

# Marschalk Aquarius II Bladder Pumps

Installation and Operation Manual



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## DOCUMENTATION CONVENTIONS

This manual uses the following conventions to present information:



**WARNING**

An exclamation point icon indicates a **WARNING** of a situation or condition that could lead to personal injury or death. You should not proceed until you read and thoroughly understand the **WARNING** message.



**CAUTION**

A raised hand icon indicates **CAUTION** information that relates to a situation or condition that could lead to equipment malfunction or damage. You should not proceed until you read and thoroughly understand the **CAUTION** message.



**NOTE**

A note icon indicates **NOTE** information. Notes provide additional or supplementary information about an activity or concept.

# Chapter 1: System Description

## Function and Theory

The Marschalk Aquarius II Bladder Pumps operate with a unique action ideal for both gentle low-flow sampling and higher volume purging. Electro/pneumatic controllers permit timed on/off cycles of compressed air to alternately pressurize (squeezing the flexible bladder to displace water out of the pump) and exhaust allowing the pump bladder to refill. Fluid enters the pump through the “Lower Head” inlet check valve located at the bottom of the Bladder Assembly, via hydrostatic pressure (automatically by submergence) refilling the bladder with fluid. Compressed air enters the space between the bladder and the interior of the Outer Stainless Steel Housing pressurizing the bladder and pushing water up the discharge tubing. During the pressure cycle the intake check valve closes and the discharge check valve opens. The compressed air squeezes the bladder, pushing the fluid up the discharge tube. The discharge check valve prevents back flow from the discharge tubing during the exhaust / fill cycle. The bladder is refilled by hydrostatic pressure and the cycle repeats. Compressed air does not contact the sample! The bladder prevents contact between the pump drive air outside the bladder and the water inside the bladder.



NOTE: Bladder pumps operate more efficiently when submerged under at least 10 feet of water. Lower submergence requires longer fill times or vacuum assist.

For all of your Bladder Pump Controller requirements, it is recommended that you use only Geotech / Marschalk Controllers. Contact GEOTECH to discuss which controller will best suit your specific site requirements.

## **System Components**

The Marschalk Aquarius II Bladder Pump consists of four main parts, the Bladder Assembly, Bladder, Intake Head and the Outer Housing.

### **Bladder Assembly**

The Marschalk Aquarius II Bladder Assembly is a welded assembly consisting of four 316 Stainless Steel components, the Upper and Lower Head and two Spanner Rods. (see figure 1, page 5).

### **Bladder**

The Bladder is constructed of a proprietary inert virgin grade PTFE polymer resin and is extruded with no markings or lubricants.

The Bladder is installed onto the Bladder Assembly and secured in place with two 316 Stainless Steel, Low-profile reusable clamps, providing a true zero leak seal.

### **Intake Head**

The Intake Head is constructed of 316 Stainless Steel.

### **Outer Housing**

The Outer Housing is constructed of 316 Stainless Steel. Viton O-rings provide the high pressure seals between the Bladder Assembly and the Intake Head.

### **Intake screen Assembly (Optional)**

The Intake Screen Assembly is constructed of 316 Stainless Steel components and is easily removable for field maintenance. The Intake Screen Assembly is intended to protect and extend the life of the bladder material by preventing particulates larger than a .023 diameter from entering the pump (see warranty, page 22).

# System Components

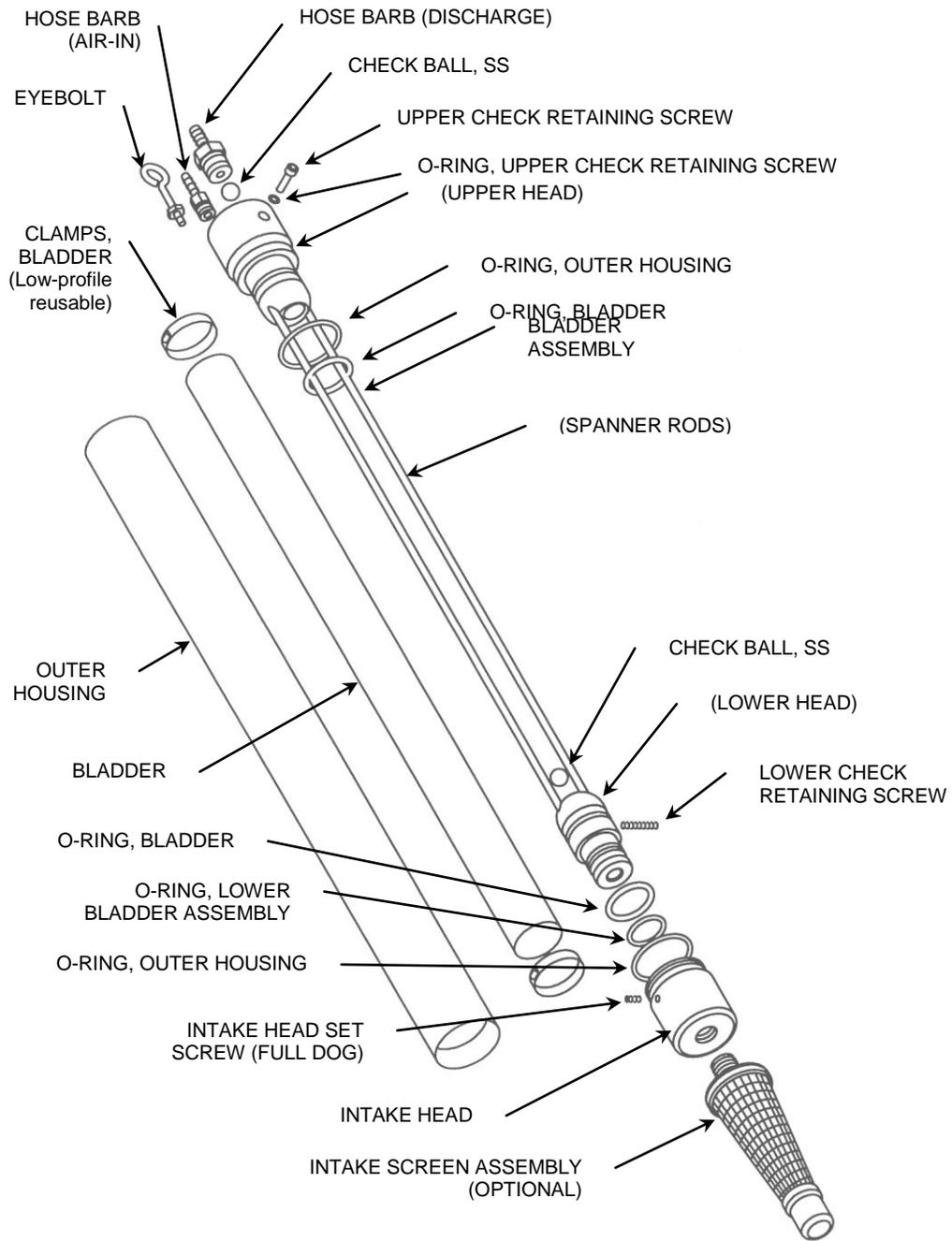


Figure 1

## Chapter 2: System Installation

### Bladder Pump

The Marschalk Aquarius II Bladder Pump is engineered for easy installation and use. As an Option, dedicated Bladder Pumps can be shipped from GEOTECH with the tubing attached. Well identifications and pump intake depths (supplied by the customer) are written on the tags connected to the tubing and on the tubing bags.

Marschalk Aquarius II Bladder pumps can also be used portably. Connect the air line tubing (.170 x .25) to the Air-in Hose barb and attach the sample line (.250 x .375) to the Fluid Discharge Hose barb. Make sure the tubing is pushed down until it bottoms out at the fitting shoulder and is secure. Tubing clamps are no longer required for this connection (see figure 2).

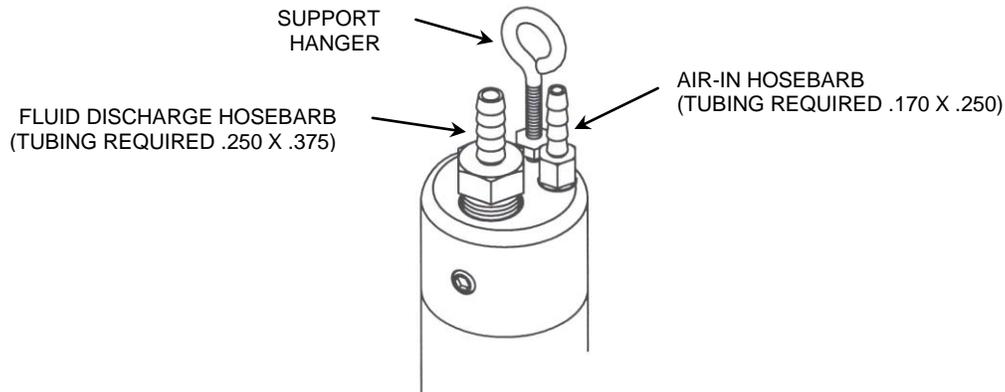


Figure 2



NOTE: To connect the bonded tubing to your Bladder Pump in the field, first trim the sample line tubing (.250 x .375) approximately 1/4" shorter than the air line tubing. This allows for a neater connection to the pump head and keeps the tubing from bulging or bowing out if one side is longer than the other.

Attach the pump suspension cable to the pump's support hanger using the low profile "Quick Link". Ensure the attachment of both tubing and support cable are secure and tight before lowering the pump into the sampling well.

## Chapter 3: System Operation

### Bladder Pump Operation

Fluid enters the pump through the Intake Head at the bottom of the pump and the bladder fills with fluid. Compressed air enters the space between the bladder and the interior of the Outer Housing, the inlet check valve closes and the discharge check valve opens. The compressed air squeezes the bladder pushing the fluid up the discharge tube. The discharge check valve prevents backflow from the discharge tubing during the fill cycle.

### Selecting an Air Source

The following explanation is based on a .170 ID air supply tubing. To determine the required capacity of the air source used, calculate the air consumption as follows. With 100 ft. of air line tubing in or out of the well, the air consumption is 125 cubic inches per cycle, with 6 cycles per minute (average).

*Example:* For 100 ft. of tubing you will need 125 cu. in. x 6 per min. which equals 750 cu. in. / min. or 45,000 cu. in. / hr. For each additional 100 ft. add 59 cu. in. If you plan to use an air compressor we advise that you use one with a reserve tank to insure proper air supply to the pump.

### Determining PSI



**CAUTION**

**It is important NEVER to apply excessive pressure to the bladder during the pump cycle. The proper setting of the pumping pressure will reduce wear and prevent permanent deformation of the bladder. Always start pumping with a pressure as set on the Controller, of 3-5 psig, regardless of pump depth and head pressure. During each successive pumping cycle, increase pumping pressure in 3-5 psi increments until water flow is observed at the surface. Once water is flowing at the surface the pressure regulator can be used to regulate flow. Example; higher pressure will empty the bladder contents quickly, lower the pressure and you will decrease the flow rate and it will take more time to empty the bladder. By using the pressure regulator in concert with the electro-pneumatic timers you can control the flow rate to less than 50mls/minute.**

## Flow Rates

Flow rates are based on the Marschalk Aquarius II Bladder Pump modeled PERFORMANCE CURVE (see figures 4, 5, 6, pages 8, 9, 10).

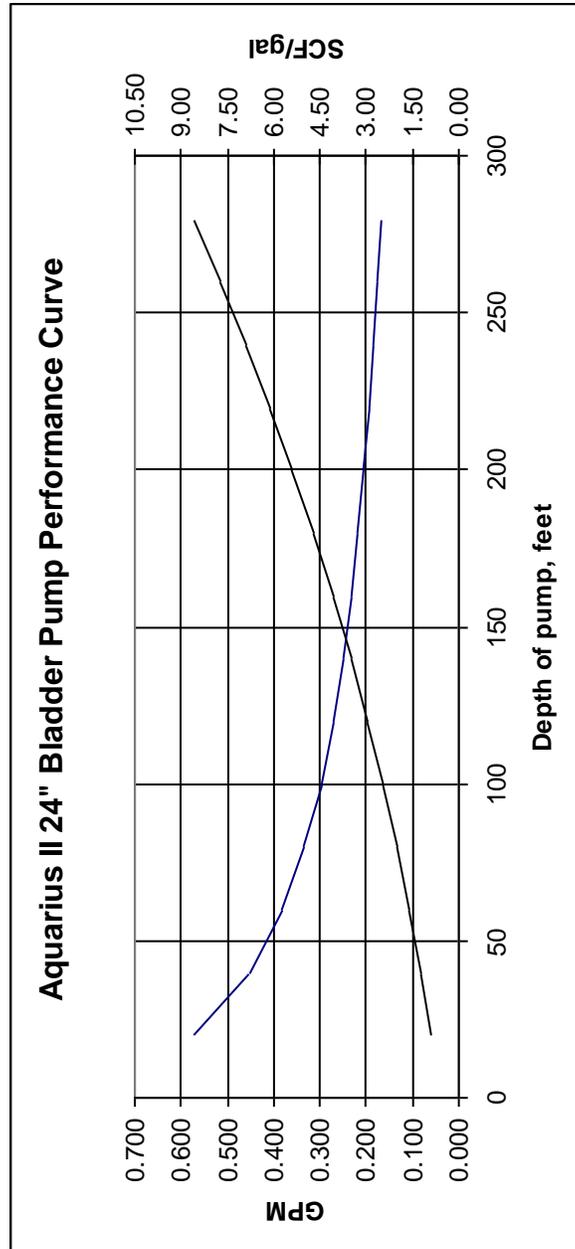


Figure 4 – Performance Curve

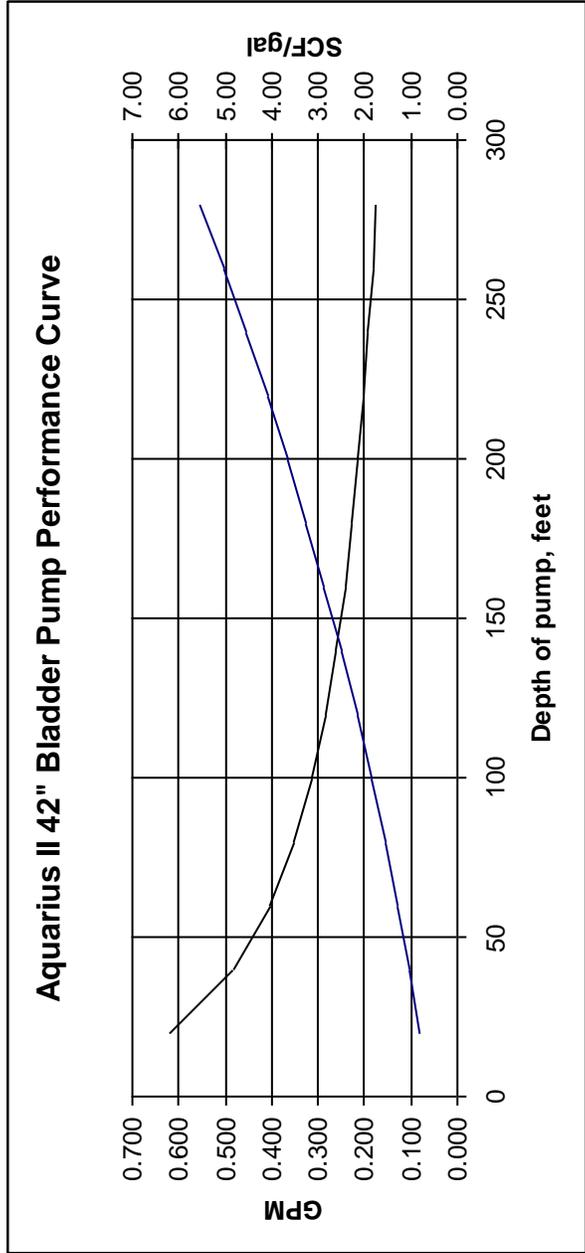


Figure 5 – Performance Curve

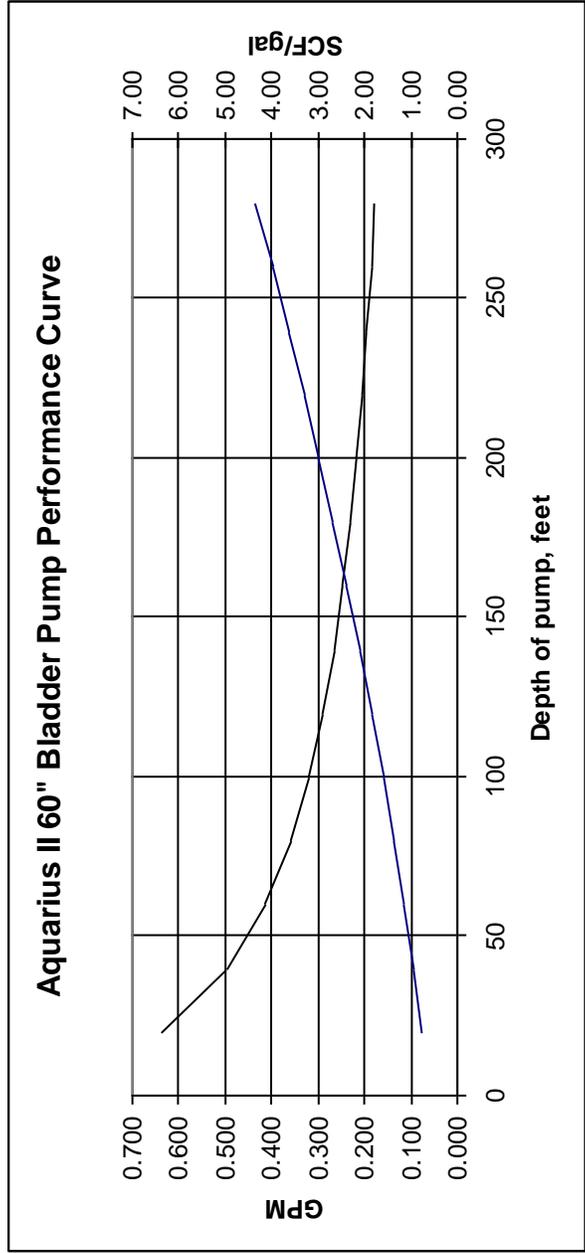


Figure 6 – Performance Curve

## Chapter 4: System Maintenance

### **Marschalk Aquarius II Bladder Pump**

As with any pump, scheduled or periodic maintenance should be performed, according to your sampling program and specific site conditions. Generally, the more turbid or sandy your water, the more often you should maintain and clean your pumps. In addition, pumps that are in wells with high concentrations of Total Dissolved Solids (ex. iron, calcium, and manganese) may be subjected to mineral deposits and require more frequent cleaning (see System Components, figure 1, page 5).

Decontaminate or replace parts as needed, then reassemble. Inspect all check balls for wear and replace as necessary. Inspect all O-rings for rigidity splits or cracks and replace as necessary.

Disassemble the Bladder Pump per the following instructions:

### **Bladder Replacement**

When replacing an existing Bladder use the following instructions:

- Pull the pump from the well. It will be necessary to remove the air and sample lines from the pump as well as the pump suspension cable.
- Using a 3/32" Allen wrench, remove the Intake Head set screw. Gently pull and twist the Intake Head to remove it from the Outer Housing (see figure 1, page 5).
- Remove the Outer Housing (see figure 1).
- Using a pair of Oetiker clamping pliers, remove the upper and lower Bladder clamps. At this time, inspect the O-rings for rigidity, splits or cracks and replace them as necessary (see figure 1).
- The Bladder can now be removed for cleaning or replacement.

- If you are pumping with a dedicated system that has a high concentration of dissolved mineral solids, it is recommended that you remove and inspect the Upper and Lower SS Check Balls for deposit build-up. If this deposit build-up is present, clean as necessary and reinstall. Mineral deposition can cause the Check Balls to become permanently seated in the Check Valve. If mineral precipitation on the Check Balls becomes a problem, a replacement PTFE Check Ball is available.
- Reinstall the bladder by reversing the sequence of steps outlined above. The low profile bladder clamps must be installed directly over the Bladder o-rings to insure a good seal.
- Reinstall the Intake Head into the Outer Housing.

**NOTE** to make reassembly easier use a little DI water to lubricate the o-rings and the Stainless Steel.

- **Reinstall the Intake Head set screw.**



**WARNING**

**This set screw connection between the Bladder Assembly's "Lower Head" and the Intake Head is a critical structural element of the Aquarius II Bladder Pump (see figure 1, page 5). Do not over-tighten the screw when assembling the pump. Tighten the set screw only until it bottoms out in the groove of the "Lower Head". Improper assembly can seriously decrease the burst resistance of the pump. Do not pressurize the pump for any reason unless it is in a well. If the Intake Head is improperly installed and the pump is pressurized outside of the well the pump may come apart suddenly causing injury.**

## Chapter 5: System Troubleshooting

### System Troubleshooting

Problem:

Solutions:

*Air is cycling thru controller, but will not pump...*

- 1) "Charge" (Pressurize) and "Exhaust" (Fill) times are not set correctly.  
Check and adjust charge and exhaust cycle times (i.e. if charge time is too long or if exhaust and charge time is too short).
- 2) Possible compromise in air line tubing.  
Check air line pump for leaks. If needed, repair using compression union or replace tubing.
- 3) Check pump intake screen for blockage and clean as needed.

*Controller is cycling but the pump stops producing water...*

- 1) Check drawdown level of water in the well.  
Ensure the pump is fully submerged and off of the bottom of the well.
- 2) Check psi at the regulator and adjust as necessary (see page 7).
- 3) Check for kinks in the discharge line.
- 4) Check pump intake screen for obstructions.
- 5) Charge time is too long or exhaust time is too short; causes pressure build up in pump, causing the pump not to fill.
- 6) Check power source, assure a strong reliable power supply. If using an old or weak battery, the control valves may not operate properly.

## System Troubleshooting cont...

*Getting air bubbles in sample line...*

- 1) Over charging pump.  
Reduce charge cycle time so that charge cycle ends as fluid discharge trails off.  
Inspect pump for compromised bladder or o-rings.
- 2) Pump is being over pressurized.  
Reduce psi to what is necessary to overcome pumping head (see page 7 for determining psi).
- 3) Check discharge line for holes or kinks.  
Repair using compression union or replace tubing.

*Discharge line drains back into pump...*

- 1) Remove Hose barb on pump discharge outlet.  
Check the check ball seat for debris. Clean and re-install.

*Pump stops pumping...*

- 1) Bladder could be collapsed due to over pressurizing (typically found in low-submergence scenarios).
- 2) Mineral deposits have caused the Check Balls to permanently seat in the Check Valve(s).

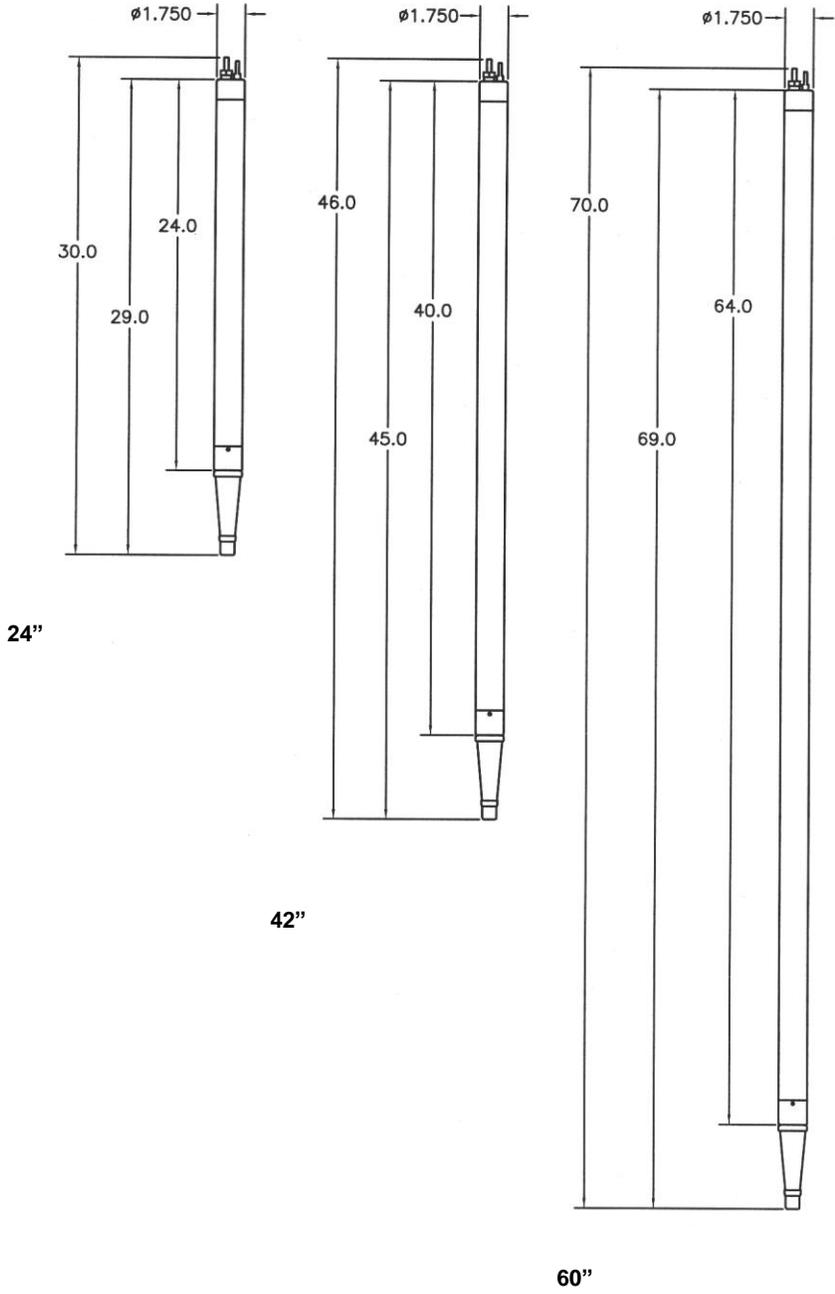
## Chapter 6: System Specifications

	24" / 61cm	42" / 107cm	60" / 152cm
<b>Bladder Assembly</b>	SS, 316	SS, 316	SS, 316
<b>Bladder</b>	Proprietary inert virgin grade PTFE Polymer resin	Proprietary inert virgin grade PTFE Polymer resin	Proprietary inert virgin grade PTFE Polymer resin
<b>Intake Head</b>	SS, 316	SS, 316	SS, 316
<b>Outer Housing</b>	SS, 316	SS, 316	SS, 316
<b>Intake Screen Assembly (optional)</b>	SS, 316	SS, 316	SS, 316
<b>Hose Barbs</b>	SS, 316	SS, 316	SS, 316
<b>Outside Diameter</b>	1.75" / 4.45cm	1.75" / 4.45cm	1.75" / 4.45cm
<b>Length: Without Screen</b>	24" / 61cm	40" / 102cm	64" / 163cm
<b>Length: With Screen</b>	29" / 74cm	45" / 114cm	69" / 175cm
<b>Weight</b>	5.44 lbs / 2.47kg	7.33 lbs / 3.32kg	9.63 lbs / 4.37kg
<b>Volume/Cycle</b>	9.8 oz / 290ml	19.2 oz / 568ml	30.5 oz / 902ml
<b>Max. Flow rate*</b>	.58 gpm / 2.2lpm	.61 gpm / 2.3lpm	.64 gpm / 2.4lpm
<b>Min. Well I.D.</b>	2" / 51mm	2" / 51mm	2" / 51mm
<b>Operating Pressure</b>	1-125 psi / .07- 9 bar	1-125 psi / .07- 9 bar	1-125 psi / .07- 9 bar
<b>Min. Operating Range</b>	5psi / .34 bar above static head	5psi / .34bar above static head	5psi / .34bar above static head
<b>Maximum Depth **</b>	289' / 88m	289' / 88m	289' / 88m

\* Flow rate determined on 6ft / 183cm submergence @ 20 psi above static head

\*\* With the use of a drop tube, maximum depth is increased

# Chapter 7: System Schematic



## Chapter 8: Replacement Parts List

### Aquarius II Bladder Pump

Qty	Description	Part #
1	Bladder Assembly – 24”	21150060
1	Bladder Assembly – 42”	21150062
1	Bladder Assembly – 60”	21150065
1	Outer Housing – 24”	21150058
1	Outer Housing – 42”	21150061
1	Outer Housing – 60”	21150066
1	Bladder – 24”	21150057
1	Bladder – 42”	21150063
1	Bladder – 60”	21150064
1	Hose Barb – (air-in)	21150019
1	Hose Barb – (discharge)	17200360
2	Check Ball, SS	11150020
1	Upper Check Retaining Screw	11150058
1	Lower Check Retaining Screw	11150054
1	intake head set screw (full dog)	11150055
1	O-ring, Upper Check Retaining Screw	16600136
1	O-ring, Lower Bladder Assembly	11150049
2	O-ring, Bladder	11150056
2	O-ring, Outer Housing	11150057
1	Eyebolt	16600133
2	Clamps, Bladder (Low-profile reusable)	11150163
1	Intake Head	21150059
1	Intake Screen Assembly (optional)	81150023
2	Check Ball, PTFE (optional )	17500083

## Notes

## Notes

## Notes

## Notes

## **The Warranty**

For a period of one (1) year from date of first sale, product is warranted to be free from defects in materials and workmanship. Geotech agrees to repair or replace, at Geotech's option, the portion proving defective, or at our option to refund the purchase price thereof. Geotech will have no warranty obligation if the product is subjected to abuse, misuse, or inability to use this product. User assumes all other risk, if any, including the risk of injury, loss, or damage, direct or consequential, arising out of the use, misuse, or inability to use this product. User agrees to use, maintain and install product in accordance with recommendations and instructions. User is responsible for transportation charges connected to the repair or replacement of product under this warranty.

## **Equipment Return Policy**

A Return Material Authorization number (RMA #) is required prior to return of any equipment to our facilities, please call our 800 number for appropriate location. An RMA # will be issued upon receipt of your request to return equipment, which should include reasons for the return. Your return shipment to us must have this RMA # clearly marked on the outside of the package. Proof of date of purchase is required for processing of all warranty requests.

This policy applies to both equipment sales and repair orders.

FOR A RETURN MATERIAL AUTHORIZATION, PLEASE CALL OUR  
SERVICE DEPARTMENT AT 1-800-833-7958 OR 1-800-275-5325.

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Date: \_\_\_\_\_

## **Equipment Decontamination**

Prior to return, all equipment must be thoroughly cleaned and decontaminated. Please make note on RMA form, the use of equipment, contaminants equipment was exposed to, and decontamination solutions/methods used.

Geotech reserves the right to refuse any equipment not properly decontaminated. Geotech may also choose to decontaminate equipment for a fee, which will be applied to the repair order invoice.

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