.

Difficulty	Probable Cause	Remedy
Piping noisy.	Pipe size too small.	Increase size of piping - install pulsation dampener.
	Pipe runs too long.	Install pulsation dampener in line.
	Pulsation dampener inoperative or flooded.	Refill with air or inert gas. Inspect and replace diaphragm and recharge.
	No surge chamber or dampener used.	Install pulsation dampeners.
Motor overheats.	Pump overloaded.	Check operating conditions against pump design. Verify discharge pressure.
	High or low voltage.	Check power source.
	Loose wire.	Trace and correct.
	Incorrect motor wiring.	Verify and correct.

8. Piping Accessories

Pressure Relief Valves

Pressure relief valves are designed to protect chemical feed systems from damage that may be caused by defective equipment or a blockage in the discharge line. These valves function to limit the pressure downstream of the pump. Field adjust the pressure relief valve to operate when the discharge pressure exceeds operating pressure by 10-15%. Pressure relief valve should always be adjusted to a setting below the maximum rated pressure of the pump. No potentially restrictive components, such as a valve, should be installed between the pump discharge and the PRV.

Diaphragm Backpressure Valve

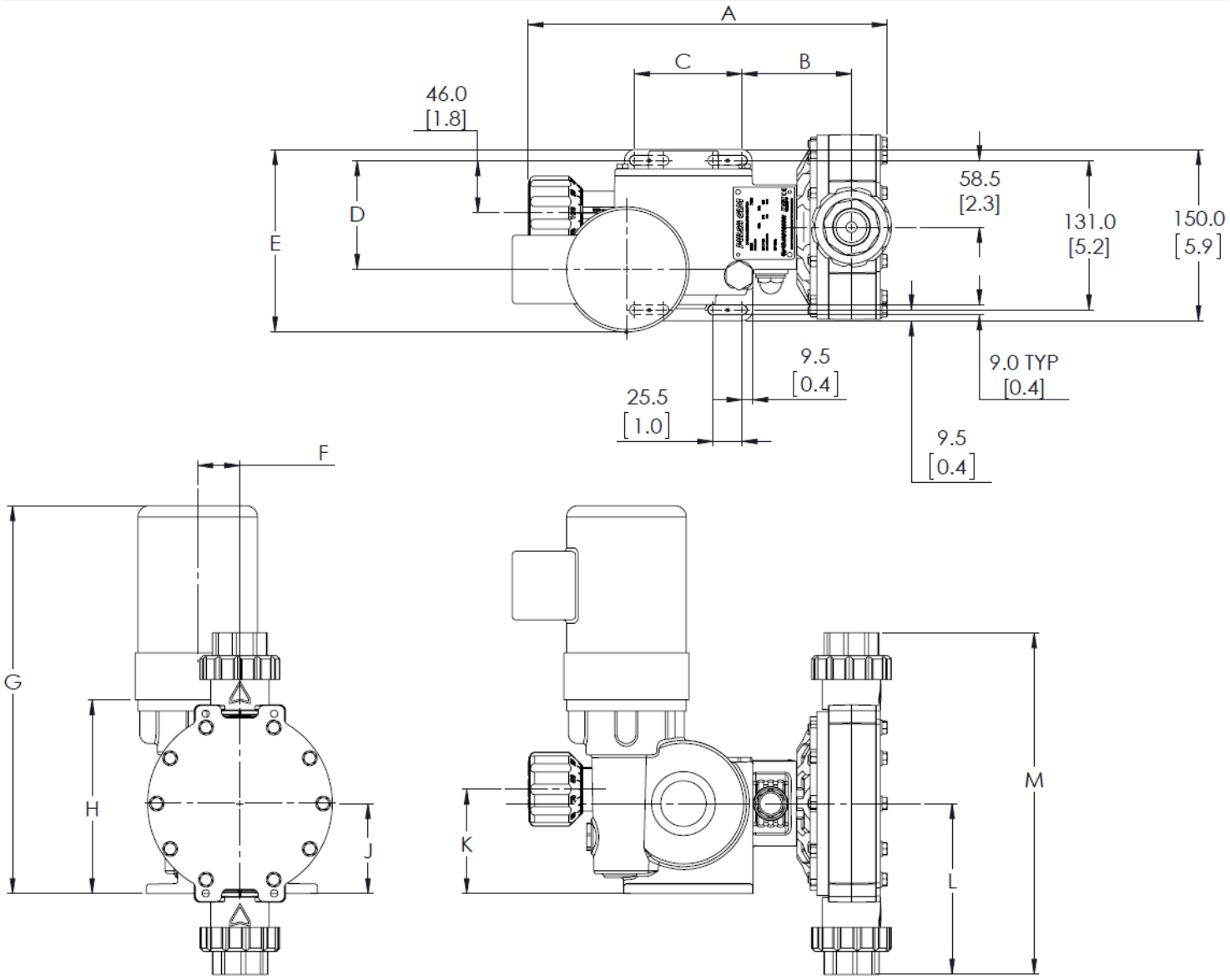
A diaphragm style backpressure valve creates constant back pressure. A PTFE or PTFE-faced diaphragm offers maximum chemical protection and service life, and seals spring and bonnet from product.

Be sure to install with fluid flow in direction of arrow on valve body.

Pulsation Dampener

A pulsation dampener is a pneumatically charged diaphragm-type chamber that intermittently stores hydraulic energy. Used on the inlet, it can improve NPSHA (Net Positive Suction Head Available) characteristics of the suction piping system. On the discharge line it will reduce discharge pressure peaks and pulsating flow variations.

9. Dimensional Drawing

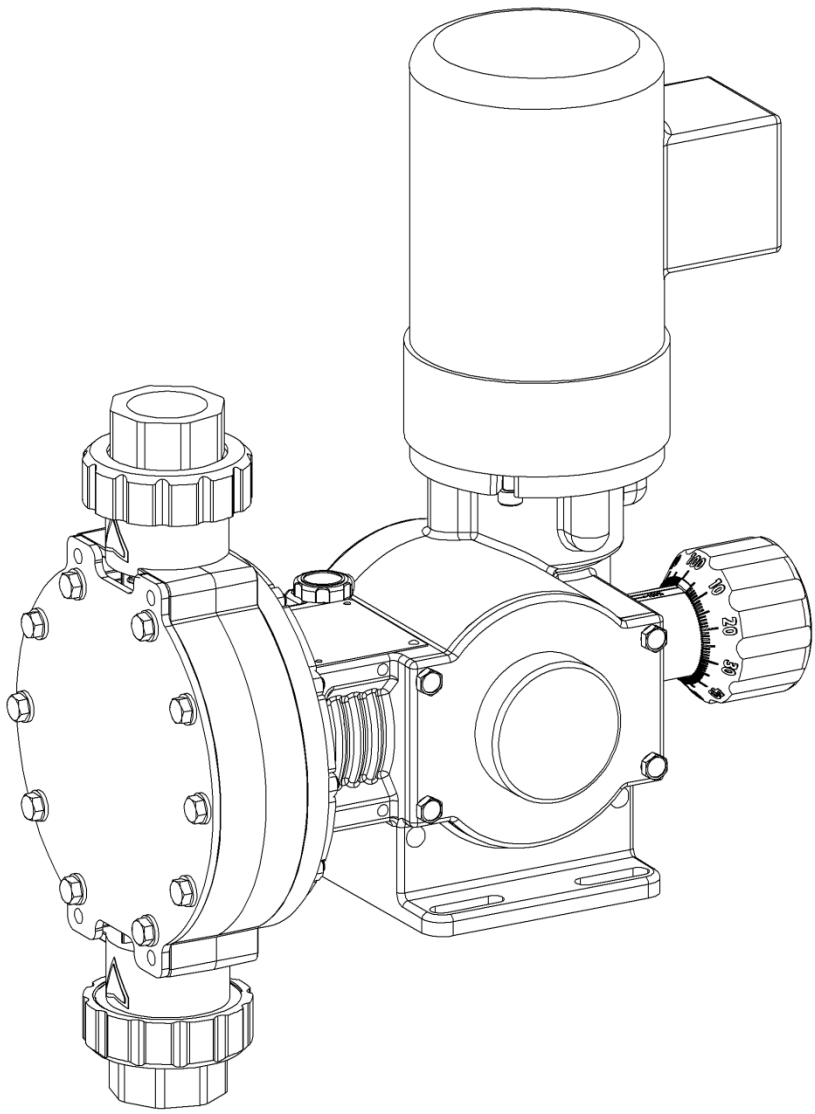


Model	Motor	Dimensions (mm / inches)					
		A	B	C	D	E	F
GLM1 & GLM2	71	160.0 / 6.3	95.5 / 3.8	300.0 / 11.8	94.5 / 3.7	Consult Factory	37.0 / 1.5
	56C	196.0 / 7.7					
GLM3 & GLM4	71	160.0 / 6.3	95.5 / 3.8	315.0 / 12.4	94.5 / 3.7		37.0 / 1.5
	56C	196.0 / 7.7					
GLM5 & GLM6	71	160.0 / 6.3	95.5 / 3.8	325.0 / 12.8	94.5 / 3.7		37.0 / 1.5
	56C	196.0 / 7.7					

Model	Motor	Dimensions (mm / inches)							
		G	H	J	K	L		M	
						NPT / BSPT	TUBING	NPT / BSPT	TUBING
GLM1 & GLM2	71	Consult Factory	170.0 / 6.7	79.0 / 3.1	91.5 / 3.6	103.0 / 4.1	131.0 / 5.2	206.0 / 8.1	262.0 / 10.3
	56C		175.0 / 6.9						
GLM3 & GLM4	71		170.0 / 6.7	79.0 / 3.1	91.5 / 3.6	150.0 / 5.9	N/A	300.0 / 11.8	N/A
	56C		175.0 / 6.9						
GLM5 & GLM6	71		170.0 / 6.7	79.0 / 3.1	91.5 / 3.6	172.0 / 6.8	N/A	344.0 / 13.5	N/A
	56C		175.0 / 6.9						

10. Policies & Procedures

Reference our Policy Manual at http://www.pulsa.com/resources/downloads/forms.



PULSA® GLM

MECHANICAL DIAPHRAGM METERING PUMP

Bulletin: IOM-GLM-5000-Rev.B

PULSAFEEDER® ENGINEERED PRODUCTS

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