PulsaPro®

HYDRAULIC DIAPHRAGM METERING PUMPS

PP7440

Installation, Operation & Maintenance Manual

5 Year DRIVE TRAIN WARRANTY

Bulletin: IOM-PRO-003 Rev B

PULSAFEEDER FACTORY SERVICE POLICY

Should you experience a problem with your *PulsaPro* pump, consult the troubleshooting guide in your operation and maintenance manual. If the issue is not covered or cannot be solved, contact your Pulsafeeder Sales Representative; or contact the Pulsafeeder Service department directly.

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. If the product requires returning to the factory for inspection and/or repair, a Return Authorization Number (RMA) issued by Pulsafeeder is mandatory. To request an RMA, contact your local sales representative for an authorization form.

TRADEMARKS

PulsaPro® is a registered trademark of Pulsafeeder, Inc.
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SAFETY CONSIDERATIONS

- Read and understand all related instructions and documentation before attempting to install or maintain this equipment
- Observe all special instructions, notes, and cautions.
- Act with care and exercise good common sense and judgment during all installation, adjustment, and maintenance procedures.
- 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.
- Caution: Dependent on Ambient conditions external surfaces of the pump (e.g., gearbox) can exceed 40C (104F). Operating personnel shall be notified and use caution with servicing pump.

REFER TO SECTION 9 for additional Safety Precautions/ Ignition Hazards and Protective Means

CONVENTIONS

A WARNING DEFINES A CONDITION THAT COULD CAUSE DAMAGE TO BOTH THE EQUIPMENT AND THE PERSONNEL OPERATING IT. PAY CLOSE ATTENTION TO ANY WARNING.

NOTES ARE GENERAL INFORMATION MEANT TO MAKE OPERATING THE EQUIPMENT EASIER.

Table of Contents

1. Introduction

THIS DOCUMENT CONTAINS INFORMATION TO BE USED BY QUALIFIED PERSONNEL ONLY

1.1 Receiving Inspection

All materials relative to supply are delivered to the shipper in perfect condition after thorough final testing and packaging. Inspect goods immediately upon receipt and check:

- The goods received correspond to the order made
- The packaging has not undergone damage due to transport or has not been tampered with
- The actual condition of goods

If anomalies or damage are found immediately issue a complaint with the courier and inform Pulsafeeder aftermarket service at Proservice@idexcorp.com or call Pulsafeeder at 585-292-8000.

1.2 General Information

The purpose of these instructions is to refer information deemed necessary for understanding as much as possible about and facilitating the installation, commissioning, use and maintenance of hydraulic diaphragm metering pumps.

1.3 Personnel Responsible for Pump Operation

Anyone operating the pump should have read and understood the instructions set forth within this manual. The employer must instruct all staff on the risks of accidents and on devices and clothing to be used for individual safety.

1.4 Testing

Each Pulsafeeder metering pump is a reliable quality product, subject to careful final inspection to ensure their proper functioning and found compliance with the specified performance. The final test results, if specifically requested by contract, are registered and made available to the customer. Pulsafeeder offers many different tests available with your PulsaPro pump.

1.5 Warranty

PulsaPro metering pumps are guaranteed for a period of eighteen (18) months from the date of shipment. Drive assemblies (gearing, shafts, eccentric, and related components within gearbox) are guaranteed for a period of sixty (60) months from the date of shipment. The guarantee covers replacement, free of charge, of any component found to be defective in material or processing by the Aftermarket Service Group at Pulsafeeder, Inc.

The Warranty is NOT valid in the following cases:

- Components subject to normal wear (gaskets, seals, O-rings)
- Installation and/or use do not meet the technical conditions of sale and instruction
- If the pump has been tampered with or disassembled
- Motor (drive) is covered by the motor manufacturer

1.6 Requesting Spare Parts

For preventative maintenance, Pulsafeeder recommends the installation of a KOPkit (**K**eep-**O**n-**P**umping), which includes the recommended spare parts needed. The part number for this kit can be located on the pump nameplate as well as the specification data sheet provided with your metering pump.

For other needed components, find and study the sectional drawings of the pump in use, if necessary, contact Pulsafeeder to obtain a copy. For drawings and bill of materials for your pump(s) please send an email to Prodocs@idexcorp.com. Using the nomenclature of the sectional drawing, make a list of the parts needed and send to your local Pulsafeeder sales representative, always specify the pump serial number.

To find the local Pulsafeeder representative for parts pricing and availability log onto www.pulsafeeder.com, select “Sales Contacts”. For assistance with determining the representative then please contact us at 585-292-8000

1.7 Spare Parts

Modifications are not allowed. Original Pulsafeeder spare parts and accessories are to be used to assure conformity with safety rules. Pulsafeeder declines any responsibility in case of use of non-original parts and which results in the warranty being voided.

1.8 Liability Exclusion

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

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

- Improper Installation
- Improper use of the machine 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 model in question
- Total or partial failure to observe the instructions
- Exception environmental events

1.9 Restrictions Regarding this Document

This document is the property of Pulsafeeder together with the technical information contained in it. Modification, reproduction, or copying (in part or whole) without written permission is prohibited.

2. Transport and Storage

2.1 Consignment receipt and unpacking

Immediately after receipt of the equipment it must be checked against the delivery/shipping documents for its completeness and that there has been no damage in transportation.

Check any crates, boxes, or wrappings for any accessories or spare parts that may be packed separately with the equipment or attached to side walls of the box.

Each product has a unique serial number, check that the number corresponds with that advised, and always quote this number in correspondence as well as when ordering spare parts.

Shortages or damage should be reported immediately to the carrier and your Pulsafeeder Representative.

2.2 Handling

Boxes, crates, pallets, or cartons may be unloaded using forklift vehicles or slings dependent on their size and construction. Slings, ropes, and other lifting gear should be positioned where they cannot slip and where a balanced lift is obtained. If lifting without equipment, follow safe practices to avoid injury (i.e., lifting with two people).

3. Storage Instructions

3.1 Short Term

Storage of PulsaPro pumps for up to twelve (12) months is considered short-term. The recommended short-term storage procedures are:

- Store the pump indoors at room temperature in a dry environment
- Confirm or fill the eccentric box to its normal operating level with PULSAlube Premium 7H Hydraulic Oil. If required by the operating environment, take steps to prevent entry of water or humid air into the eccentric enclosure.
- Prior to startup, inspect the housing and gearbox. Replenish hydraulic oil as required to maintain operating levels. If water or condensation is present, change oil as described under Equipment Set-Up.
- Start up in accordance with instructions in this manual

3.2 Long Term

Every twelve months, in addition to the above short-term procedures, power up the motor and operate the pump for a minimum of one hour. It is not necessary to have liquid in the reagent head during this operation, but the suction and discharge ports must be open to atmosphere. If the pump is equipped with a PULSAlarm leak detection system, ensure that a vacuum is drawn before operating the pump. See Appendix I for more information.

After twelve months of storage, Pulsafeeder Warranty cannot cover such items which are subject to deterioration with age such as seals and gaskets. If the pump has been in storage longer than twelve (12) months, it is recommended that such items be inspected and replaced as necessary prior to startup. Materials and labor to replace this class of items under these circumstances are the purchaser's responsibility. For continuance of the warranty after extended storage, equipment inspection and any required refurbishing must be done by a Pulsafeeder Representative.

4. Principles of Operation

4.1 Overall Operation

A piston reciprocates within an accurately sized cylinder at a preset stroke length, displacing an exact volume of fluid. The piston, however, does not pump various chemicals. The piston and associated mechanisms are enclosed in a gearbox that also serves as a hydraulic oil reservoir. A diaphragm separates the oil from the product pumped. The diaphragm moves in exact response to piston displacement. The diaphragm does no work and acts only as a separator. Consequently, the oil displacement is translated into equal product displacement. The piston retraction causes the product to enter through the suction check valve. Piston advancement causes the discharge of an equal amount of product through the discharge check valve.

Individual pumps may vary in appearance due to various liquid ends, accessories, and multiplexing. The basic principles of operation, however, remain the same.

The maximum A-weighted sound pressure level of the Pulsa Pro 7440 series metering pump was tested and determined to be 59 dBA.

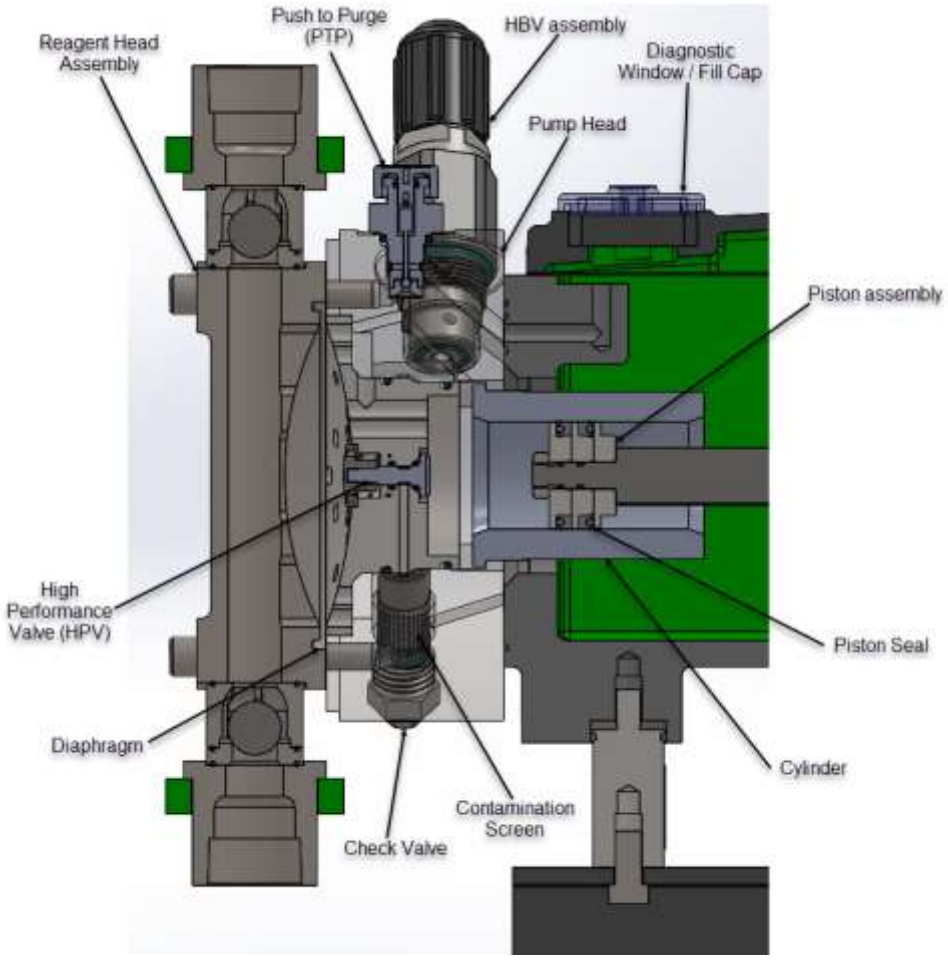


Figure 1

4.2 Nameplate Identification

Each pump carries a nameplate for identification with the following information:

- Model Series
- Serial Number
- Rated Flow
- Rated Pressure
- KOPkit (recommended spare parts)
- Piston Diameter
- Gear Ratio
- Motor Frame Size, RPM Rating

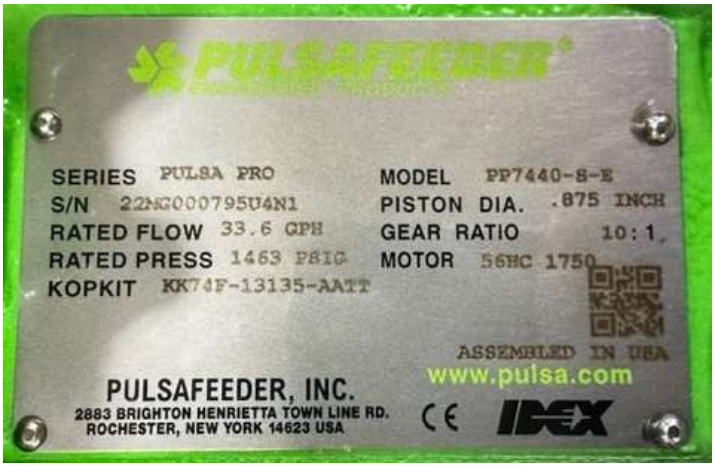


Figure 2

4.3 Flow Rate

PulsaPro has pulsating flow rates, generated by the alternating movement of the piston and the action of the check valves on the pump head which determine flow direction. Pump flow rate is adjustable and increases or decreases in direct proportion to the variation of the stroke adjustment.

The theoretical flow rate – corresponds exactly to the volume described by the movement of the diaphragm.

The actual flow rate – is inevitably lower than the theoretical flow rate, due to the volumetric efficiency of the pump. It varies depending on the type and size of the pump, the nature and viscosity of the liquid to be pumped, working pressure, etc.

4.4 Intended Use

PulsaPro 7440 Pumps are designed for dosing liquid fluids (flammable, acids, alkaline, solvents, etc.) at ambient temperature or heated, suitable for continuous service.

These pumps are used in the following markets:

- Chemical Processing, Petrochemical, Oil & Gas, Power & Energy, Water/Wastewater treatments, and General Industries.

Applications may include but not limited to:

- Amines, Defoamers, Oxygen Scavengers, Disinfectants, Oil Additives, Acids, Demulsifiers, Caustics, Methanol, Biocides, Corrosion Inhibitors, Ethylene Glycol, Anti-Scalants, and other chemical feeds.

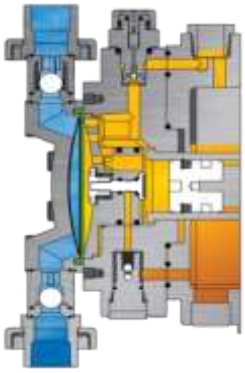
4.5 Components and Operation

Reagent Head (Wet End) – The typical reagent head assembly consists of the reagent head, diaphragm, and the suction/discharge check valves. This assembly is the only part of the pump to contact the process liquid; consequently, maintenance is critical to pump performance.

Figure 3

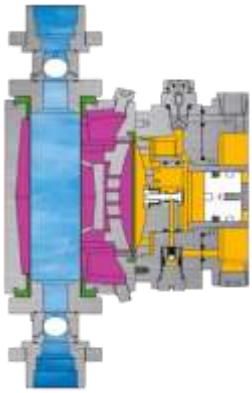
Types of Diaphragms – PulsaPro 7440 offer the Flat Diaphragm and HYDRAtube. Additionally, you can utilize our Double Diaphragm (Flat) with PULSAlarm Leak detection. (Figure 4 showing the Flat diaphragm and HYDRAtube.

Figure 4



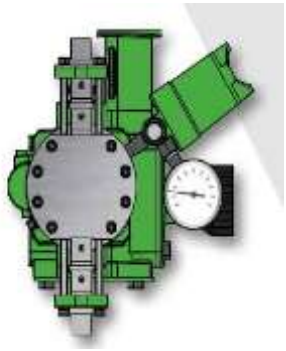
Flat Diaphragm – is the standard design ensuring high performance metering in a leak-free operation. PulsaPro flat diaphragms are available in a variety of both metal and plastic materials and can handle a wide range of chemicals. As with PulsaPro diaphragm constructions, the flat diaphragm is hydraulically balanced and operates stress free, providing exceptional life and accuracy.

Figure 5



HYDRAtube – is the best choice for sheer sensitive, high viscosity fluids and slurries. It's straight flow through design eliminates clogging and flow restrictions. It offers double diaphragm safety as a standard as well as optional slurry valves. Available in FKM, CSM, or PFA, it can be utilized with the most corrosive or acidic chemicals. Optional ChemAlarm leak detection system monitors the electrical conductivity of the intermediate liquid between the HYDRAtube and second diaphragm to detect diaphragm failure and, can signal an alarm or stop the pump.

Figure 6



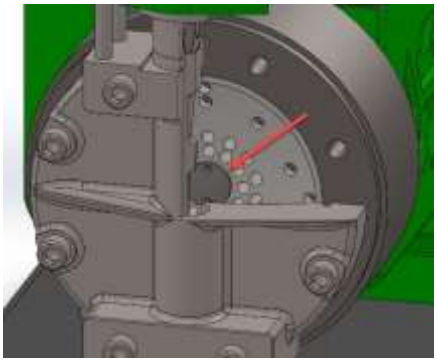
Double Diaphragm (Flat) with PULSAlarm Leak Detection – offers a rugged sandwich style double diaphragm construction for increased protection against leaks. PULSAlarm provides a pressurized leak detection technology to monitor the diaphragm integrity and can signal an alarm or stop the pump at the first sign of diaphragm failure. PULSAlarm is designed to contain full rated pressure up to 3,000 PSI (207 BAR), and is rated NEMA Type 7, EEMAC7 Class 1, Division 1, Groups C&D, Class 1, Zone 1, Groups IIA&IIB; UL, cUL, CE, ATEX. An optional pressure gauge is also available for visual indication of diaphragm integrity at the pump.

Figure 7

Pump Head Assembly – attached to the intermediate head of the pump, it consists of the pump head, cylinder, piston assembly, and three hydraulic valves.

Push-To-Purge (PTP) – situated at the top of the pump head automatically removes gases from the hydraulic system during normal operation. Momentary manual actuation of the external valve button overrides automatic operation to validate priming or to determine diaphragm integrity.

Figure 8



Hydraulic Performance Valve (HPV) – integrated within the dish plate this valve automatically maintains the required hydraulic oil volume by replacing any oil lost past the piston or through the PTP valve.

Figure 9

Hydraulic Bypass Valve (HBV) – this valve protects the pump from over-pressurization by relieving any excess pressure in the pump's hydraulic system. The valve is preset based on customer's specification, typically adjusted to 10% above the system pressure. The sight glass above the valve allows visual aid to observe the operation.

⚠ **Designed to protect the pump only, does not provide an overall system protection.**

Figure 10

Manual Control/Stroke Adjustment

The PulsaPro 7440 pump flow rate is adjusted by changing the stroke length utilizing a counter located next to the handwheel which denotes the stroke position. The stroke is adjusted by turning the control knob to the desired setting. The stroke length percentage is denoted by a counter.

NOTE: Stroke Adjustment is measured to the tenths. The below picture represents **100.0%** stroke.

Figure 11

Automatic Stroke Adjustment

If ordered with a controller you would have the XAE which is a microprocessor-based stroke length control device. The unit is physically attached and integrated into the pumps design. This controller allows for precise adjustment of output flow of a process media by means of stroke length position. For additional information on your XAE please download or review a copy of the IOM.

Figure 12

Gear Ratio Assembly/Motor Adaptor

PulsaPro pumps are driven by a standard C-face electric motor mounted on the adaptor input flange. The motor drives a set of worm gears located in the gearbox which will then convert rotational speed into torque. They in turn power the eccentric shaft assembly that converts rotary motion into reciprocating motion. The motor adaptor is available in a variety of sizes to accommodate different motor frame specifications.

Figure 13

More than one pump can be driven through a single drive assembly, which is referred to as multiplexing. The pumps are mounted on a common gear reducer assembly on the drive pump and the pump without a gear reducer is called the driven pump. Each pump is mounted on its respective standard simplex base. Each pump will have its own gear ratio.

Whenever pumps are multiplexed, the eccentric shafts are positioned to place a uniform load on the driver. Before full disassembly, always note the relative positions of the eccentric shafts to each other so they can reassemble in the same orientation.

5. Installation

5.1 Location

When selecting an installation site or designing a skid package, consideration should be given to access for routine maintenance.

PulsaPro pumps are designed to operate indoors and outdoors, but it is desirable to provide a hood or covering for outdoor service. External heating may be required if ambient temperatures are below -40°F are anticipated. Check with the factory regarding suitability of the operating environment.

The pump must be rigidly bolted to a solid and flat foundation to minimize vibration, which can loosen connections. When the pump is bolted down, care must be taken to avoid distorting the base and affecting alignments, check for levelness when securing. This will assure that the hydraulic oil is maintained at the proper levels and that the check valves can operate properly.

5.2 Ideal Metering Pump Installation

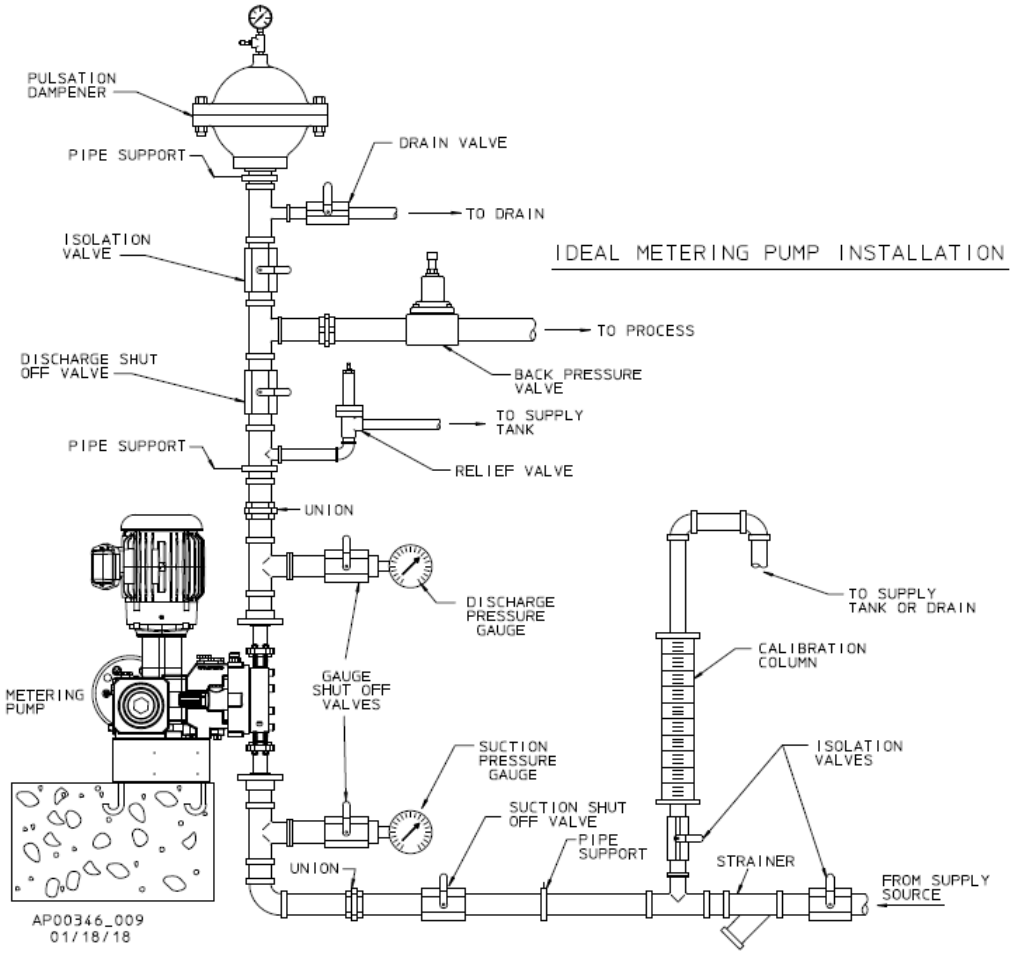


Figure 14

All piping systems should include:

- Shutoff valves and unions (or flanges) on suction and discharge piping. This permits check valve inspection without draining long runs of piping. Shutoff valves should be the same size as connecting pipe. Ball valves are preferred since they offer minimum flow restriction.
- An inlet strainer, if the product is not a slurry. Pump check valves are susceptible to dirt and other solid contaminants unless designed for that service, and any accumulation can cause a malfunction. The strainer should be located between the suction shutoff valve and the pump suction valve. It must be sized to accommodate the flow rate and the anticipated level of contamination; 100 mesh screens are recommended.
- Vacuum/pressure gauges in the suction and discharge lines installed to check system operation. Gauges should be fitted with protective shutoff valves for isolation while not in use.
- A separate system relief valve to protect piping and process equipment, including the pump, from excess process pressures.

Piping weight must not be supported by the valve housings or other portions of the reagent head, as the resulting stresses can cause leaks. If appropriate, provide for thermal expansion and contraction so that no excess force or moments are applied to the pump.

If piping assembly, use a sealing compound chemically compatible with the process material.

Users of sealing tape are cautioned to ensure that the pipe thread ends are not taped. 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. Flow issues at pump startup are often related to the check valves being fouled with piping and process debris.

5.3 Suction Pressure Requirements

Although PulsaPro metering pumps have suction lift capability, all pump installations should have minimum lift for optimum performance. 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 other source.

Piping should be sized to allow for best possible NPIP conditions.

IT IS NOT RECOMMENDED TO INSTALL A PUMP EQUIPPED WITH A PULSALARM LEAK DETECTION IN A SUCTION LIFT SYSTEM

If suction lift is required, the net positive suction pressure required (NPSHr) is 0.21 bar (or 3 psia). If this requirement is not met the process liquid may cavitate inside the pump, degrading metering accuracy. To maintain prime on a suction installation, a foot valve is required. In addition, suction pressure must be maintained at a minimum absolute value of 0.35 bar (or 5 psia) to ensure proper hydraulic system and proper pump operation.

IT IS CRITICAL THAT PULSAPRO PUMPS HAVE FREE FLOWING AND UNOBSTRUCTED SUCTION CONDITIONS AT ALL TIMES. CLOSED VALVES, CLOGGED STRAINERS, OBSTRUCTED PIPING, ETC. ARE TO BE AVOIDED. SUCTION RESTRICTIONS CAN PLACE STRESS ON THE DIAPHRAGM THAT MAY RESULT IN PREMATURE FAILURE.

Refer to Appendix II for procedures for the calculation of suction pressure.

5.4 Discharge Pressure Requirements

PulsaPro Metering Pumps are designed for continuous service at the rated discharge pressure. If system suction pressure exceeds system discharge pressure, flow would be generated in addition to that caused by the pump, resulting in a reduction in accuracy and loss of control over the metering process. To prevent this condition, commonly referred to as “flow-through”, discharge pressure must exceed suction pressure by at least 5 PSI (.35 BAR). The installation of a back-pressure valve can achieve this is necessary to achieve the differential pressure.

Discharge systems should be protected from excessive pressures by utilizing a pressure relief or pressure limiting valve in the piping system. Operation of the pump at pressure above its rated maximum (found on nameplate) may result in damage to the pump components and/or unsafe system conditions.

Refer to Appendix II for procedures for the calculation of discharge pressure.

5.5 PULSAlarm Leak Detection Electrical Connections

If equipped with an optional pressure switch, install electrical wiring and conduit in accordance with local electrical codes.

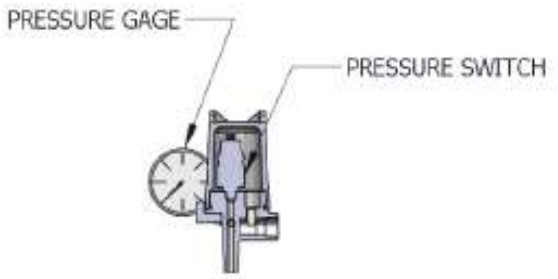
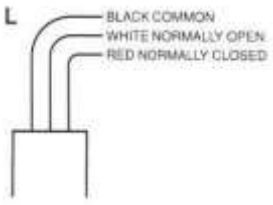


Figure 15

The switch is rated as follows:

Voltage	115VAC
Phase	Single
Load	1.0 Amp (Resistive)
Contacts	NO/NC (SPDT)
Connection	Flying Leads, 20AWG
Max Pressure	3000PSI

The switch is the SPDT (single pole, double throw) type and can therefore be connected to either open or to close upon detection of a diaphragm leak condition. Contacts or wires are identified as follows:



Normally Open (NO)	Wire Color White
Normally Closed (NC)	Wire Color Red
Common (COM)	Wire Color Black

⚠ **THE ENCLOSURE IS LABELED WITH APPLICABLE SAFETY AGENCY RATINGS FOR HAZARDOUS AREA INSTALLATION. SINCE THE SWITCH IS OF THE MECHANICAL CONTACT TYPE, IT CAN NEVER QUALIFY AS NON-SPARKING (NON-INCENDIVE, OR “M”) FOR OCCASSIONAL AND SHORT-TERM HAZARDOUS AREA USE. PROTECTION MUST BE PROVIDED BY THE ENCLOSURE.**

Go to Section 11 Appendix I for further description and instructions for the PULSAlarm Leak Detection System.

6. Equipment Setup

6.1 Hydraulic Oil Fill

The PulsaPro ships from the factory pre-filled with oil after testing is completed. When starting up you can verify the oil level from the provided sight glass on the gearbox as well as the Intermediate Head.

Figure 16

Figure 17

Remove the oil fill cap on the rear of the gearbox to gain access to the gear oil reservoir and add PULSAlube 8GS gear oil. For the hydraulic oil, remove the plastic cover on the top of the intermediate chamber cover and add PULSAlube 7H hydraulic oil. High oil level will not affect the operation of the pump; however, it can result in nuisance leakage of oil.

Oil Type	Color	Amount
Hydraulic	Purple	3 Liters
Gear	Amber	1.75 Liter

6.2 Drive Motor Installation

PulsaPro pumps may be shipped with the drive motor packed separately. This is done to avoid damage during transport.

- Remove the unattached coupling half from the motor adaptor. Ensure that the elastomer coupling spider remains in place, on the coupling half that remains attached to the worm shaft in the pump.
- If applicable, remove any tape or retainer rings that hold the motor shaft key in place.
- Place the loose coupling half on the motor shaft. Align the face of the motor shaft flush with the face of the coupling.
- Tighten the setscrew onto the shaft key
- Place the motor in a vertical position and align the coupling teeth
- Install the motor downwards onto the adaptor. Final position can be achieved by slightly rotating the motor until the coupling jaws align
- Rotate the motor until the clearance holes in the adaptor and the tapped holes in the motor align. Fasten the motor to the adaptor using the supplied bolts (4). Tighten bolts evenly to secure motor.

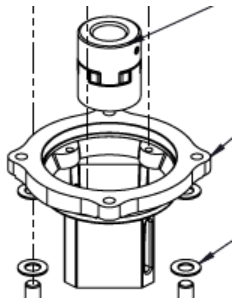


Figure 18

6.3 Drive Motor Wiring

Wire the PulsaPro drive motor according to the motor vendor's nameplates and instructions, and according to any appropriate national and local electrical codes and regulations.

6.4 Motor Rotation

Verification of the motor direction is necessary at startup. The motor direction must be counterclockwise as indicated on the gearbox by a directional arrow.

Figure 19

7. Startup Procedure

7.1 Output Adjustment

All PulsaPro pumps have a handwheel for manual stroke length adjustment. Mounted on the top of the stroke adjustment housing, the hand-knob can be adjusted at any point (from 0 to 100% stroke setting) by rotating the hand wheel as required. A counter, located next to the handwheel will denote the stroke position.

Adjustments can be made while the pump is at rest or operating, although operating adjustments are easier to make.

Figure 20

NOTE: Stroke Adjustment is measured to the tenths. The below picture represents **100.0%** stroke

IF THE PUMP IS EQUIPPED WITH A PRESSURE LEAK DETECTION SYSTEM, THE SYSTEM MUST REMAIN SEALED AT ALL TIMES DURING PUMP OPERATION, WHETHER OR NOT LEAK DETECTION IS REQUIRED. IF THE SEAL IS BROKEN, DECREASED FLOW AND/OR DIAPHRAGM DAMAGE WILL OCCUR. SEE APPENDIX I FOR FURTHER INFORMATION

LEAK DETECTION DIAPHRAGM SYSTEMS REQUIRE SPECIAL HYDRAULIC PRIMING CONSIDERATIONS TO PROTECT THE DIAPHRAGM FROM DAMAGE DURING INTIAL PUMP STARTUP. SEE APPENDIX I FOR FURTHER INFORMATION.

7.2 Suction System

Before operation of any PulsaPro pump, carefully ensure that all suction valves are in the open position. Verify that all filters and strainers are clean and clear. Ensure that any other potential causes of restriction have been addressed. Unrestricted flow of liquid to the suction side of the pump is critical to proper operation.

7.3 Priming the Pump Head

All pumps are shipped with a fully primed hydraulic system. However, during shipping and handling some air may enter the hydraulic system. Generally, this air will be automatically purged after a short run-in period. If necessary, rapid purging may be accomplished by fully depressing and holding the PTP valve for five to ten seconds, while the pump is operating. Repeat as necessary until the pump stabilizes at rated flow.

7.4 Priming the Reagent Head

- Open the suction and discharge line shutoff valves
- If the piping system design and the storage tank are such that the product flow due to gravity through the pump, no priming is required. 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.
- If the installation involves a suction lift, it may be necessary to prime the reagent head and suction line. Try priming the reagent headfirst. Remove the discharge valve by unscrewing the four tie bar bolts and removing the valve as a unit. Fill the head through the discharge valve port with process (or compatible) liquid, then reinstall the valve and retighten the tie bar bolts to the recommended specification.
- 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.
- 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, replace the valve, then remove the discharge valve assembly and fill the reagent head as described in the third step above. The pump will now self-prime when started up per step four above.

7.5 Calibration

All metering pumps must be calibrated to accurately specify stroke length settings for required flow rates.

A typical calibration charge is shown in figure 23. Although output is linear with respect to 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 output pressure is based on the displacement of the hydraulic piston (the product of piston cross-sectional area and stroke length) and the stroking rate of the pump. With increasing the discharge pressure there is a corresponding decrease in output flow of approximately 1% per 100 PSI (7 BAR) increase in output pressure. Whenever possible, calibration should be performed under actual process conditions (i.e., the same or a similar process liquid at system operating pressure).

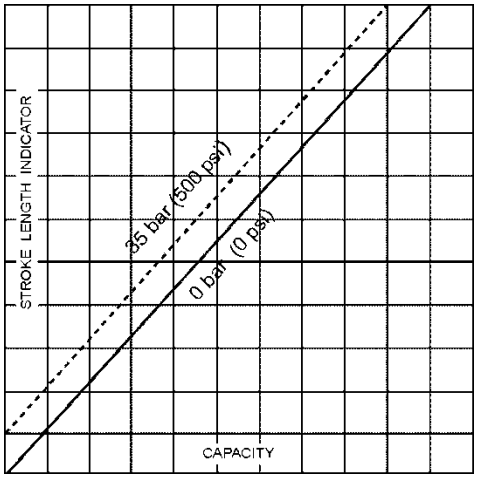


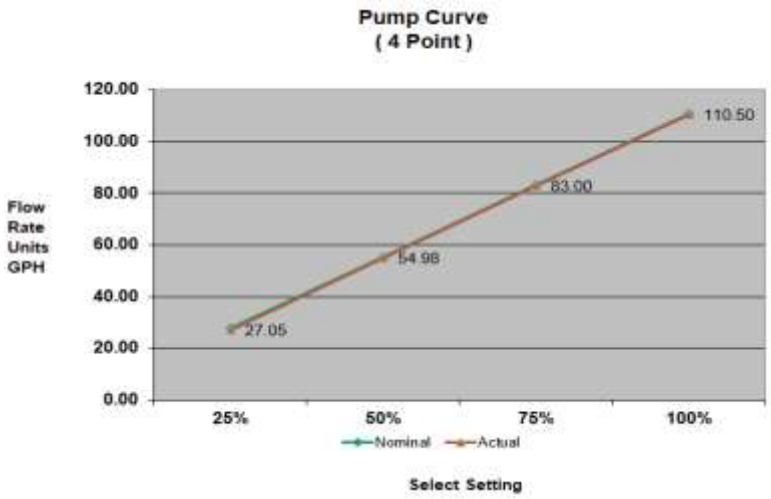
Figure 21

To assure a sound hydraulic system, run the pump for ten to fifteen minutes prior to calibration. This will allow the PTP valve to purge any air from the system.

To construct a calibration chart, measure the flow rate several times at three or more stroke settings (i.e., 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. See figure 2 for example of a four-point test plotted onto a calibration chart.

Checking the actual flow rates is especially important in pumps producing low flow rates and operating against high discharge pressures. In this type of system, normal losses of efficiency can result in lack of measurable flow at shorter piston stroke lengths. This is a function of the system conditions and does not indicate a problem with the pump. Careful measurement of actual pump flow at several test points will allow for proper calibration over the complete flow range.

Figure 22



7.6 Stopping Mechanism

The PulsaPro 7440 pump shall be fitted with a local/clearly visible control device that will allow the pump motor and accessories (e.g. stroke length actuator, hypovalve, PULSAlarm, etc.) to be brought to a complete stop. This is commonly known as an emergency stop or E-Stop.

Any external drivers (e.g. motor) or controls (e.g. XAE) used with the pump shall be purchased as accessories and installed in accordance with the manufacturer installation manual. Proper installation is the responsibility of the customer.

8. Maintenance

Accurate records from 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 service conditions.

Each PulsaPro pump is provided with an individual specification data sheet included in the parts list package. The data sheet contains important information relating to the application along with the pump serial number and pump specifications (i.e., materials, piston size, stroking rate, etc.).

PulsaPro KOPkits (**K**eep-**O**n-**P**umping) contains all the replacement parts normally used in preventative maintenance program. It is always recommended that KOPkits and PULSAlube hydraulic oil be kept available. A good instruction manual, parts list, and a good maintenance record are key to long trouble-

free metering pump operation.

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. FOLLOW SAFETY MEASURES BY WEARING YOUR PROTECTIVE CLOTHING BASED ON THE HAZARDOUS.

8.1 Operating Precautions

All operations must be performed by qualified personnel. Prior to work:

- The power line is disconnected, and no parts are energized
- Any risk of accidental restart has been excluded
- Handled fluid, present in the pump head and pipelines is not pressurized
- With the pump off, suction and discharge valves are closed
- Pump has been adequately cleaned, when operating in aggressive chemical environments

THESE MAINTENANCE SUGGESTIONS ARE NOT INTENDED AS "DO IT YOURSELF" REPAIRS. TO PERFORM SUCH WORK, SPECIALIZED TECHNICAL KNOWLEDGE IS REQUIRED, AND OPERATIONS ARE TO BE PERFORMED BY QUALIFIED PERSONNEL.

8.2 Consulting with Technical Documentation

Before starting work, you should consult this maintenance manual, identify the correct sectional drawing of the pump in use and get all the tools and equipment necessary to perform the maintenance or repair work.

When the pump has been disassembled, waiting to be reassembled, it is necessary to protect the various components to prevent damage caused by oxidation or accidental impact.

8.3 Oil Changes

It is recommended after six months of operation to replace the hydraulic oil within the PulsaPro pump. To accomplish this, you will need to remove the drain on the gearbox as well as the drain plug on the intermediate head. Oil changes thereafter would be on an annual basis for Normal Service, or every six months for Severe Service as defined below.

Normal Service: Clean/Dry Atmosphere, an ambient operating temperature of 0°C to 40°C (32°F to 104°F) and/or up to 2,000 annual operating hours.

Severe Service: Humidity/Chemical/Dust laden atmospheres, and/or ambient operating temperatures below 0°C or above 40°C (below 32°F, above 104°F), and/or over 2,000 annual operating hours.
Hydraulic/Gear Oil Change Procedure:

- Disconnect the power source to the drive motor
- Relieve all pressure from the piping system
- Drain the oil by removing both drain plugs on the back of the gearbox
- Drain the remaining oil in the pump head/intermediate head reservoir by removing the drain plug located on the side of the intermediate head
- After drained, replace the plugs using thread sealant
- Fill the gear chamber from the black oil fill cap located just underneath the motor adapter on the gearbox using PULSAlube 8GS.
- Fill the hydraulic chamber from the purple (or aluminum) cover affixed to the top cover of the intermediate head using PULSAlube 7H.

8.4 Wet End Removal, Inspection, and Reinstallation

IF THE DIAPHRAGM HAS FAILED, PROCESS MATERIAL MAY HAVE CONTAIMINATED THE PUMP HYDRAULIC OIL. HANDLE WITH APPROPRIATE CARE; CLEAN AND REPLACE OIL.

Flat Diaphragm Replacement

PulsaPro diaphragms do not have a specific cycle life; however, the accumulation of foreign material or the entrapment of sharp particles between the diaphragm and the dish cavity can eventually cause failures. Failure can also occur because of hydraulic system malfunction or chemical attack.

Flat Diaphragm Replacement Procedure:

- Disconnect the power source to the drive motor.
- Relieve all pressure from the piping system.
- Take all precautions to prevent environmental and personnel exposure to hazardous materials.
- Close the inlet and outlet shutoff valves.
- Place a suitable container underneath the pump head to catch any liquid leakage.
- Disconnect piping to the reagent head and drain process liquid, following material safety precautions described.
- Remove all but one top reagent head bolts. Oil will leak out between the pump head and reagent head as the bolts are loosened. The HPV will hold the reservoir of oil in the intermediate head but any oil between the diaphragm and dish plate will drain.
- Tilt the head and pour out any liquids retained by the check valves into a suitable container, continue to follow safety precautions.
- Remove the final bolt and rinse or clean the reagent head with appropriate material.
- Remove the old diaphragm and replace it with the new one supplied in the KOPkit.
- To install a diaphragm, first ensure that the critical sealing areas of the diaphragm, reagent head, and pump head are clean and free of debris. Set the diaphragm in place on the reagent head and ensure the seat of the diaphragm sealing ring into mating groove in the reagent head.
- Install the reagent head bolts and tighten in an alternating pattern to ensure an even seating force. Refer to torque values in torque table.
- Re-prime the pump head.

HYDRAtube Replacement

1. Remove all pressure from piping system.
2. Disconnect the power source to the drive motor.
3. Adequately flush the reagent head and associated piping with a neutralizing liquid to remove all toxic or hazardous product.
4. Close the suction and discharge shut off valves.
5. Disconnect the unions or flanges on the piping and drain off any liquid. Use extreme caution if the product is hazardous.
6. Remove the top fill plug from the HYDRAtube housing. Next place a pan under the housing and remove the bottom pipe plug to drain the intermediate fluid. Note – on models equipped with a CHEMALARM the bottom pipe plug is replaced with a conduction probe. Refer to separate instructions for removal and reinstallation of the probe.

NOTE **IF THE DIAPHRAGM HAS FAILED, INTERMEDIATE LIQUID COULD HAVE PROCESS LIQUID MIXED INTO IT. IF THE PRIMARY DIAPHRAGM HAS ALSO FAILED, PRODUCT MAY HAVE CONTAIMINATED THE PUMP OIL. HANDLE WITH PROPER CARE.**

7. Remove the tie bars, valves, and valve adaptors from both suction and discharge.

NOTE **FOR ELASTOMER HYDRATUBES FOLLOW STEPS 8 THROUGH 20. FOR PFA HYDRATUBES FOLLOW STEPS 21 THROUGH 35.**

8. Pick up on the edge of the HYDRAtube flange and push that same edge down the throat of the HYDRAtube. The balance of the flange will fold and follow.
9. Pull the HYDRAtube out from the bottom of the housing by a combination of twisting and bending sideways.
10. Inspect for any damage (i.e. cuts, cracks, chemical attack, or excessive deformation). Replace if necessary.

11. When installing a HYDRAtube do not use tools which may cut or damage the tube.
12. Obtain a rubber band
13. Fold a point on the edge of the flange upward. Push the edge down the throat of the tube. Fold the sides of the flange inward to form a compact 45° and wrap tightly with a rubber band. This wrapped nose should be reasonably compact and secure.
14. Work the wrapped nose of the tube up through the bottom hole of the housing, rotating gently to work the tube upward to the top of the housing.
15. With a slight push at the bottom flange of the tube, guide the nose of the tube to the center and out of the top hole in the housing.

16. If the HYDRAtube is one of the larger models, (inside is greater than 1 inch or 38.1mm) the time required to fill the housing can be reduced by pouring the intermediate liquid past the top flange while it is still folded.
17. Reinstall the bottom valve adaptor and drain plug and then partially fill the housing with the appropriate liquid.
18. Remove the rubber band.
19. Unfold the top flange and center both the top and bottom of the HYDRAtube
20. Reassemble the top and bottom adaptor parts, torque the tie bar bolts to the recommended value.
21. If the HYDRAtube housing has been removed from the pump head and the hydraulic prime lost, follow the flat diaphragm re-priming procedure before re-priming the intermediate/housing chamber.

The following steps apply to PFA HYDRATUBES

22. Pick up the edge of the HYDRAtube flange and bend it upwards so that it is even with the body of the tube. Avoid creasing the tube material.
23. While keeping the flange bent up, lift and remove the HYDRAtube adaptor and any gaskets beneath it.

24. Pull the HYDRAtube out from the bottom by a combination of twisting and bending. Also remove any gaskets which were beneath the bottom tube adaptor.
25. Inspect the tube for any damage (i.e.; cuts, cracks, chemical attack). Replace if necessary.
26. When installing a tube do not use tools which may cut or damage the tube
27. Obtain a rubber band.
28. Place one flat gaskets in the top recess of the HYDRAtube housing.
29. Check the bottom HYDRAtube adaptor, it should have one flat gasket on it. Carefully straighten the flange on one end of the tube and work it through the adaptor and gasket. Slide the adaptor and gasket to the opposite end of the HYDRAtube.

30. Now tightly wrap the straightened end of the HYDRAtube with a rubber band.
31. Work the wrapped end of the HYDRAtube up through the bottom hole of the housing, rotating gently to work the HYDRAtube upward to the top of the housing.
32. With a slight push at the bottom flange of the tube, guide the nose of the HYDRAtube to the center and out the top hole in the housing.
33. Work the top tube adaptor over the top end of the tube. It may be necessary to remove the rubber band first.

34. Unfold the top flange and center both the top and bottom of the HYDRAtube. Make certain the HYDRAtube flanges are seated in the HYDRAtube adaptors.
35. Reassemble the top and bottom adaptor parts, torqueing the tie bar bolts to the recommended value.
36. If the HYDRAtube housing has been removed from the pump and the hydraulic prime lost, follow the flat diaphragm re-priming procedure before re-priming the intermediate/housing chamber.

8.5 Priming

Flat Diaphragm Priming

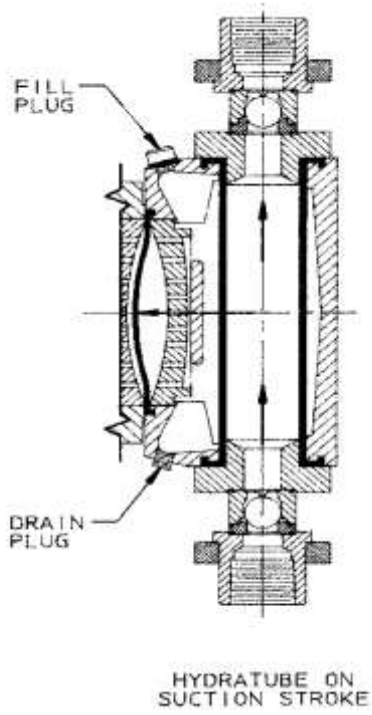
1. Disconnect the power source to the drive motor.
2. Relieve all pressure from the piping system.
3. Remove the diagnostic window from the intermediate chamber cover. Pour the appropriate amount of Pulsalube 7H hydraulic oil. Replace diagnostic window.
4. Remove the fill cap on the back of the gearbox and fill the gearbox with Pulsalube 8GS gear oil to the proper level. Replace the fill cap after complete.
5. Turn on the pump and adjust the stroke length to the maximum setting of one hundred percent stroke. Fully depress and hold the PTP valve. Oil should begin to flow out of the center diagnostic port. Depress the PTP valve down for three to five seconds then release and repeat until the oil is clear of bubbles. The pump is now primed. If oil fails to flow out of the diagnostic port, re-check the oil levels.
6. If you continue to have issues, you can try to speed up the process. Set the stroke to Zero and isolate the power from the pump.
7. Remove the PTP valve from the pump head. Using a plastic funnel, slowly pour oil into the pump head through the PTP valve port until full.

8. Replace the PTP valve in the pump head, ensuring that the flat copper gasket and O-ring are properly in place.
9. Restore power to the pump. Increase the stroke slowly to 100% depressing and holding the PTP valve periodically. Oil should begin to flow out of the center diagnostic port. Continue to hold the valve down until the oil is clear of bubbles.
10. If oil fails to flow out of the diagnostics port, then additional oil is required: repeat steps 7-9.
11. The pump is fully primed and ready to put into service.

HYDRAtube

Before filling the HYDRAtube chamber you must first have performed the hydraulic priming of the flat diaphragm. If this has not been done, follow the instructions above for priming of a flat diaphragm. You must have the flat diaphragm and the HYDRAtube diaphragm in sync for proper operation. This process will place the flat diaphragm back with the tube diaphragm in a fully relaxed and open state.

The HYDRAtube, when properly primed, should be in its neutral position (fully round) when the diaphragm is in its rearmost position (as dictated by the piston, figure 33), and should begin to close as the diaphragm moves forward (figure 34). Priming in this way assures stable performance and protects the HYDRAtube from damage during system upsets. The priming procedures is the same for elastomer and PFA HYDRAtubes.



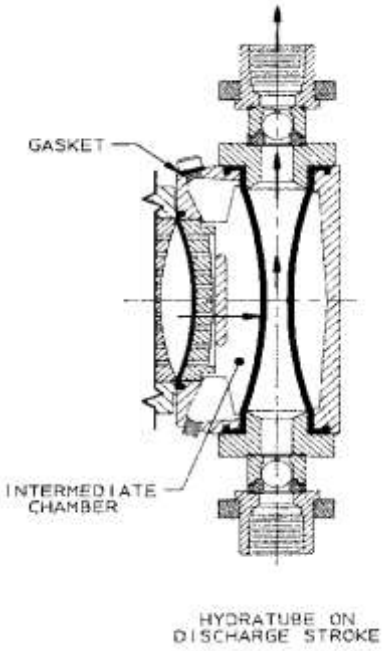


Figure 30 ***Figure 31***

- With the intermediate chamber fill plug removed and motor removed, manually rotate the motor coupling until the pump piston assembly is in the full rearward position.
- Fill the intermediate chamber using a mixture of water and 1/3 propylene glycol by volume or other liquid selected for the application.
- Check the seal on the fill plug and replace if necessary. Reinstall and tighten the fill plug to the intermediate chamber.
- Reinstall the motor. Allow the pump to run for 5 to 10 minutes. Observe the action of the HYDRAtube through the discharge port. It may be helpful to shine a light up through the suction port. It should go from a complete round form at the end of the

suction stroke to an elliptical shape at full discharge stroke, but not closing off at the middle. The pump now has a correct intermediate prime and is ready for service.

- Reinstall the suction and discharge valve assemblies.

Double Diaphragm Flat Leak Detection

Please refer to Appendix I for detailed information for priming of the Leak Detection Diaphragm.

8.6 Check Valves

Description of Check Valves

Most fluid metering problems are related to check valves. Problems usually stem from solids accumulation between the valve and seat, corrosion of seating surfaces, erosion, or physical damage due to wear or the presence of foreign objects.

The check valve incorporates a ball or disc, guide, and seat. Flow in the unchecked direction lifts the ball or disc off the seat, allowing liquid to pass through the guide. Reverse flow forces the ball or disc down, sealing it against the sharp edge of the seat. The guide permits the ball to rotate but restricts vertical and lateral movement to minimize “slip” or reverse flow. Ball rotation prolongs life by disturbing wear over the entire surface of the ball.

Since check return is by gravity, the valve must be in the vertical position to function properly. The guide and seat are sealed by O-rings.

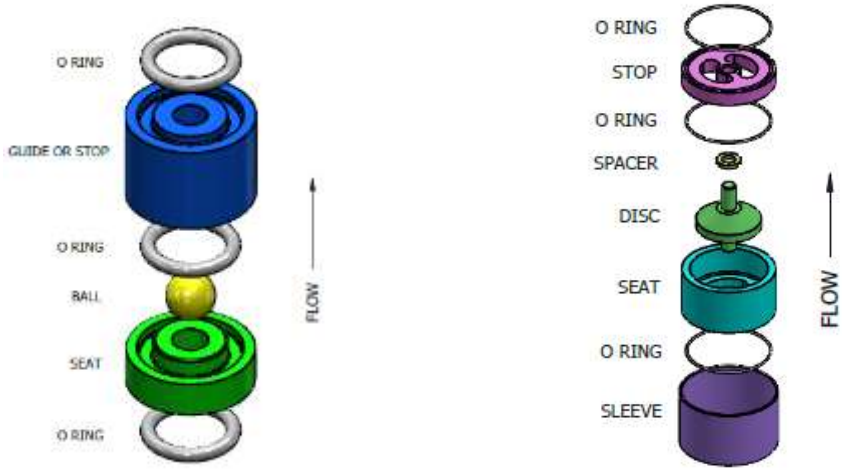


Figure 32

Removal, Inspection, and Reinstallation

With the removal of wet end components follow the recommended safety procedures in place and use your Personal Protective Equipment (PPE).

- Disconnect the power source to the drive motor.
- Relieve all pressure from the piping system.
- Take all precautions to prevent environmental and personnel exposure to hazardous materials.
- Close the inlet and outlet shutoff valves.
- Loosen the suction valve tie bar bolts and spring the suction piping slightly to drain any liquid from the reagent head cavity. If the piping is closely connected it may be necessary

to disconnect a union or flange.

- Remove the suction check valve assembly (ball contained within guide and seat), holding it together as a unit.

Figure 33

- Loosen the tie bar bolts on the discharge valve and spring the piping slightly to drain any liquid.
- Remove the discharge valve assembly, holding it together as a unit as before.
- Disassemble both valves and examine components for wear. Seats should have sharp edges or a small chamfer, free from dents or nicks. Hold the ball firmly against its mating seat in front of a bright light to inspect for fit.

NOTE

OBSERVATION OF LIGHT BETWEEN THE BALL AND SEAT IS CAUSE FOR REPLACEMENT OF EITHER OR BOTH COMPONENTS. FOR BEST RESULTS, ALWAYS LOOSEN THE UNIONS OR FLANGES ON EITHER SIDE OF THE PIPING PRIOR TO RE-TIGHTENING OF THE CHECK VALVE ASSEMBLIES. RE-TIGHTEN THE UNIONS OR FLANGES AFTER THE CHECK VAVLES ARE TIGHTENED INTO POSITION.

Figure 34

- Reassemble both valves using new parts as required. Sealing O-rings should always be replaced.
- Reinstall both valve assemblies, taking care to ensure that they are correctly orientated with balls above seats.
- Tighten the tie bar bolts evenly.
- Torque the tie bar bolts according to the torque specification list in Appendix IV

8.7 Hydraulic Performance Valve (HPV)

PulsaPro pumps utilize the high-performance valve which is integrated within the dish plate to preserve hydraulic balance. The valve is factory preset and requires no maintenance provided the hydraulic oil remains clean. When the valve is actuated, oil can flow into the hydraulic system until the piston reaches the end of the suction stroke.

As the piston starts forward a check valve prevents oil from flowing back through the HPV, thereby allowing the valve to close as the diaphragm moves forward. Through this process the diaphragm is continually maintained in a proper operating position relative to the pump head dish plate. Since the HPV is unaffected by the vacuum level in the pump head, oil cannot be inadvertently brought into the hydraulic system which would result in over extension and damage to the diaphragm. This feature provides the pump protection should the suction line become restricted or closed.

The check valve (HPVC) in series with the HPV includes a screen to trap contaminants and should be removed and cleaned with each change of hydraulic oil as indicated. A clogged filter screen will impede the operation of the HPV and can lead to diaphragm damage. If a diaphragm has failed, and chemical has contaminated the pump head assembly, both HPV and HPVC should be removed and thoroughly cleaned.

Figure 35

Check Valve Screen (HPVC) – Removal and Cleaning

- Disconnect power, relieve all pressure, and drain the hydraulic fluid.
- Unscrew the check valve from the bottom of the pump.
- Clean the valve and screen in a solvent compatible with the nitrile seal material and blow air through the valve to remove all contaminants.
- Inspect the copper gasket and O-ring for nicks or other damage and replace if necessary.
- Lubricate the O-ring with PULSAlube 7H and install the valve, tightening securely.
- Re-install the drain plug and refill the hydraulic oil.

Figure 36

8.8 Hydraulic Bypass Valve (HBV)

All PulsaPro pumps incorporate a hydraulic bypass valve which is an adjustable spring-loaded valve ported into the hydraulic cavity of the pump head. The valve is designed to protect the pump against excessive hydraulic pressure and will not limit or regulate system pressure. The valve is factory adjusted for pressure as originally specified, or at 10% above the rated pressure.

The HBV is located on the side of the pump head and any discharge, indicating over pressurization, is visible through the diagnostic port via sight glass. If adjustments are necessary in the field, remove the valve's plastic cover and loosen the lock nut. When turning the adjustment screw clockwise you will increase the bypass pressure, counterclockwise will decrease the bypass pressure. The locking nut must be tightened after adjustment.

Pump damage may occur during a system upset, if the hydraulic bypass pressure is set higher than 10% over the design pressure of the pump. Conversely, if the setting is too low the valve will operate on each discharge stroke. This results in decreased pumping capacity and will eventually affect the efficiency of the valve.

To check the hydraulic bypass pressure setting, install a pressure gauge and a regulating valve in the pump discharge line. The gauge must be between the pump and valve. For convenience, locate the two as close to the pump as possible. With the pump operating at maximum stroke length, gradually increase the discharge pressure and observe when the HBV starts to operate. The cracking pressure of the valve must be at least as high as the maximum pressure of the system but no more than 10% over the pumps rated pressure.

Periodic inspection of the valve is recommended. If it becomes worn or damaged leakage will occur.

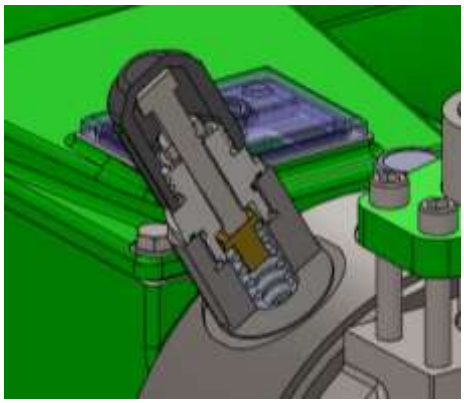


Figure 37

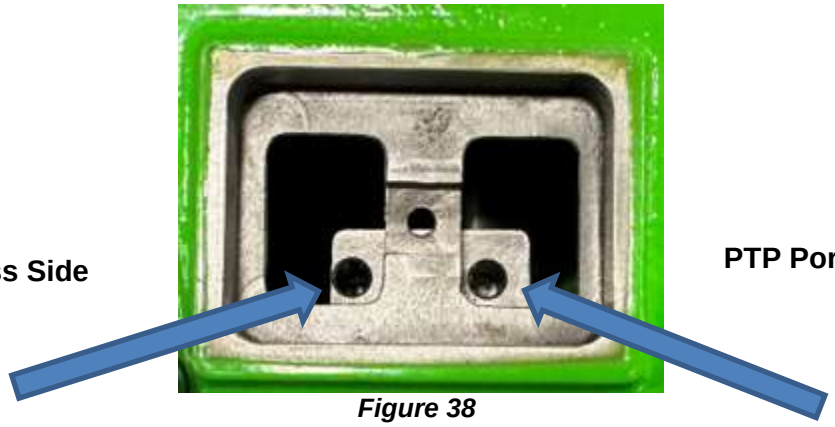


Figure 38

	BYPASS PORT	PTP PORT
Connected to	The hydraulic bypass valve on the side of the pump head	The PTP push-button valve on the top of the pump head
Function	Bypass protects the pump from excessive pressure and hydraulic upset conditions	Allows any air trapped in the hydraulic system to escape
Normal operation	No oil should move through this port when the pump is operating normally	Small amount of oil will weep from port during operation, flow increases if PTP button is depressed
Abnormal operation	Oil is seen flowing from the port	No oil moving through the port at any time, or product (not oil) is seen
Things to check if abnormal operation is suspected	○ Discharge pressure too high ○ Bypass valve setpoint too low ○ Bypass valve malfunction ○ Other upset condition	○ PTP damaged ○ HPV filter screen clogged ○ HPV not operating properly ○ Diaphragm damaged

8.9 Push to Purge (PTP)

The PTP is a gravity operated ball check valve that automatically removes gases from the hydraulic system. On each discharge stroke of the pump, hydraulic pressure drives the ball off the lower seat, expelling any accumulation of gases at the top of the hydraulic system. An upper seat limits ball travel and flow during each actuation. On each suction stroke, the ball is pre-positioned by gravity against the lower seat to prevent reentry of gas into the system. When all gas has been expelled, a small amount of oil will be displaced on each discharge stroke. This oil is returned by gravity to the hydraulic reservoir.

Under normal operating conditions this ongoing process removes accumulation of gas long before they are visible or detrimental to pump operation. To accelerate hydraulic startup, pressing the spring-loaded button at the top of the valve holds the valve momentarily open so that large amounts of gas can be instantly purged. When the button is released, the valve reverts to normal automatic operation. PTP operation can be monitored by observing oil flow from the diagnostic port through the sight glass. Any accumulation of solids can cause the valve to malfunction.

Figure 39

Removal, Cleaning, and Reinstallation of PTP

- Disconnect the pump from the power source.
- Relieve all pressure from the piping system.
- Slowly unscrew the valve to gradually relieve any residual hydraulic system pressure.
- Remove the valve and clean it by soaking in compatible solvent. Valve operation can be confirmed by blowing air through it in both directions and listening for the “click” sound of ball seat contact in both directions.
- Make sure that the copper gasket is installed at the bottom of the threaded hole in the pump head. It does not need replacement if it is undamaged.
- The elastomer gasket around the upper portion of the valve assembly may be likewise re-used.

NOTE

THE VALVE IS NOT REPAIRABLE, AND MUST BE REPLACED IF IT CONTINUES TO MALFUNCTION AFTER CLEANING.

8.10 Piston Seals

PulsaPro piston seals are a thermoplastic elastomer with an FKKM energizer seal. The seal is mounted two different ways: on the piston (for larger piston sizes) or in the cylinder (for smaller piston sizes). With oil changes at recommended intervals, piston assemblies should provide years of service.

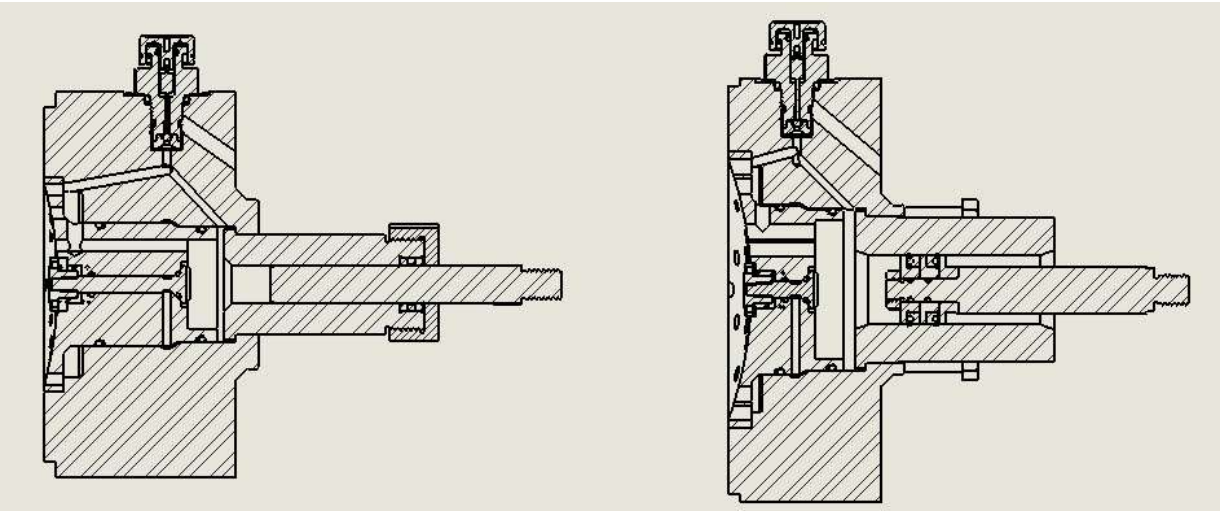


Figure 40

Removal and Replacement of Piston Seals (small piston sizes 7/8" and under)

- With any maintenance performed, follow safety procedures in place. Lockout/Tagout, relieve pressure, close valves, flush the reagent head, drain the hydraulic oil.
- Remove the reagent head from the pump head.
- Remove the four bolts that secure the pump head to the intermediate head.
- Loosen the nut at the end of the cylinder that holds the piston seals.
- With the nut removed from the cylinder, remove the piston seals. Install new piston seals into cylinder, follow same direction as removal.
- With the new seals installed, apply Loctite #242 (blue) to the threads of the nut and tighten. Torque nut to 50-foot pounds.

Figure 41

Figure 42

Figure 43

Removal and Replacement of Piston Seals (large piston sizes above 7/8")

- With any maintenance performed, follow safety procedures in place. Lockout/Tagout, relieve pressure, close valves, flush the reagent head, drain the hydraulic oil.
- Remove the reagent head from the pump head.
- Remove the dish plate from the pump head to have access to the piston.
- Remove top cover from intermediate chamber.
- Using ¾ inch box wrench, loosen piston rod from crosshead.
- Push/pull piston assembly from cylinder.
- Remove jam nut from piston rod. Remove all piston plates and seals. NOTE orientation during disassembly, as this is important.
- Remove and replace O-rings (x2) from piston rod. Grease O-rings.
- Slide piston plate 1 into position.
- Attach piston seal 1 to piston plate 2 and slide into position.
- Attach piston seal 2 to plate 3 and slide into position.
- Apply Loctite 242 to jam nut and tighten to 35 ft.-lbs.
- Oil/grease piston seals and cylinder inner diameter.
- Reinstall piston assembly into cylinder.
- Apply Loctite 263 onto threaded end of rod and resecure to crosshead.
- Reassemble the pump in reverse order.

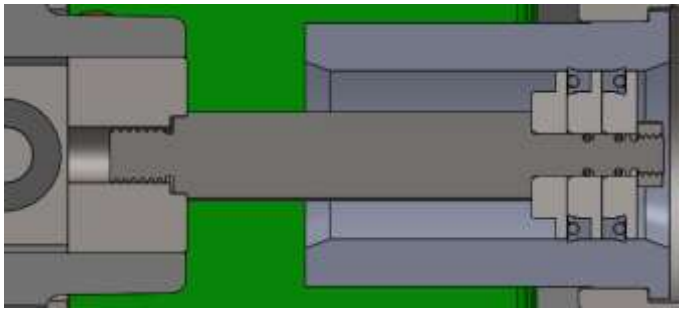


Figure 44

8.11 Oil Seal

The PulsaPro pumps utilize an oil seal on the worm shaft (input shaft) like the Pulsa product line. This seal is serviceable, but only necessary to replace if there is an oil leak.

Replacing the Oil Seal

- Power has been disconnected from the source; safety procedures are followed.
- Remove the four fasteners securing the motor to the motor adaptor and remove motor.
- Rotate the coupling on the worm shaft until you see the set screw through the slots on the adaptor.
- Remove the four hex head cap screws securing the motor adaptor to the gearbox.
- With the motor adaptor removed, you have visibility of the tension nut and the oil seal, using a marker or equivalent put a mark on both tension nut and gearbox. This will provide a reference when reassembly is performed, ensuring that the nut is properly aligned.
- Remove the oil seal
- Place electrical tape or equivalent over the end of the worm shaft prior to installing new oil seal to prevent damage.
- Use Loctite # 534 around the outer surface of the oil seal.
- Press the oil seal onto the worm shaft and slide in place.
- Gently tap the oil seal flush into the tension nut.

Figure 49

Figure 50

Figure 51

8.12 Pump Motor Removal & Reinstallation

- Disconnect the power source to the drive motor.
- Disconnect the motor wiring from the motor.
- Remove the four bolts retaining the motor to the motor adaptor and remove the motor.
- The coupling is an interlocking jaw design and uses an elastomer spider between two coupling halves. One half of the coupling remains on the worm shaft and the other on the motor shaft.
- Loosen the setscrew that retains the coupling half of the replacement motor, ensuring that the shaft key is in place.
- Align the end of the shaft flush with the inner surface of the coupling and tighten the setscrew.
- Reinstall the motor by reversing the steps.

9.0 Safety Precautions/ Ignition Hazards and Protective Means

Potential Ignition Source	Measures to take to prevent the source from becoming effective
Electric Motor • Heat • Sparking	• Motor sizing is to be as approved by the factory. • Motors must be nameplated for the environment. • Motors must be compliant with IEC EN 60079-0. • Motors are to be wired/used in accordance with the manufacturer's direction. • Motor secondary earth (bond) to be used. Must be grounded. • Motor alignment to be assured prior to securing with bolts. • Shaft rotation direction to be verified in compliance with pump • Motor case temperature under load to be verified and monitored. • Do not tamper with Pump protective Bypass Valve • Include External Back Pressure and Bypass Valve in discharge piping. • Whenever possible first-time startup in non-hazardous environment
Couplings • Heat • Impact • Sparking	• Couplings to be supplied/approved by factory. • Couplings to be installed flush with shaft end per Instruction Manual. • Coupling set screw to be installed with thread locking compound. • Motor alignment to be assured prior to securing with bolts. • Coupling to be monitored for noise/vibration/heat on startup. • Couplings to be inspected quarterly for evidence of spider wear. • Motor to be removed to inspect Spider annually and replaced if worn. • Coupling guards used between multiplexed pumps shall not be removed during operation. Care should be taken to avoid contact with guarded couplings. Guards shall not be used as steps for personnel to climb over equipment.
Drivetrain • Heat • Impact • Sparking	• Do not operate pump beyond limits stated on nameplate (e.g. pressure, SPM). • Immersive lubrication is required to prevent ignition due to friction. • Use only factory authorized lubricants. • Check oil level weekly. Repair leaks immediately. • Check external Pressure Relief valve quarterly. • Check external Back Pressure valve gage daily. Adjust back pressure as required. • Use only factory authorized replacement parts. • Do not run pump dry of both lubricant and process fluid. • Oil drain plugs must be sealed with liquid thread sealant and tightened.
Caps & Closures • Heat • Impact • Sparking	• Covers and/or sight glass elements are only to be removed when the pump is cool (at ambient) and/or the environment is safe. • Adhere to instructive labeling "WARNING-AFTER DE-ENERGIZING, DELAY 30 MINUTES BEFORE OPENING ANY COVERS" • Pipe threaded fittings (i.e., sight glass, drain plugs) removed for maintenance are to be replaced with liquid thread sealant in accordance with the thread sealant instruction. • The oil fill cap is to be replaced after opening and hand tightened so that the o-ring seals against the housing. • Protect sight glass elements from falling objects (e.g., dropped hand tools/flange hardware). If breakage occurs repair immediately. • At temperatures less than 20F, the Diagnostic Sight Glass may be prone to cracking if impacted. If this occurs, replace immediately.

Dust • Accumulation • Tools/Methods	• Prevent dust deposits from accumulating to a thickness great enough to become an Ignition hazard. • Clean pump regularly • Apply methods and tools appropriate to the Hazardous Location. • Use only a damp cloth to clean pump surfaces.

Potential Ignition Source	**Measures to take to prevent the source from becoming effective**
Static Electricity / Stray Currents • Discharge • Arcing	• Ground (bond) Pump all "Protective Earth Ground" marked locations. • Ground (bond) all accessories (e.g., controls, motor) in accordance to manufacturer instructions. • Ground (bond) terminals must not be modified. • Non-metallic parts in contact with the process fluid must be retained with all supplied fasteners and fixtures. These components must be grounded (bonded). • Thickness of protective coating (i.e., paint) must not exceed 2mm (0.080in) at any location. • Clean pump surfaces with a damp cloth only. • Clean with methods prescribed for the area
Corrosion • Heat	• Coating to be approved by Pulsafeeder. • Coatings to be maintained by user • Coatings to be as specified. Field additions are not allowed unless pre-arranged with factory. • Thickness of protective coating (i.e., paint) must not exceed 2mm (0.080in) at any location.
Equipment/Accessories • RF/EM Waves	• Controls/Accessories approved for the Hazardous Location. • Controls/Accessories must be compliant with IEC EN 60079-0. • Controls/Accessories must be used in accordance with manufacturer's instructions.
Hydraulic System • Adiabatic Compression • Shock Waves	• Pump Installed Protective Valves (i.e., Hydraulic Pressure By-Pass Valve [HBV], Hydraulic Make-up Valve [HPV/HPV-C], Automatic Bleed Valve [PTP]) are not to be over-ridden or defeated. • Protective valves only to be adjusted by qualified personnel. • Visual Diagnostics Windows to confirm proper Protective valve operation per manual. • Stroke adjustment mechanism not to be modified by user (excluding normal adjustment).
Pumped Fluid • Pyrophoric	• User is responsible for equipment maintenance including replacement of wet end sealing components and torque of retaining bolts (Reagent Head and Valve Cap). • Protective measures must be taken against accidental release of pumped chemical on equipment startup and whenever maintenance is performed.

9. Troubleshooting Chart

ISSUE	POSSIBLE CAUSES	REMEDY
Flow Rate Lower than Expected	Motor Speed too low	Check voltages, frequency, wiring, and terminal connections. Check nameplates vs. specifications.
	Check Valves worn or dirty	Clean of any debris, replace if damaged or worn
	Hydraulic bypass valve operating each stroke	Refer to *Hydraulic Bypass Valve*
	Calibration system error	Evaluate and correct
	Product Viscosity too high	Lower viscosity. Increase pump and/or piping size
	Product cavitation	Increase suction pressure
	Piston seal worn or damaged by contamination	Inspect and replace, if necessary, refer to Piston Seal (Section 8 Maintenance)
	Process pressure relief valve leaking or relieving	Repair, adjust or replace
Delivery gradually drops	Check Valve Leakage	Verify the tie bar bolts are properly torqued, evaluate for any pipe stress placed on check valve. Replace the O-Ring.
	Leak in Suction Line	Locate and correct
	Strainer Fouled	Clean or replace screen
	Product change	Check viscosity
	Bypass leakage	Correct for bypass valve leakage
	Piston seal worn or damaged by contamination	Inspect and replace, if necessary, refer to Piston seal
	Supply tank vent plugged	Unplug vent
Pump does not start	Coupling Disconnected	Connect Coupling
	Faulty power source	Check power source
	Blown fuse, and circuit breaker	Replace – eliminate overload
	Broken Wire	Locate and repair
	Wired Improperly	Check wiring diagram and correct
	Pipeline blockage	Open valves
No Delivery	Motor not running	Check power source. Check wiring diagram
	Supply tank empty	Fill tank
	Lines clogged	Clean and flush
	Closed line valves	Open valves
	Ball check valves held open with solids	Clean and inspect
	Vapor lock, cavitation	Increase suction pressure
	Prime lost	Re-prime, and check for leak
	Strainer clogged	Remove and clean, replace screen if necessary
	Hydraulic system under-primed	Re-prime the pump
Delivery Erratic	Leak in suction line	Locate and correct
	Product cavitation	Increase suction pressure
	Entrapped air or gas in product	Ensure proper venting of system
	Motor speed erratic	Check voltage and frequency
	Fouled check valves	Clean, replace if necessary
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
	Calibration error	Review calculations

Pump loses hydraulic oil	Diaphragm ruptured	Replace diaphragm
	Leaky seal	Replace seal
	Cover gasket leaks	Replace or retighten
	Pump head O-ring leaks	Replace – tighten pump head bolts. Apply sealing compound
	Pump head overfilled	Remove excess oil
Noisy gearing/knocking	Discharge pressure too high	Reduce pressure
	Water hammer	Install dampener or dampener not charged properly
	Hydraulic bypass valve set too high	Readjust bypass valve
Piping Noisy	Pipe size too small	Increase size of piping
	Pipe runs too long	Install dampener in line
	Surge chambers flooded	Repair with air or inert gas. If dampener is installed, replace diaphragm and recharge
	No surge chambers used	Install dampener
Motor Overheats	Pump overloaded	Check operating conditions against pump design
	High or low voltage	Check power source
	Loose wire	Trace and correct

Diagnosis of Diaphragm Failure

FAILURE OBSERVED	POTENTIAL CAUSES
Puncture, surface wear, or physical damage	Abrasives or solids in the process stream Foreign object in process or hydraulic system
Extrusion and/or failure to the front (towards the process side)	Extended time under poor suction conditions, can included inadequate NPIP, closed valves, clogged strainers or filters, obstructed piping Malfunctioning High Performance Valve (HPV)
Extrusion and/or failure to the rear (towards the hydraulic side)	HPV filter screen clogged High (excessive) suction pressure Discharge pressure above maximum limit Leaking (damaged) discharge check valve
Change in surface characteristics, color	Chemical incompatibility with the process fluid

10. Technical Service Support

10.1 Authorized Service Centers

Pulsafeeder has several Authorized Service Centers across the United States. Contact your local sales representative for a service center near your location.

10.2 Local Sales Representative

Your local Pulsafeeder Sales Representative has knowledge of Pulsafeeder Products and can provide technical service support. To find a representative, go to www.pulsafeeder.com and select the Sales Contacts tab. Or contact Pulsafeeder directly to find a local representative.

10.3 Factory Service Support

Pulsafeeder 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 issued by Pulsafeeder through your local representative. Pulsafeeder cannot accept any pump, part, or piping accessory that has pumped strong odorants (such as mercaptan).

11. APPENDIX I

11.1 PULSAlarm® Leak Detection System

The PULSAlarm® leak detection system utilizes a two-layer PTFE diaphragm, coupled to a pressure switch. The system is initially primed by filling the void within the detection assembly and between the diaphragm layers with a barrier fluid. The setup process then bleeds excess fluid from between the diaphragm layers until they are in close contact.

During normal pump operation, the two layers of the PTFE diaphragm bear directly against one another, and there is no pressure generated between the two layers. The sensing system monitors the space between the layers, which will remain at zero pressure if the diaphragm layers remain undamaged.

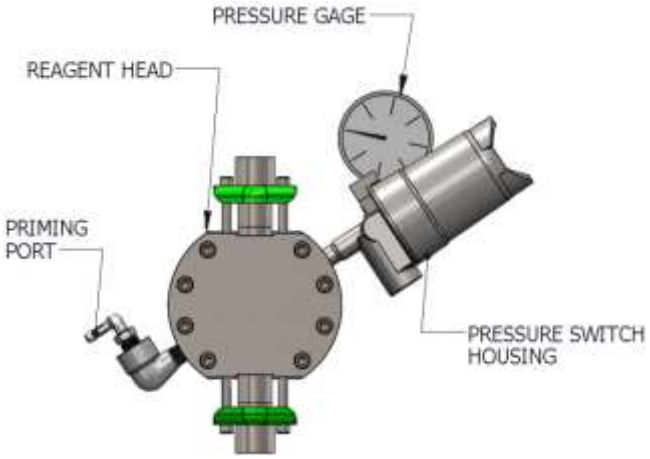


Figure 52

In the event of a failure of either layer of the diaphragm, liquid will enter the space between the two layers. This liquid will be either the hydraulic oil (if the rear layer fails) or the pumped fluid (if the front layer fails). As the pump operates, this liquid will generate pressure between the layers of the diaphragm that will then be transferred outwards by the barrier fluid. This fluid will create pressure against the pressure switch. The switch has a trip point of 20 PSI (1.37 BAR). When this pressure is reached the switch will operate.

The output of the switch (both normally closed, and normally open connections are available) can then signal the failure of the diaphragm. It is recommended that the pump be stopped in the event a leak is detected. Immediate attention to the problem, followed by cleanup and appropriate maintenance, will avoid further damage to the pump.

11.2 PULSAlarm® Leak Detection Diaphragm

Double, or sandwiched, PTFE diaphragms are sealed at the peripheries to an intermediate metal spacer ring. The space between the diaphragms is sealed so that the diaphragm functions as does a standard single diaphragm. The space is filled with a small amount of barrier fluid (silicon oil is factory default unless advised otherwise). This space is connected to an electrical switch that actuates in response to a buildup of pressure resulting from rupture of either or both diaphragms. Switch operation can be used to perform any external function, typically to signal an alarm or turn off the pump.

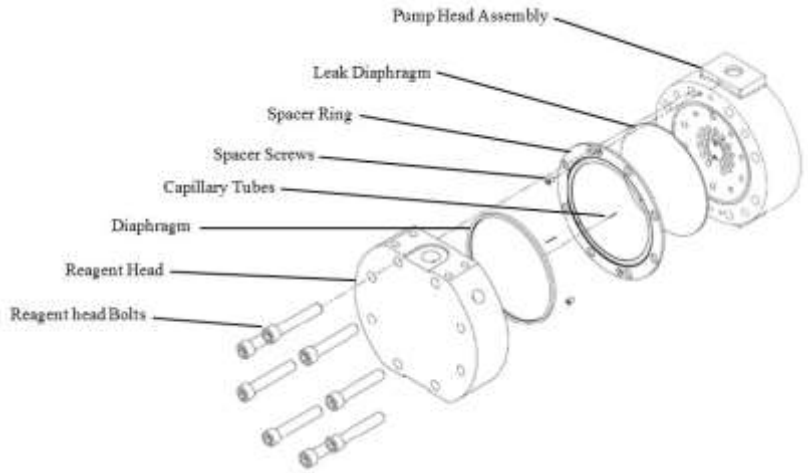
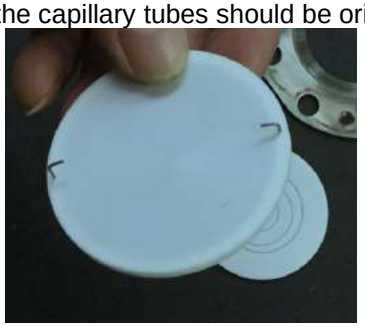


Figure 53

11.2.1 Reinstallation of Leak Detection Diaphragm

1. Ensure that the critical sealing areas of diaphragm assembly, reagent head, and pump head are clean and free from debris.
2. Place a dab of grease on the back of the rear diaphragm. Note the rear diaphragm has swirls on the face. Apply grease to the side that does not have swirls and set in place on the pump head face as shown below.
3. Place the capillary tubes (2) into the holes located on the perimeter of the diaphragm.

4. Once inserted, the capillary tubes should be orientated as shown below.



5. If possible, use compressed air to ensure the tubes are free of debris.
6. Push the capillary tubes down so that they are flush with the surface of the diaphragm as shown below.

7. Turn the diaphragm over and place the O-Rings onto the capillary tubes. Push them down until they meet the lip of the diaphragm.

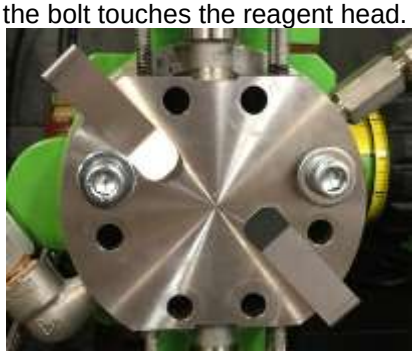
8. Place the diaphragm onto the reagent head; ensuring the capillary tubes are seated into the pre-drilled holes in the reagent head.

9. Place the leak detection spacer onto the diaphragm. Ensure that the capillary tubes are in the slots as shown.

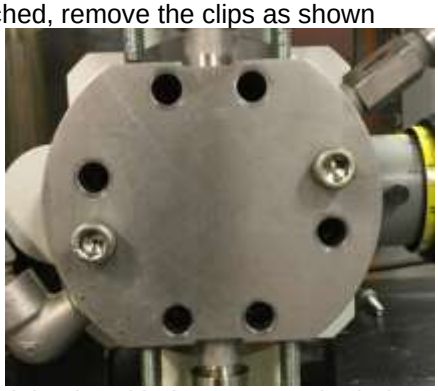
10. Place two (2) clips onto the assembly to hold the spacer and diaphragm in place.

11. Place the two reagent head bolts into the reagent head.

12. Slide the reagent head forward onto the pump head and hand tighten the bolts until the head of the bolt touches the reagent head.



13. Once attached, remove the clips as shown

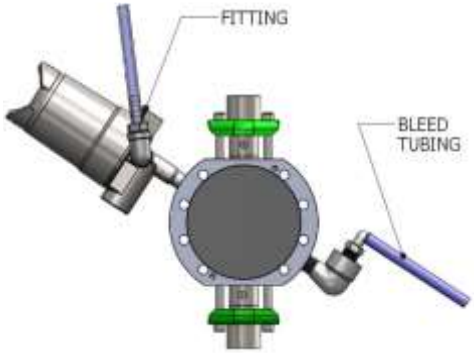


14. Install remaining head bolts. Torque the bolts per the recommended torque settings.

11.3 Priming of Leak Detection Diaphragm

NOTE **IF THE LEAK DETECTION SYSTEM IS OPENED TO THE ATMOSPHERE DURING MAINTENANCE OR INSPECTION, THE SYSTEM MUST BE RE-PRIMED PROPERLY TO AVOID DIAPHRAGM DAMAGE AND ENSURE PROPER LEAK DETECTION OPERATION AND SYSTEM PERFORMANCE.**

THE STANDARD FACTORY INTERMEDIATE FLUID IS A SILICON OIL. IF ANY OTHER CUSTOMER SPECIFIED MEDIA IS USED, IT MUST BE COMPATIBLE WITH THE MATERIALS OF CONSTRUCTION.



1. Complete re-assembly of the diaphragm, reagent head, and external components. Ensure that the reagent head and tie bar bolts are tightened according to the appropriate torque specifications (Appendix IV).
2. Remove the pressure gauge from the housing body and replace with the straight tubing connection that is supplied with the pump.
3. Install a short length of the appropriately sized tubing to the fitting and connect a vacuum supply (either handheld or electric vacuum pump).
4. Remove the pipe plug from the fill port and install the 90º fitting supplied with the pump.
5. Install a short length of the appropriately sized tubing to the fitting and place tube into the container of the barrier fluid being used.
6. Apply a vacuum, the fluid should rise into the fill tube and enter through the system.
7. Observe the fluid at the exit (vacuum pump) side. When clear, air free fluid is observed, close the fill valve, while maintaining the vacuum on the system for approximately 2 -3 minutes to begin the process of drawing out excess fluid.
8. Remove the vacuum source and leave the tube on the outlet side (pressure gauge) open to atmosphere.
9. If the pump is not already hydraulically primed, remove the PTP valve from the top of the pump head. Using a plastic funnel or similar, slowly pour hydraulic fluid into the pump head cavity until full.
10. Inspect the PTP valve to ensure the sealing O-ring is still in position and re-install the valve.
11. Adjust the pump to full (100%) stroke.
12. To fully balance and evacuate the leak detection system, the pump must now run at normal discharge pressure for a period of about thirty minutes to one hour.
13. Supply either process fluid, or test fluid (i.e., water) to the suction fitting and ensure that the discharge system is configured for safe operation. The pump can be started with minimal discharge pressure and then slowly brought up to full pressure if the system allows for this.
14. Apply power and start the pump. Hold down the PTP valve momentarily and observe the port via sight glass. Continue to depress the PTP to release any entrapped air within the hydraulics until you observe oil from the sight glass.
15. Slowly increase the discharge pressure to full operating pressure and continue to run the pump for a period of one hour.
16. During this time, excess barrier fluid will be displaced from the system into the short length of the tubing attached to the exit port, balancing the system for proper operation. A small pen mark on the tube can assist in observing this process visually.
17. After the one-hour startup period, remove the tubing and connection from the housing body and reinstall the pressure gauge.
18. Reconnect the alarm to the external system if necessary.
19. The pump and pressure leak detection system are now properly prepared and ready for normal service. During normal operation, the gauge should indicate zero (0) pressure.

12. APPENDIX II

12.1 Piping Calculations

All reciprocating metering pumps require a net positive suction head ($NPIP_R$). Refer to Table 1 for the ($NPIP_R$) required for PULSAPRO pump models. The $NPIP_R$ is defined as the pressure required above the absolute vapor pressure of the process fluid at the pumping temperature. This pressure is required at the suction port of the pump throughout the entire pump stroking cycle to prevent cavitation of the process fluid within the reagent head. The $NPIP_R$ is one of the requirements necessary to assure metering accuracy.

$NPIP_R$	PULSAPRO 7440
English (psi)	3
Metric (bar)	0.21

Table 1

The net positive suction head available ($NPIP_A$) must be greater than the $NPIP_R$. The $NPIP_A$ of any given system is calculated as follows for comparison to the $NPIP_R$ as shown in Table 1.

Equation # 1 – For fluid viscosity below 50 centipoises

$$NPIP_A = P_A \pm P_H - P_V - \left(\frac{L_S R G Q}{C_1 d^2} \right)$$

Equation # 2 – For fluid viscosity above 50 centipoises

$$NPIP_A = P_A \pm P_H - P_V - \sqrt{\left(\frac{L_S R G Q}{C_1 d^2} \right)^2 + \left(\frac{L_S \mu Q}{C_2 d^4} \right)^2}$$

Refer to Section 12.3 Nomenclature, for the definitions of variables used in the equations above; follow the units shown in Table 3B for the constants listed to be used correctly.

NOTE

IF PIPING SIZES VARY THROUGHOUT THE SUCTION LINE, DIFFERENT ADDITIVE VALUES MAY BE USED FOR PRESSURE LOSSES ATTRIBUTED TO THE LIQUID'S ACCELERATION AND DECELERATION. USE THE LAST TERM OF EQUATION 1 OR 2 AS MANY TIMES AS NEEDED IN THE EQUATION TO ADJUST FOR DIFFERENT LENGTHS OF DIFFERENT PIPE DIAMETERS IN THE SUCTION LINE. (EVERYTHING BUT THE PIPE LENGTH AND DIAMETER WILL STAY THE SAME IN THE EQUATION).

All reciprocating metering pumps also require that a minimum absolute pressure and minimum suction head (msh), be maintained at the pump inlet throughout the pumping cycle to ensure a stable hydraulic system and proper pump operation. The sum of the NPSHa and the vapor pressure (pv) must be greater than the values shown in table 2.

MSP	PULSAPRO 7440
English, (psia)	5.0
Metric, (bar(a))	0.35

Table 2 - Minimum values for the sum of $NPIP_A$ and vapor pressure. (MSP)

12.2 System Back Pressure

The system back pressure must exceed the suction pressure by at least five (5) psi (0.35bar) to prevent flow through, however it must not exceed the rated discharge pressure of the pump. Flow through can be defined as the process liquid flowing from a higher pressure to a lower pressure, which attributes to pump failure and undesired flow at pump shutdown. If the system back pressure is not at least five (5) psi (0.35bar) greater than the suction pressure, a back-pressure valve must be installed in the discharge piping. To calculate the system's total backpressure, use Equation 3 or 4.

Equation # 3 – For fluid viscosity below 50 centipoises

$$P_T = \left(\frac{L_S R G Q}{C_1 d^2} \right) + P_P \pm P_H$$

Equation # 4 – For fluid viscosity above 50 centipoises

$$P_T = \sqrt{\left(\frac{L_S R G Q}{C_1 d^2} \right)^2 + \left(\frac{L_S \mu Q}{C_2 d^4} \right)^2} + P_P \pm P_H$$

12.3 Nomenclature

Table 3A – Definitions of abbreviations used in NPIP Equations

$NPIP_R$	Net positive inlet pressure required, [psi, bar]
$NPIP_A$	Net positive inlet pressure available, [psi, bar]
P_A	Pressure at the surface of the liquid being pumped (atmospheric or supply tank blanket pressure) [psi(a), bar(a)]
P_H	Head pressure above (+) or below (-) the pump centerline, [psi, bar,] (convert from ft or m)
P_V	Absolute vapor pressure at pumping temperature of the process liquid at pump inlet, [psi(a), bar(a)]
L_S	Length of suction piping (actual, not equivalent), [ft, m]
R	Pump stroking rate, strokes/min [spm]
G	Specific gravity of process liquid, [no units]
Q	Pump average flow rate, [gph, lph]
d	Internal pipe diameter, [inches, mm]
C1, C2, C3	Numeric constants used in Equations 1 - 4 [no units] see table 2 for values
μ	Viscosity of process liquid at pumping temperature, centipoise [cp]
L_D	Length of discharge piping (actual, not equivalent), [ft, m]
P_P	System discharge pressure, [psi(g), bar(g)]
P_T	Peak pump discharge pressure at the discharge port, [psi(g), bar(g)]
V_P	Peak liquid velocity generated by the pump, (suction or discharge) [ft/s, m/s]

Table 3B – Unit sets and constant values for use in NPIP Equations

Variable	**Units Set**	
	English	**Metric**
NPIP	psi	bar
P_A	psia	bar(a)
P_H	psi	bar
P_V	psia	bar(a)
L_S	feet	meters
R	strokes/min	strokes/min
G	no units	no units
Q	gallons/hr.	liters/hr.
d	inches	millimeters
μ	centipoise	centipoise
L_D	feet	Meters
P_T	psi	bar
P_P	psi	bar
V_P	feet/sec	meters/sec
C_1	24,600	640
C_2	45,700	1.84
C_3	46.8	0.91

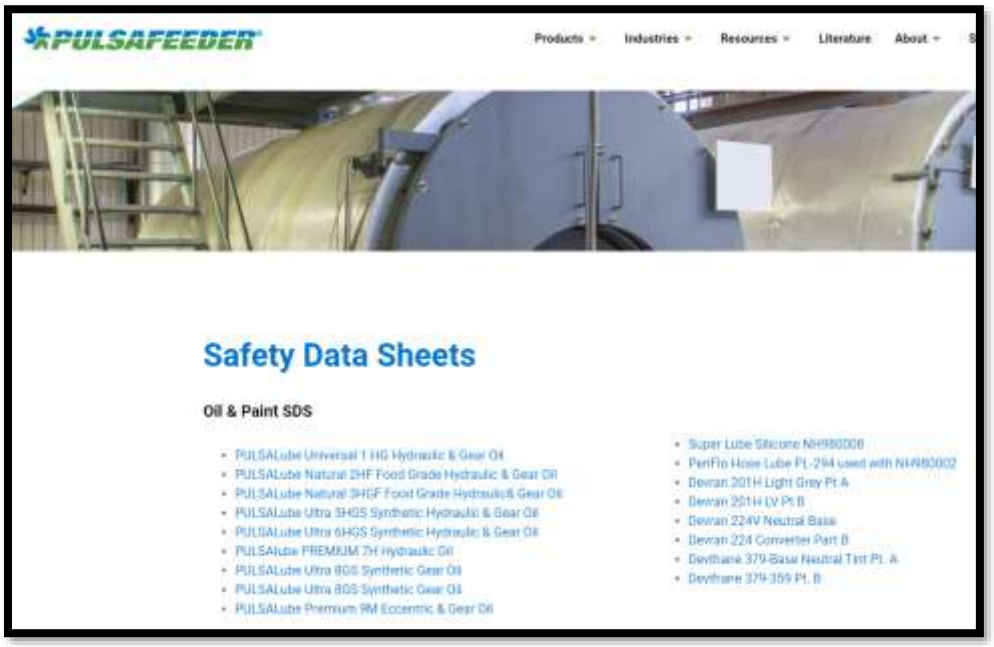
13. APPENDIX III

13.1 Oil Specification

PULSALube Ultra 8GS Synthetic Gear Oil

PULSAlube Premium 7H Hydraulic Oil

NOTE **Please visit our website at www.pulsafeeder.com to view and download any Safety Data Sheet (SDS) under the Resources tab.**



14. APPENDIX IV

14.1 Bolt Torque Recommendations

For Models with Metal Heads and PTFE Diaphragm:

REAGENT HEAD BOLTS				TIEBAR BOLTS		
REAGENT HEAD	# BOLTS AND THREAD SIZE	TORQUE (2) FT-LBS	TORQUE (2) N-M	# BOLTS AND THREAD SIZE	TORQUE (2) IN-LBS	TORQUE (2) N-M
MW160078	(14) 5/8-11	75	101.7	(4) 1/4-20	45	5.1
MW160079	(12) 5/8-11	60	81.3	(4) 1/4-20	45	5.1
MW160080	(8) 3/8-16	30	40.1	(4) 5/16-18	50	5.6
MW160082	(6) 1/2-13	35	47.5	(4) 1/2-13	30	3.4
MW160083	(6) 3/4-10	95	128.8	(4) 1/2-13	30	3.4
MW160084	(14) 5/8-11	75	101.7	(4) 1/4-20	45	5.1
MW160085	(12) 5/8-11	60	81.3	(4) 1/4-20	45	5.1
MW160086	(8) 3/8-16	30	40.1	(4) 5/16-18	50	5.6
MW160088	(6) 1/2-13	35	47.5	(4) 1/2-13	30	3.4
MW160089	(6) 3/4-10	95	128.8	(4) 1/2-13	30	3.4
MW160098	(8) 3/8-16	30	40.1	(4) 5/16-18	50	5.6
MW160099	(6) 1/2-13	35	47.5	(4) 1/2-13	30	3.4
MW160100	(6) 3/4-10	95	128.8	(4) 1/2-13	30	3.4
MW160101	(8) 3/8-16	30	40.1	(4) 5/16-18	50	5.6
MW160102	(6) 1/2-13	35	47.5	(4) 1/2-13	30	3.4
MW160103	(6) 3/4-10	95	128.8	(4) 1/2-13	30	3.4

For Models with PTFE/PVC Heads and PTFE Diaphragm:

REAGENT HEAD BOLTS				TIEBAR BOLTS		
REAGENT HEAD	# BOLTS AND THREAD SIZE	TORQUE (2) FT-LBS	TORQUE (2) N-M	# BOLTS AND THREAD SIZE	TORQUE (2) IN-LBS	TORQUE (2) N-M
MW160090	(4) 5/8-11	50	67.8	(4) 1/4-20	45	5.1
MW160091	(4) 3/8-16	10	13.6	(4) 1/4-20	45	5.1
MW160092	(6) 1/2-13	15	20.3	(4) 5/16-18	50	5.6
MW160093	(6) 3/4-10	30	40.7	(4) 1/2-13	30	3.4
MW160094	(4) 5/8-11	50	67.8	(4) 1/4-20	45	5.1
MW160095	(4) 3/8-16	10	13.6	(4) 1/4-20	45	5.1
MW160096	(6) 1/2-13	15	20.3	(4) 5/16-18	50	5.6
MW160097	(6) 3/4-10	30	40.7	(4) 1/2-13	30	3.4

NOTE

The torque valve is based on the reagent head part number which is stamped or cast on the part itself. If assistance is needed in identifying your specific torque value for your pump please contact the local representative or the Pulsafeeder Service Group at 585-292-8000 or via email at ProService@idexcorp.com

15. APPENDIX V – Accessories

15.1 PULSAtrol Pulsation Dampener

The PULSAtrol is a pneumatically charged diaphragm-type chamber that intermittently stores energy. Used on the inlet, it will improve NPIPA (Net Positive Inlet Pressure available) characteristics of the suction piping system. On the discharge line it will reduce peak pressures and pulsating flow variations.

Installation
On both discharge and suction lines, it is desirable to mount the PULSAtrol as close to the pump connection as possible. It can be mounted in any position: horizontally, vertically, or at any angle. A shutoff valve should always be used between the piping system and PULSAtrol. If the discharge line is open to atmospheric pressure, a backpressure valve should also be incorporated in the system near the PULSAtrol to assure proper operation. Pulsation dampeners do require regular maintenance and inspection. Charge pressure should be checked every 2 – 4 months and renewed as needed. Temperature, pressure, and other variables will affect charge life and diaphragm/bladder life.

Discharge Setup
The PULSAtrol may be pre-charged with air or nitrogen. When properly pre-charged the diaphragm is positioned against the bottom liquid chamber. It is therefore necessary to drain all liquid below the diaphragm and vent to atmospheric pressure when pre-charging.

Use the pre-charge pressure as determined from the PULSAtrol selection and sizing procedure. This can vary from 50 to 80% of mean line pressure in accordance with fluctuation level selected. The PULSAtrol is now ready for service and the diaphragm will move to a neutral position as liquid enters the chamber.

Pre-Charge Procedure for Discharge Installation
1. Calculate the pre-charge pressure
   a. Mean line pressure (psig) + Atmospheric Pressure = Absolute Pressure (psia)
   b. Absolute Pressure (psia) x Pre-charge percentage (80% max) = Pressure Absolute
   c. Pressure Absolute – Atmospheric Pressure = Pre-charge Pressure (psig)
2. Isolate PULSAtrol from line
3. Carefully drain off process fluid by open a drain valve
4. Apply pre-charge pressure (additional liquid may drain as diaphragm moves)
5. Close drain valve
6. Place PULSAtrol in stream

Suction Setup (Flooded Suction)
Charge the PULSAtrol with adequate pressure to overcome the static suction head. Start up the pump. Depress the stem on the charge valve, but only during discharge strokes of the pump, until the gauge indicates pressure pulses. The diaphragm has now centered allowing the PULSAtrol to accumulate liquid while the pump is discharging. If too much air becomes released and the gauge will not indicate pressure pulses, recharge the PULSAtrol and repeat the procedure.

Pre-Charge Procedure for Suction Installation
1. Isolate accumulator from line
2. Carefully drain off process fluid by opening a drain valve
3. Apply 5 – 10 psi pre-charge pressure (additional liquid may drain as diaphragm moves)
4. Close drain valve
5. Bleed off all pressure on the PULSAtrol
6. Open the valve to put PULSAtrol in stream
7. Push in on the stem of the charging valve during the discharge stroke of the pump and release during the suction stroke
8. Continue this for about ten times and observe the compound gauge. As accumulator functions, the needle will go from pressure to vacuum

15.2 Back Pressure Valve

The Pulsafeeder diaphragm backpressure valve creates constant backpressure. A PTFE diaphragm, offering maximum chemical protection and service life, seals the spring and bonnet from process fluid. This diaphragm seals directly on a replaceable seat. Be sure to install with fluid flow in direction of arrow on valve body. If arrow is missing from plastic valve body, install with flow exiting out center hole of valve body.

15.3 Pressure Relief Valve

Pressure relief valves should be utilized in any system to protect the pump and other process equipment and piping from potentially damaging or unsafe pressures. It is critical that the pressure relief valve be mounted in the discharge piping system before any other devices that can potentially block or impede flow, or it cannot perform its intended function. The pressure relief valve must be set to a pressure high enough to prevent unwanted fluid relief during normal process conditions. A setting that is approximately 10-20% above normal operating pressures is generally enough. The valve must also be set below the maximum pressure capability of the lowest rated device in the system. For example, if a PulsaPro pump is rated with a maximum pressure capability of 150 psi (approx. 10bar) but the piping within the system is rated only to a maximum of 100 psi (approx. 7 bar) then the pressure relief valve must be set to a value lower than 100 psi.

REVISION HISTORY

Revision Level	Date	Description of Change
A	11/3/2023	Initial Release
B	10/30/2024	In Section 5.4, changed discharge pressure must exceed suction pressure by at least 5 PSI. Previously stated 20 PSI.

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