

2" Alpha Ferret In Well Separator Installation & Operation Manual

P/N 95153 3-13-08

What this manual covers

Welcome to the Operations and Maintenance manual for the Alpha Ferret Hydrocarbon recovery pumps by QED. Ferret recovery pumps feature a patented system for delivering water-free hydrocarbons from contaminated groundwater wells to the surface.

This manual covers Ferrets designed for 2" and larger recovery wells:

The fixed inlet AIWS22 Ferret can recover up to 200 gallons of product per day. Product with kinematic viscosities as high as 100 centistokes (at 55°F) can be pumped by the AIWS22 (fluids with viscosities near the pump's maximum will lower pumping rate). The AIWS22 must be continuously positioned with the inlet in the product to enable recovery.

The floating inlet AIWSFI12 Ferret can recover up to 60 gallons of product per day. Product with kinematic viscosities up to 4 centistokes (at 55°F) can be pumped by the AIWSFI12 (fluids with viscosities near the pump's maximum will lower pumping rate). The AIWSFI12 features a floating inlet that moves across a 12" range to automatically adjust for changes in the well static water level.

How to read the manual

This manual will help you install and use your new Ferret pumping system. Please read the Safety Information section first. Troubleshooting and Service Sections cover basic things to look at if your system is not working and gives you information on how to reach QED should you require more detailed service information. At the back of the manual is a Technical Information Section that contains specification sheets and other background technical information

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General Warnings

Ferret pumping devices are designed to pump floating hydrocarbons from groundwater recovery wells. The recovered product is frequently flammable and vapors may be explosive if exposed to heat, flame or sparks. **When the Ferret pneumatic pumping system is used care should be taken to ensure that any venting of pump drive air, potentially mixed with explosive vapors within the pump, is located in a well ventilated area away from sources of open flame, sparks and extreme heat. As in all situations – failure to take adequate precautions may result in catastrophic injury or death.** Protection for eyes, hands and person should be worn when working with the Ferret to avoid injury from contact with hazardous fluids. Tubing used with the Ferret system should be routed in a manner that prevents damage due to chafing, cutting or crushing.

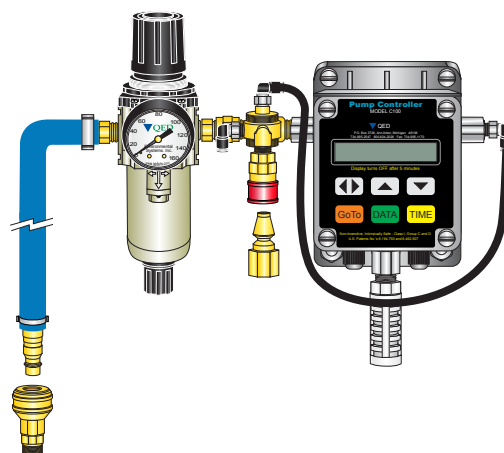
Do not apply compressed drive air to the Ferret system unless all safety precautions are followed.

C100M Controller Warnings

The C100M controller (see Fig. 1) is a solar powered timer and valve that has an onboard battery pack for operation during the night and on days with marginal sunlight. The C100M is CSA Approved intrinsically safe for Class 1, Division 1, Group C and D use. The C100M may be mounted at the well head. The General Warning for venting of pump drive air needs to be followed with the C100M as it will vent potentially explosive pump drive air during operation (venting at, or near the C100M is not a problem). The C100M is also NEMA4 rated for use in environments or in situations where the device might be exposed to rain or water spray. The C100M includes an optional AC adapter to allow use inside where there is insufficient light available for charging. The AC adapter is not approved for intrinsically safe use.

The AC adapter is not rated for use in explosive environments or in situations where the device might be exposed to rain or water spray. It should be mounted at least 3' above the ground and at least 25' horizontally from sources of combustibles vapors and liquids.

Figure 1. C100M Controller



Electro-Static Grounding

All QED product hose fittings and hoses are electro-statically grounded to each other to provide for the removal of static build-up. This reduces the likelihood of any sparks igniting fires or explosions. All product storage tanks should also be properly grounded.

Operating principle

The Ferret pump is used to recover floating hydrocarbons from wells without pumping water. The Ferret is typically installed in a 2" or larger groundwater recovery well, with the pump inlet positioned at or above the interface between the groundwater and any floating hydrocarbon. The Ferret uses specific gravity check balls to separate hydrocarbon and water inside the pump, reject the water and pump any hydrocarbon (see Figs. 2 and 3). The Ferret uses an internal air displacement pump to provide the pumping action. Timers and a surface mounted air valve cycle compressed air into the pump and let the air vent. The cycling of air creates a pumping action with the fluid discharging from the pump when the compressed air is applied and the fluid filling the pump when the compressed air is vented.

Floating hydrocarbons vary widely in specific gravity and viscosity. As specific gravity approaches 1.0 (the specific gravity of water) it becomes harder to separate the hydrocarbon from the water in any device. Ferrets are used when hydrocarbons have specific gravity in the 0.70 to 0.90 gm/cc range. As viscosity increases the ability of the hydrocarbon to flow into the well and into recovery devices decreases, the fixed inlet Ferret can handle liquids with kinematic viscosities up to 100 centistokes at 55° F, while the floating inlet Ferret can handle up to 4 centistoke fluids (at 55° F)

Selecting an air source

The AIWS22 and AIWSFI12 pumps will require about 2 CFM of compressed drive air to operate at their maximum flow rates. An air source with less than 2 CFM (per pump) will run the pump in cases where pump refill cycle times are set long (greater than 2-3 minutes) and recovery flow rate is less than maximum. The following recommendations will minimize air supply system problems:

- Locate compressor and support equipment inside a building. This protects compressor components from rain and freezing conditions.
- Follow compressor manufacturer recommendations for sealing oil use and service life.
- In areas where freezing may occur locate compressor supply piping below the frost line or use heat-trace. Insulate other valves or areas where compressor condensate may collect and freeze. Use an after cooler and air drier to minimize freezing problems.
- Purge all air supply pipes and tubing runs before attaching equipment. Frequently tubes become filled with installation cuttings and debris
- In hot climates provide sufficient ventilation to prevent compressor and motor overheating.
- An auto-drain on the compressor tank is recommended to prevent moisture build-up in air distribution piping.

Figure 2 Water Discharge

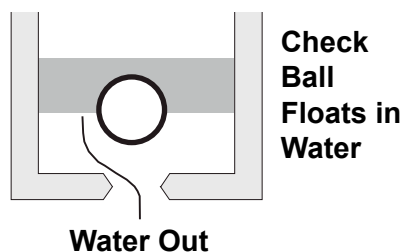
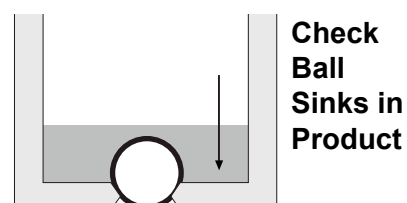


Figure 3 Product Discharge



Installing the pump

Pump installation is similar for both the AIWS22 and AIWSF12 pumps. Pump installation involves attaching the tubing to the pump, locating the tubing loosely in the well cap, positioning the pump in the well and tightening the well cap fittings. Next complete any surface tubing runs. Step by step:

1. Attach tubing to the Ferret (See Figure 4).
2. Insert tubing through the well cap (See Figure 5).

Figure 4 Tubing Attachment to Pump

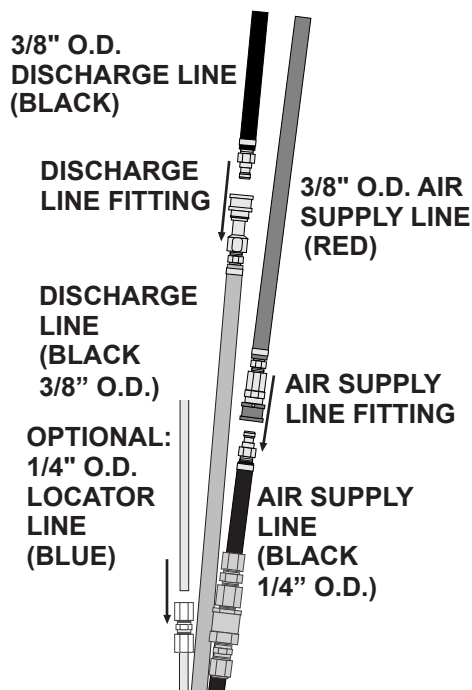
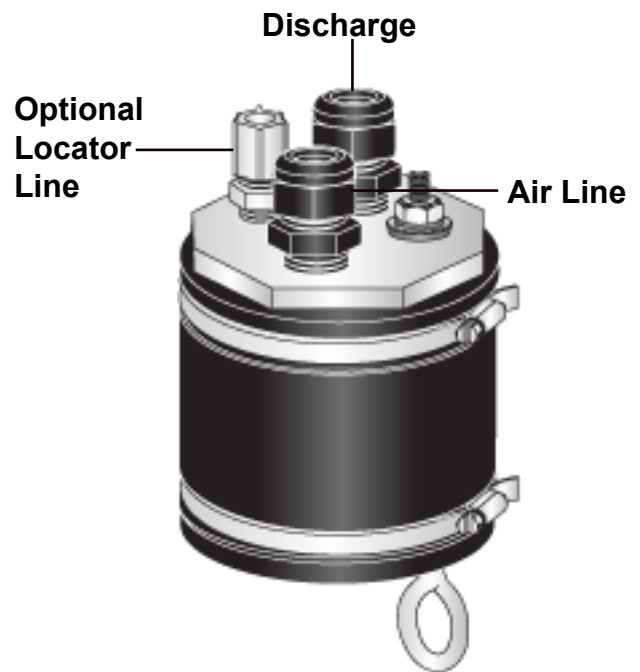
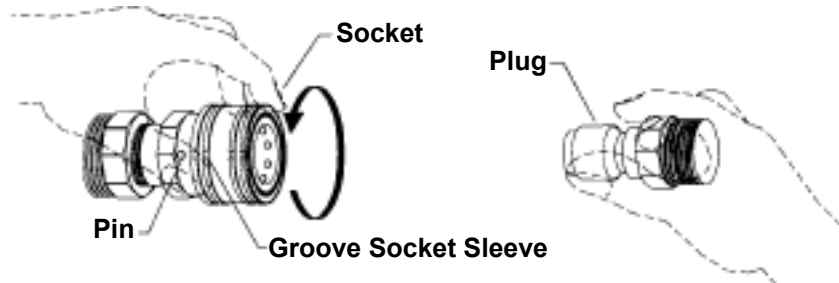
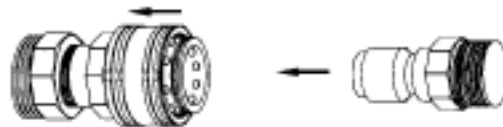


Figure 5 Tubing Through Well Cap





1. Rotate socket sleeve until groove is aligned with the pin close to the hex.



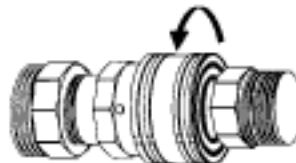
2. Pull socket sleeve against the hex (the pin will be totally covered). Hold in position for plug insertion.



3. Push plug into socket until the plug is almost covered.



4. Let the socket sleeve go in. It must slide all the way until the pin is visible again.



5. Rotate the socket sleeve so the groove does not align with the pin. To test, gently pull hexes of both fittings in opposite directions. Fitting must remain attached.

1. Position the Ferret in the well (See Figure 6 and 7).
2. Tighten cap fittings (See Figure 5).
3. Complete all discharge tubing connections and runs.

Figure 6 AIWS22 Pump Position

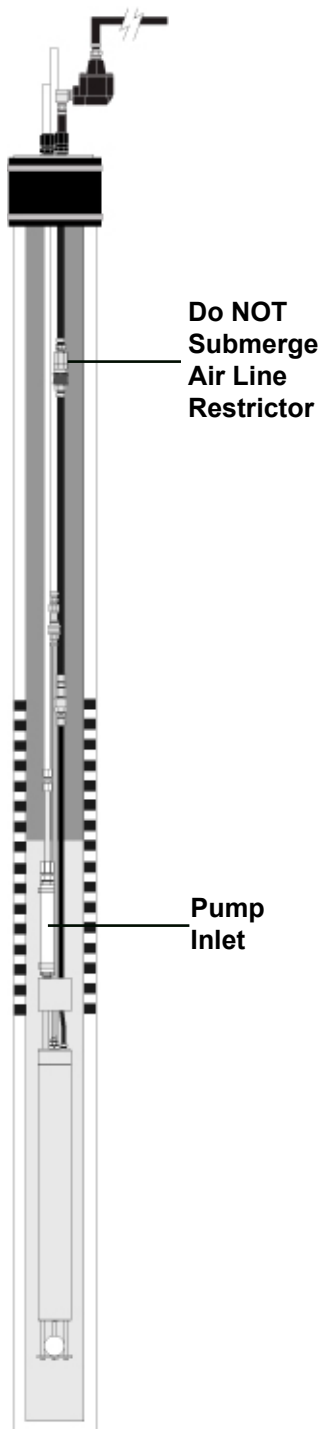
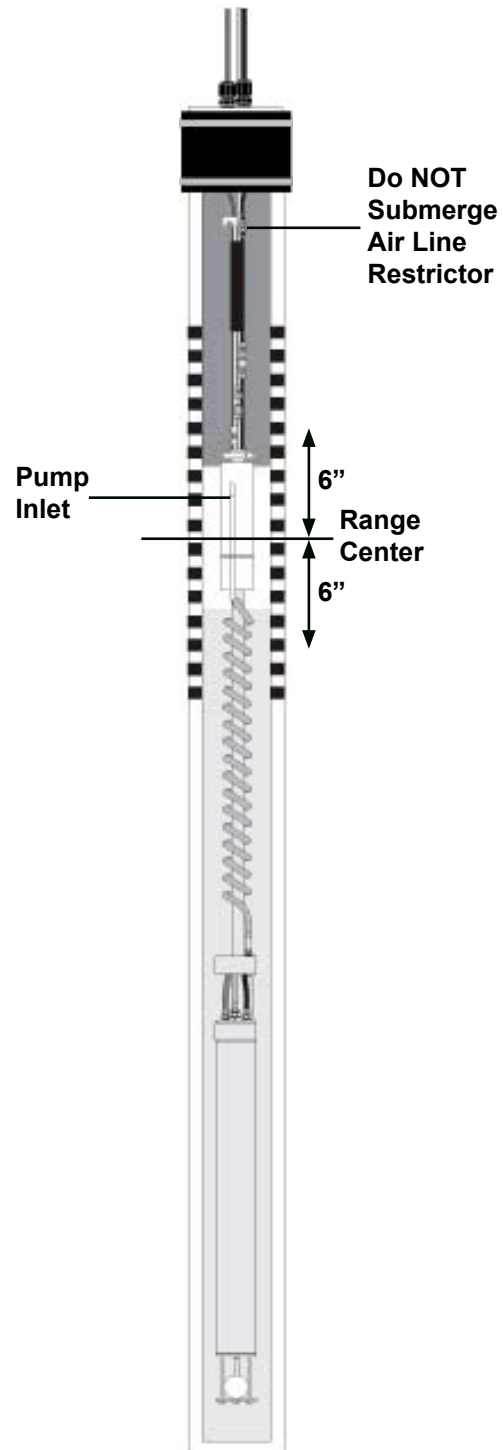


Figure 7 AIWSFI12 Pump Position



Installing the controller

The Ferret pump requires a timer operated air valve to provide pump discharge and refill action. The C100M Controller can be used in environments containing explosive vapors, when powered by the solar panel and not with the A/C. **See the Safety Section of this manual for further information.**

C100M Controller Installation

C100M in outdoor use mode (See Fig. 8). C100M is located near or at the recovery well in an area that receives sunlight. Fig. 9 shows optional AC adapter use with the C100M. Use of the AC adapter makes the C100M unsafe for use in explosive environments. **See the Safety Section of this manual for further information.**

Figure 8 C100M in Solar Charge Mode

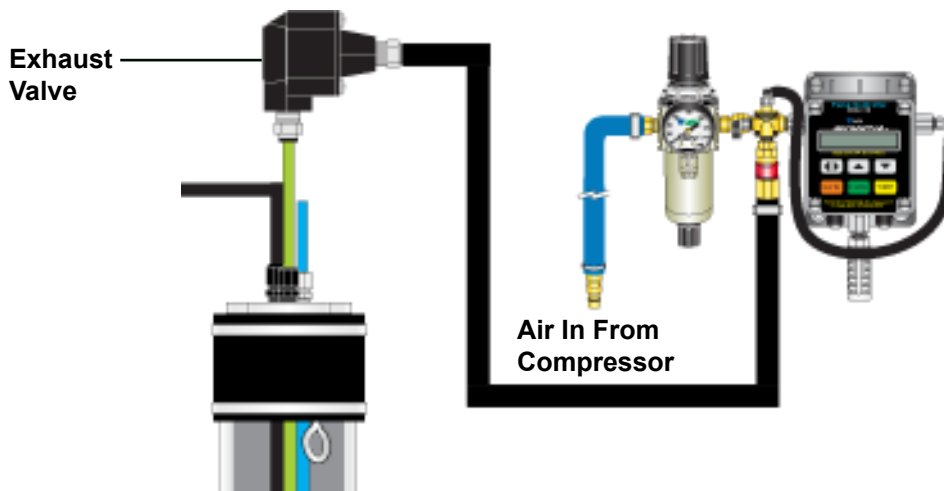
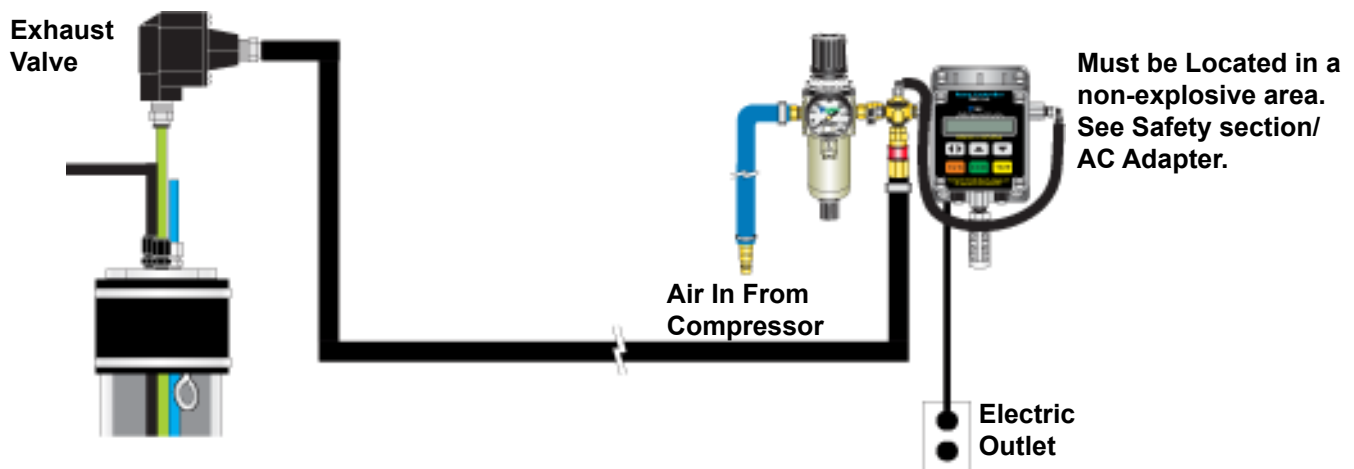


Figure 9 C100M With Optional AC Adapter Use

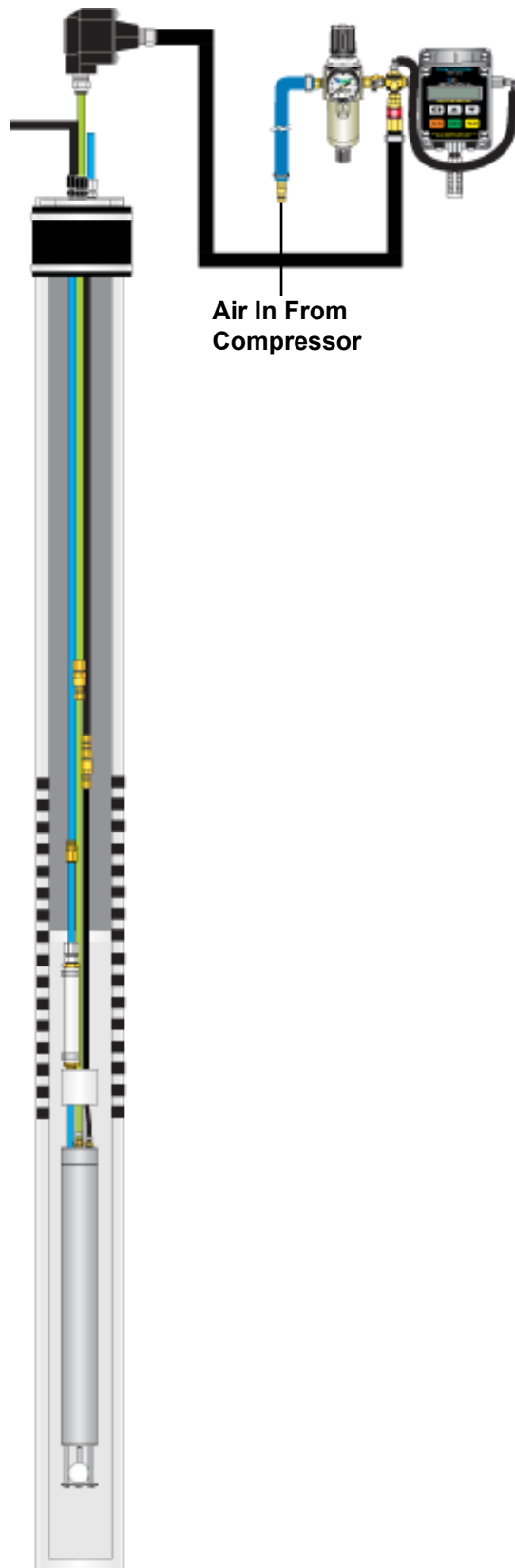


Operating the system

Adjust the controller refill and discharge times to allow for complete pump filling and discharge. Partial discharge from a pump can be the result of insufficient product availability in the well, a refill time that is set too short or a discharge time that is set too short. In general, a discharge time of 10-15 seconds and a refill time of 1-2 minutes will initiate pumping. Further tuning of times may be required to maximize pump flow rate. If the discharge time is set too long air may appear in the discharge tube. Control of flow rate is also available through adjustment of the regulator on the controller. In general, leave the regulator turned fully clockwise (delivering maximum compressor supply pressure to the pump) unless there is a need to slow down the pump action during a discharge cycle.

Ferret pump position may require occasional adjustment in cases where static water level changes or product layer thickness changes. Both Ferret pumps are designed to continue pumping in conditions where coalesced liquids or bio-growth exist in the well. Occasional pump and pump inlet cleaning may be required to ensure trouble-free operation.

Figure 10 Single Pump Controlled by a Single Controller



IMPORTANT! - If AC Adapter Option is Used on the C100M the C100M must be Mounted at Least 25' Away From the Exhaust Valve and Well Head.

Air In From Compressor

Pump location

If using the optional blue pump locator tube and pump positioner hand pump, use the hand pump gauge readout to locate the inlet of the pump. The dynamics of product flow into a well once pumping is underway may require pump inlet adjustment. In general, a pump inlet location several inches below the static liquid surface (as shown on the pump positioner gauge) will ensure that all floating liquids enter the Ferret and are recovered. If the well has no floating hydrocarbons or a very thin layer, the Ferret will reject the water that enters the inlet and will continue to accumulate product in the pump body until there is sufficient product to pump to the surface.

Controller settings

C100M Controllers have three basic controls available that affect pump operation:

- **Refill time setting** - The refill time setting determines how long the pump will fill. This time needs to be longer when product has a high viscosity and flows slowly. The AIWS22, fixed inlet Ferret, will allow faster inflow of product than the floating inlet AIWSF112 Ferret (where the product flows down a coiled drain attached to the float). The C100M controller is settable from 1 second to 99 hours, 59 minutes and 59 seconds. In general, a refill time setting of 1-2 minutes is appropriate for most sites and conditions. Setting a long refill time can help to match pump performance to product inflow in cases where the product flows into the well slowly.
- **Discharge time setting** - The discharge time setting determines how long the pump will discharge. This time needs to be longer when pump is deeper, when the pump is pumping against a higher back pressure (a pressure header or pumping up a hill) and when the product has a high viscosity and flows slowly. The C100M controller is settable from 1 second to 99 hours, 59 minutes and 59 seconds. In general, a discharge time setting of 10-15 seconds is appropriate for most sites and conditions. If the discharge time is set too long drive air may enter the discharge tubing.
- **Pump supply pressure setting** - The filter-regulator attached to the controller is used to raise or lower the pressure applied to the pump during a discharge cycle. For most sites this is set at the fully clockwise position to deliver full compressor supply pressure to the pump. If the pump discharge is too aggressive for your particular situation, this pressure may be decreased to slow the flow from the pump during a discharge cycle. If the pressure is decreased, it is often necessary to increase the discharge time slightly to offset the decrease in flow and maintain a full pump discharge volume.

The C100M Controller features an additional control option to set an awake or sleep mode. (refer to the C100M O&M Manual for full operation details). This option can be used to schedule Ferret system operation during a several day period (for example, the controller can be set to turn on once per day and operate the pump for 2 hours, etc.). This is useful to match Ferret system performance to real world product inflow rates in slower recovery situations.

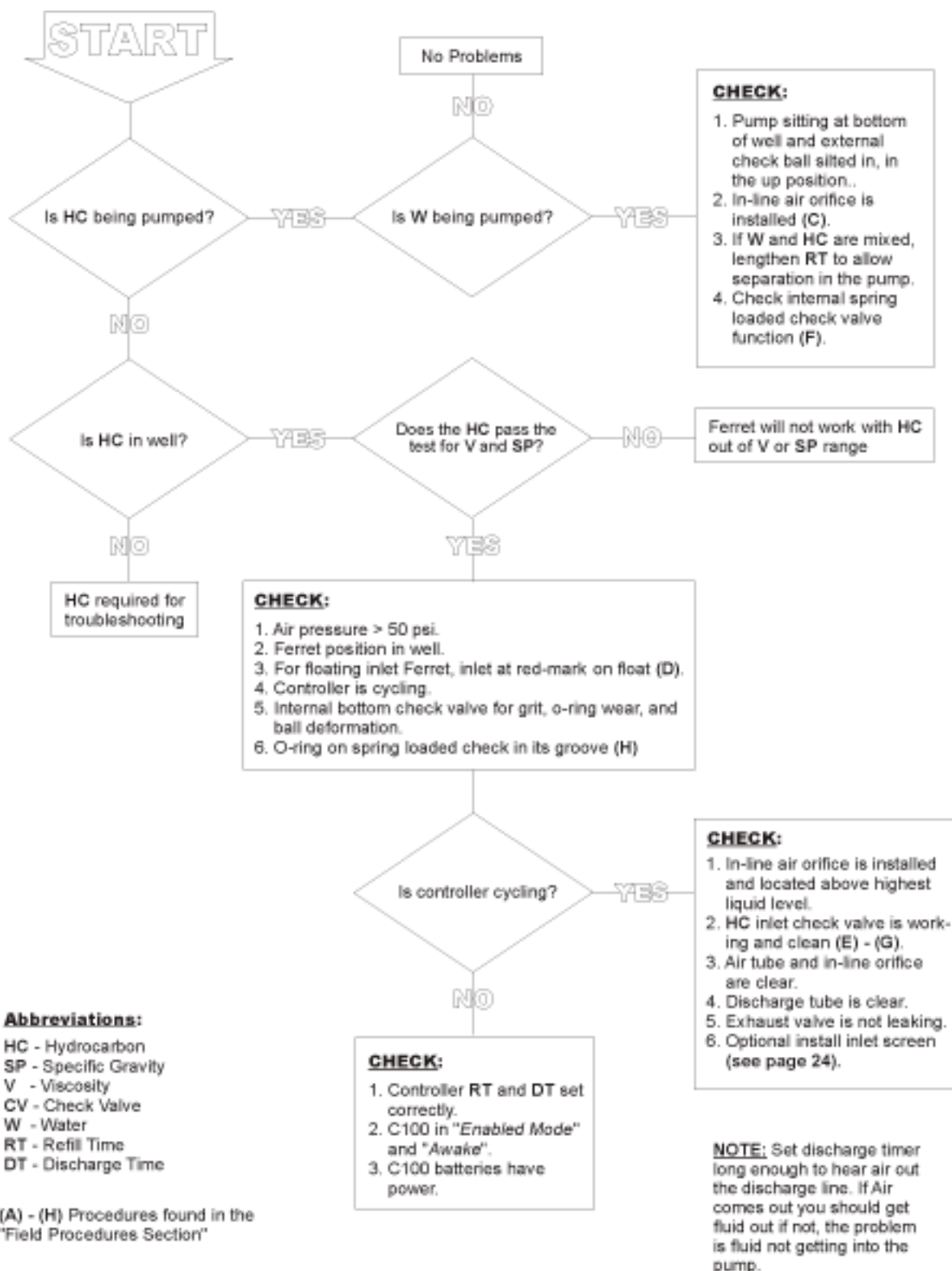
General Troubleshooting

In most cases your Ferret system will operate trouble-free month after month and will produce hydrocarbon without water the whole time. Since the Ferret relies on specific gravity rated check balls to separate hydrocarbon and water the forces created from the difference in specific gravity between the recovered hydrocarbon and water can be slight. The following items determine how well your Ferret will perform and how frequently the device might require attention:

- The well / aquifer system has an ample volume of hydrocarbon to be recovered and this hydrocarbon readily flows into the recovery wells.
- The hydrocarbon has a viscosity and specific gravity within the Ferret's capabilities (this is listed on each Ferret technical support sheet, see Appendix 1.) and the liquid properties have not changed since last tested.
- The well has minimal biofouling and/or suspended particles.
- Mixed hydrocarbon and water (coalesced) separate in a reasonable time (less than 1-2 minutes).
- The static water level in the well is fairly stable over short time periods.

Problems commonly are traced to one of the following causes:

- The well has solids or bio-solids that clog pump inlet ports.
- The well has suspended grit, sand, PVC casing shavings etc. that prevents check balls from fully seating.
- The well doesn't have a rapidly replenished supply of hydrocarbon.
- The air supply system isn't clean and clogs filters or orifices.
- The target hydrocarbon has a higher viscosity than recommended for the Ferret model being used.



If this guide fails to identify your problem contact QED Service and Repair at:

Phone: 1-800-624-2026 FAX: 1-734-995-1170 24 Hour Beeper: 1-800-272-9559
 Outside of U.S.: 1-734-995-2547 e-mail: service@qedenv.com

Ferret manifold - cleaning procedure

Manifold cleaning is recommended whenever the pump is removed from the well.

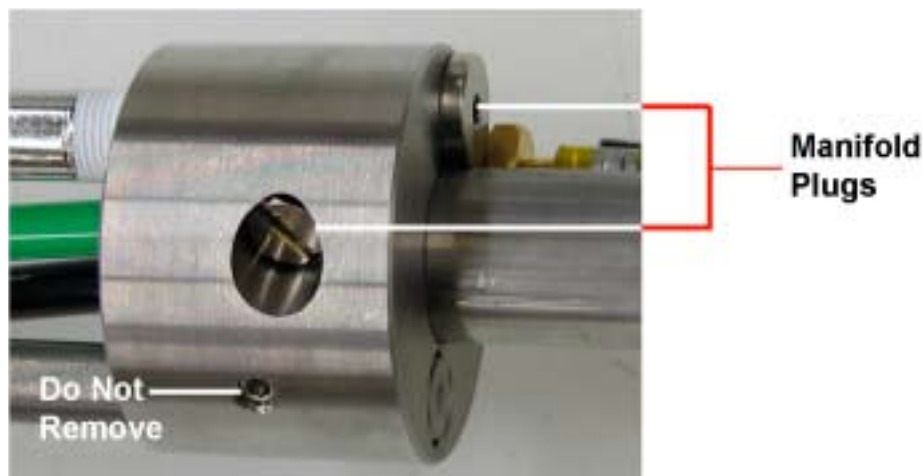
Symptom - No product being discharged from the pump, and there is a gurgling sound down-well (depending on the depth of the pump, the gurgling sound may not be detectable). This could be an indication that the manifold passages are clogged. This gurgling sound could also indicate that the check ball is not properly seating on the manifold o-ring, allowing fluid to go back up through the pump inlet. A small piece of debris could prevent the check ball from seating properly.

- Location: On the 4" models, the manifold is located on top of the stainless steel pump body. On the 2" models, the manifold is suspended approximately 2" – 3" above the top head of the pump.
- The plug on the top of the manifold has a check ball, o-ring, and possibly a g-ring (depending on the model) holding the ball in place.
- There are two plugs on the side of the manifold.

AIWSFI12- (Floating Inlet 2")

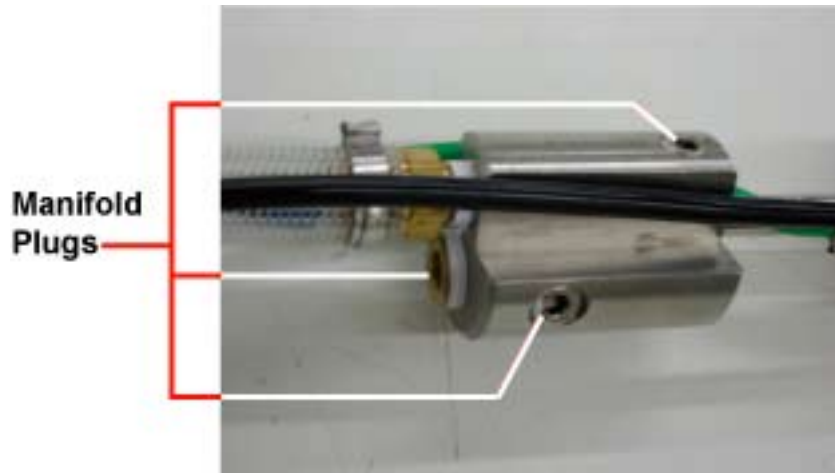
1. The top manifold plug requires an Allen wrench. The two side manifold plugs (one of which is not pictured) require a flat-head screwdriver. Do not remove the side plug which requires an Allen wrench.
2. To clean the manifold, follow the same procedure as outlined above. Remove the manifold plugs and flush the manifold with water or compressed air.

CAUTION: Always wear goggles and any other appropriate personal protection when using compressed air.



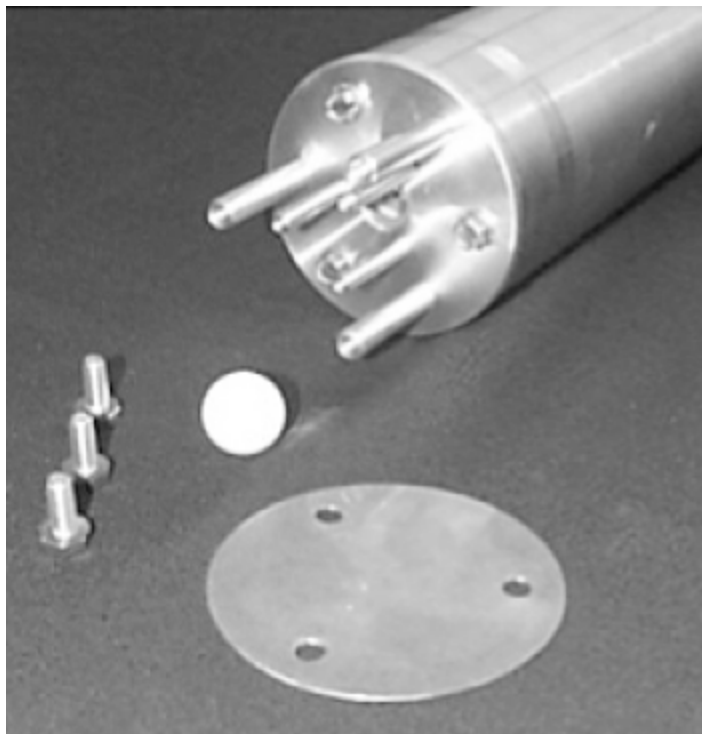
AIWS22- (Stationary Inlet 2")

1. Removing the plugs on this pump requires an Allen wrench.
2. Located under the top plug is a g-ring, which holds the check ball in place.
3. To clean the manifold, follow the same procedure as outlined above.

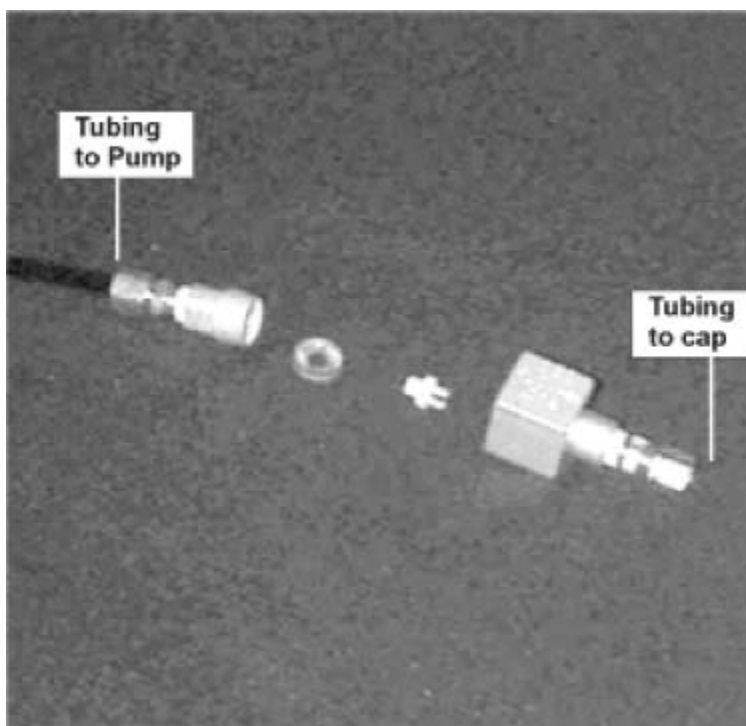


If cleaning the pump's manifold does not resolve the problem, please contact **QED** at **1-800-624-2026**

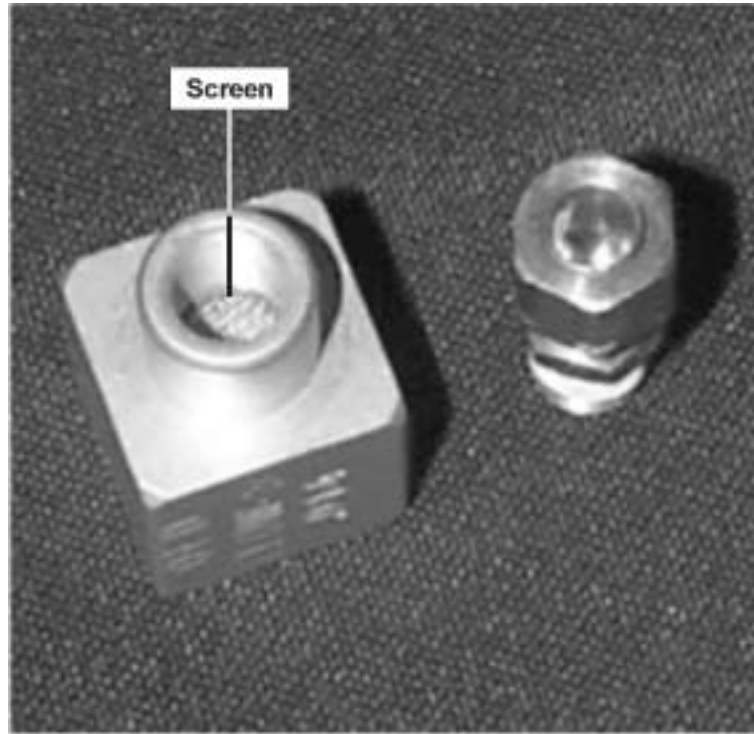
(A) Cleaning the pump bottom check ball.



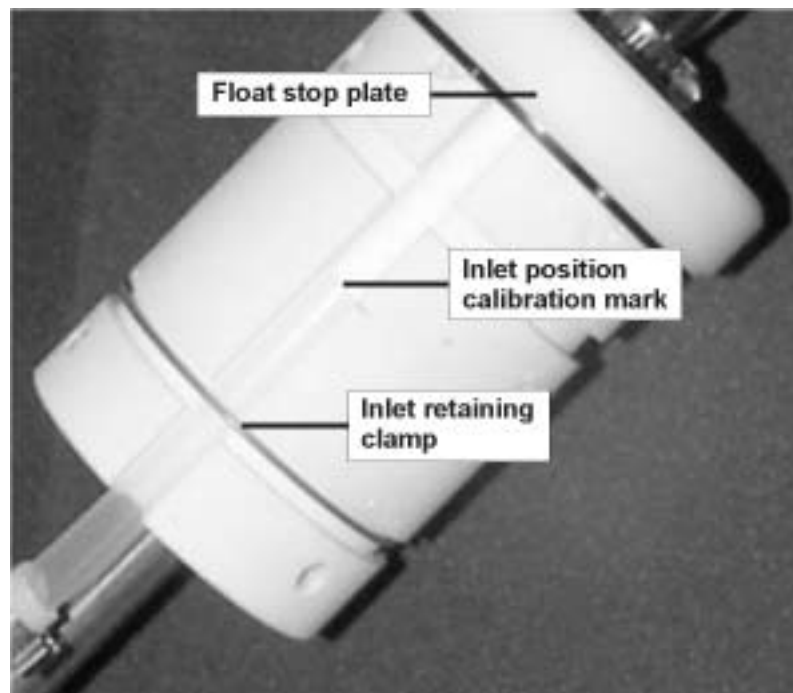
(B-1) Cleaning the in-line air restrictor. Note orientation of parts for correct re-assembly.



(B-2) Verify that screen is clean



(C) Floating inlet calibration position and inlet retaining clamp. Ensure inlet tube is even with calibration mark on float.



Contacting QED

If you have any questions, comments, need to order repair parts or have any other issues you wish to discuss, please contact our Service and Repair Department at:

Phone: (800)-624-2026

Fax: (734)-995-1170

24 Hour Beeper: (800)-272-9559

Outside of USA: (734)-995-2547

e-mail: service@qedenv.com

! Safety Guide for Selecting and Using Hose, Tubing, Fittings, and Related Accessories

WARNING: Failure or improper use of hose, tubing, fittings, assemblies or related accessories (Products™) can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of these Products include but are not limited to:

- Fittings thrown off at high speed
- High velocity fluid discharge
- Explosion or burning of the conveyed fluid
- Electrocution from high voltage electric power lines
- Contact with suddenly moving or falling objects that are controlled by the conveyed fluid

- Dangerously whipping Hose
- Contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious
- Sparking or explosion caused by static electricity buildup or other sources of electricity

- Injections by high-pressure fluid discharge

Before selecting or using any of these Products, it is important that you read and follow the instructions below.

General Instructions

Scope: This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) these Products. For convenience, all rubber and/or thermoplastic products commonly called "hose" or "tubing" are called "Hose" in this safety guide. All assemblies made with Hose are called "Hose Assemblies". All products commonly called "fittings" or "couplings" are called "fittings". All related accessories (including crimping and swaging machines and tooling) are called "Related Accessories".

Fail-Safe: Hose, and Hose Assemblies and Fittings can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Hose or Hose Assembly or Fitting will not endanger persons or property.

Distribution: Provide a copy of this safety guide to each person that is responsible for selecting or using Hose and Fitting products. Do not select or use Hose or Fittings without thoroughly reading and understanding this safety guide.

User Responsibility: Due to the wide variety of operating conditions and applications for Hose and Fittings, QED does not represent or warrant that any particular Hose or Fitting is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the hose and fitting
- Assuring that the user's requirements are met and that the application presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the Hose and Fittings are used.
- Assuring compliance with all applicable government and industry standards.

Hose And Fitting Selection Instructions

Electric Conductivity: Certain applications require that the Hose be nonconductive to prevent electrical current flow. Other applications require the Hose and the Fitting and the Hose/Fitting interface to be sufficiently conductive to drain off static electricity. Extreme care must be exercised when selecting Hose and Fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor. The electrical conductivity or nonconductivity of Hose and Fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials used to make the hose and the fittings, fitting finish (some fitting finishes are electrically conductive while others are nonconductive), manufacturing methods (including moisture control), how the Fittings contact the Hose, age and amount of deterioration or damage or other changes, moisture content of the Hose at any particular time, and other factors.

Pressure: Hose selection must be made so that the published maximum recommended working pressure of the Hose is equal to or greater than the maximum system pressure. Surge pressures or peak transient pressures in the system must be below the published maximum working pressure for the Hose. Surge pressures and peak pressures can usually only be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressures and cannot be used to determine surge pressures or peak transient pressures. Published

burst pressure ratings for Hose is for manufacturing test purposes only and is no indication that the Product can be used in applications at the burst pressure or otherwise above the published maximum recommended working pressure.

Suction: Hoses used for suction applications must be selected to insure that the Hose will withstand the vacuum and pressure of the system. Improperly selected Hose may collapse in suction application.

Temperature: Be certain that the fluid and ambient temperatures, both steady and transient, do not exceed the limitations of the Hose. Temperatures below and above the recommended limit can degrade hose to a point where failure may occur and release fluid. Properly insulate and protect the Hose Assembly when routing near hot objects (e.g. manifolds). Do not use any Hose in any application where failure of the hose could result in the conveyed fluids (or vapors, or mist from the conveyed fluids) contacting any open flame, molten metal, or other potential fire ignition source that could cause burning or explosion of the conveyed fluids or vapors.

Fluid Compatibility: Hose Assembly selection must assure compatibility of the hose tube, cover, reinforcement, and fittings with the fluid media used. Actual service life can only be determined by the end user by testing under all extreme conditions and other analysis. Hose that is chemically compatible with a particular fluid must be assembled using Fittings and adapters containing likewise compatible seals.

Permeation: Permeation (that is, seepage through the Hose) will occur from inside the Hose to outside when Hose is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, diesel fuel, gasoline, natural gas, or LPG). This permeation may result in high concentrations of vapors which are potentially flammable, explosive, or toxic, and in loss of fluid. Dangerous explosions, fires, and other hazards can result when using the wrong hose for such applications. The system designer must take into account the fact that this permeation will take place and must not use Hose if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations which govern the use of fuels and refrigerants. Never use a Hose even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the Hose assembly. Permeation of moisture from outside the Hose to inside the Hose will also occur in Hose assemblies, regardless of internal pressure. If this moisture permeation would have detrimental effects, incorporation of sufficient drying capacity in the system or other appropriate system safeguards should be selected and used.

Routing: Attention must be given to optimum routing to minimize inherent problems (kinking or flow restriction due to hose collapse, twisting of the Hose, proximity to hot objects or heat sources).

Environment: Care must be taken to insure that the Hose and Fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals, and air pollutants can cause degradation and premature failure.

Mechanical Loads: External forces can significantly reduce hose life or cause failure. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type Fittings or adapters may be required to insure no twist is put into the Hose. Unusual applications may require special testing prior to Hose selection.

Physical Damage: Care must be taken to protect Hose from wear, snagging, kinking, bending smaller than minimum bend radius, and cutting, any of which can cause premature Hose failure. Any Hose that has been kinked or bent to a radius smaller than the minimum bend radius, and any Hose that has been cut or is cracked or is otherwise damaged, should be removed and discarded.

Length: When establishing a proper Hose length, motion absorption, Hose length changes due to pressure, and Hose and machine tolerances and movement must be considered.

Specifications and Standards: When selecting Hose and Fittings, government, industry and QED specifications and recommendations must be reviewed and followed as applicable.

Radiant Heat: Hose can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the Hose.

Welding or Brazing: When using a torch or arc-welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld splatter could burn through the hose and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including Hose Fittings and adapters, above 450°F (232°C) such as during welding, brazing, or soldering may emit deadly gases.

Atomic Radiation: Atomic radiation affects all materials used in Hose assemblies. Since the long-term effects may be unknown, do not expose Hose assemblies to atomic radiation.

Unlocking Couplings: Ball locking couplings or other couplings with disconnect sleeves can unintentionally disconnect if they are dragged over obstructions or if the sleeve is bumped or moved enough to cause disconnect. Threaded couplings should be considered where there is a potential for accidental uncoupling.

Hose & Fitting Assembly & Installation Instructions

Component Inspection: Prior to assembly, a careful examination of the Hose and Fittings must be performed. All components must be checked for correct style, size, catalog number, and length. The Hose must be examined for cleanliness, obstructions, blisters, cover looseness, kinks, cracks, cuts or any other visible defects. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion or other imperfections. **DO NOT** use any component that displays any signs of nonconformance. **Pre-Installation Inspection:** Prior to installation, a careful examination of the Hose Assembly must be performed. Inspect the Hose Assembly for any damage or defects. **DO NOT** use any Hose Assembly that displays any signs of nonconformance.

Minimum Bend Radius: Installation of a Hose at less than the minimum listed bend radius may significantly reduce the hose life. Particular attention must be given to preclude sharp bending at the Hose to Fitting juncture. Any bending during installation at less than the minimum bend radius must be avoided. If any Hose is kinked during installation, the Hose must be discarded.

Securement: In many applications, it may be necessary to restrain, protect, or guide the Hose to protect it from damage by unnecessary flexing, pressure surges and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.

Proper Connection of Ports: Proper physical installation of the Hose Assembly requires a correctly installed port connection insuring that no twist or torque is transferred to the Hose when the Fittings are being tightened or otherwise during use.

External Damage: Proper installation is not complete without insuring that tensile loads, side loads, kinking, flattening, potential abrasion, thread damage, or damage to sealing surfaces are corrected or eliminated.

Routing: The Hose Assembly should be routed in such a manner so if

a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame, or sparks, a fire or explosion may occur.

Hose & Fitting Maintenance & Replacement Instructions

Even with proper selection and installation, Hose life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a possible Hose failure, and experience with any Hose failures in the application or in similar applications should determine the frequency of the inspection and the replacement for the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user **Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the Hose Assembly:

- Fitting slippage on Hose,
- Damaged, cracked, cut or abraded cover (any reinforcement exposed);
- Hard, stiff, heat cracked, or charred Hose;
- Cracked, damaged, or badly corroded Fittings;
- Leaks at Fitting or in Hose;
- Kinked, crushed, flattened or twisted hose; and
- Blistered, soft, degraded, or loose cover.

Visual Inspection All Other: The following items must be tightened, repaired, corrected or replaced as required:

- Leaking port conditions;
- Excess dirt buildup;
- Worn clamps, guards or shields.

Functional Test: Operate the system at maximum operating pressure and check for possible malfunctions and leaks. Personnel must avoid potential hazardous areas while testing and using the system.

Replacement Intervals: Hose assemblies and elastomeric seals used on Hose Fittings and adapters will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Hose Assemblies and elastomeric seals should be inspected and replaced at specific requirement intervals, based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk.

Elastomeric Seals- *Elastomeric seals will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Elastomeric seals should be inspected and replaced.*

QED Environmental Systems, Inc. (QED) warrants to the original purchaser of its products that, subject to limitations and conditions provided below, the products, materials and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

This warranty shall be limited to the duration and the conditions set forth below. All warranty durations are calculated from the original date of purchase.

1. Liquid contacting equipment (including pumps), tubing, liquid contact ing supplies and flow totalization equipment are warranted for 1 year.
2. Control devices, control device mounting, and surface air supply hose are warranted for 1 year.
3. Separately sold parts and spare parts kits are warranted for ninety (90) days.
4. Repairs performed by QED are warranted for ninety (90) days from date of repair or for the full term of the original warranty, whichever is longer.

Buyer's exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defects in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to buyer, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Buyer. If QED for any reason, cannot repair a product covered hereby within four (4) weeks after receipt of the original Purchaser's/Buyer's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Buyer, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement or refund are conditioned upon the Buyer's return of the defective product to QED.

IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.

The foregoing warranty does not apply to major subassemblies and other equipment, accessories, and other parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties, if any, supplied by their respective manufacturers. QED makes no warranty concerning products or accessories not manufactured by QED. In the event of failure of any such product or accessory, QED will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY, and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products, materials and/or workmanship.

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty.

Chemical attack to liquid contacting equipment and supplies shall not be covered by this warranty. A range of materials is available from QED and it is the Buyer's responsibility to select materials to fit the Buyer's application. QED will only warrant that the supplied liquid contacting materials will conform to published QED specifications and generally accepted standards for that particular material.

QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the written consent of QED. If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts and labor as authorized by owner hereunder shall be borne by the Purchaser.

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identify the product involved (by model or serial number or other sufficient description that will allow QED to determine which product is defective).
2. Specifying where, when, and from whom the product was purchased.
3. Describing the nature of the defect or malfunction covered by this warranty.
4. Sending the malfunctioning component, after authorization by QED to:



6155 Jackson Rd.
Ann Arbor, Michigan
48103



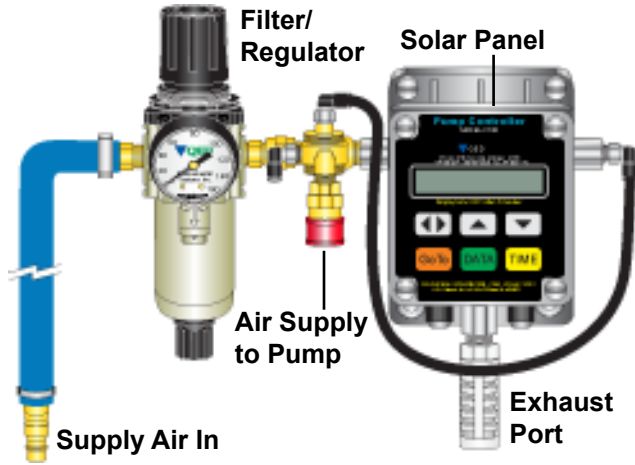
P.O. Box 3726 Ann Arbor, MI 48106-3726 USA
1-800-624-2026 Fax (734) 995-1170
info@qedenv.com www.qedenv.com

Appendix 1 C100M Controller Technical Information Sheet

Appendix 2 Ferret Model AIWS22 Technical Information Sheet

Appendix 3 Ferret Model AIWSFI12 Technical Information Sheet

Appendix 4 Float Screen Installation



Controller Type:

Solar/Electrical/Pneumatic

Enclosure:

Dimensions - W HD3.5" (8.9 cm) x 3.65" (9.3 cm)
H x 3.5" (8.9 cm) D

Weight- 6 LBS. (6.4 kg)

Type - Fiber reinforced thermoplastic NEMA 4X & UL 508

Power:

Solar - Shatterproof solar panel on enclosure top, with backup battery pack with. CSA compliance, intrinsically safe, class 1, division 1, group C & D

C100M is CSA rated intrinsically safe when used in solar mode

110 VAC - Power converter plugs in to standard 110 VAC outlet and supplies 3 VDC,(300 milli-amp) to connector plug in enclosure bottom.3-24 VDC external power supply (C100 batteries must be removed and polarity must be correct.



C100M is NOT rated intrinsically safe when used with 110 VAC power converter or external DC source.

Temperature:

Operating - -20° F to 150° F (-28.9° C to 65.6° C)

Display:

Type - LCD display, 16 character alphanumeric w/ temperature compensated contrast and power off control

Window - Non-glare, double hardened optical acrylic

Pneumatic Control:

Type - Latching solenoid w/ dual port manifold

Pressure - 100 P.S.I. (690 kPa) maximum



Allows manual toggling of valve and system ON & OFF cycles. Also allows enabling & disabling of system.



Multi screen key to sequentially display well status, battery status, solar panel voltage, ON/OFF and system valve.



Allows system counts and time sums, and valve time settings.



Left/right cursor key



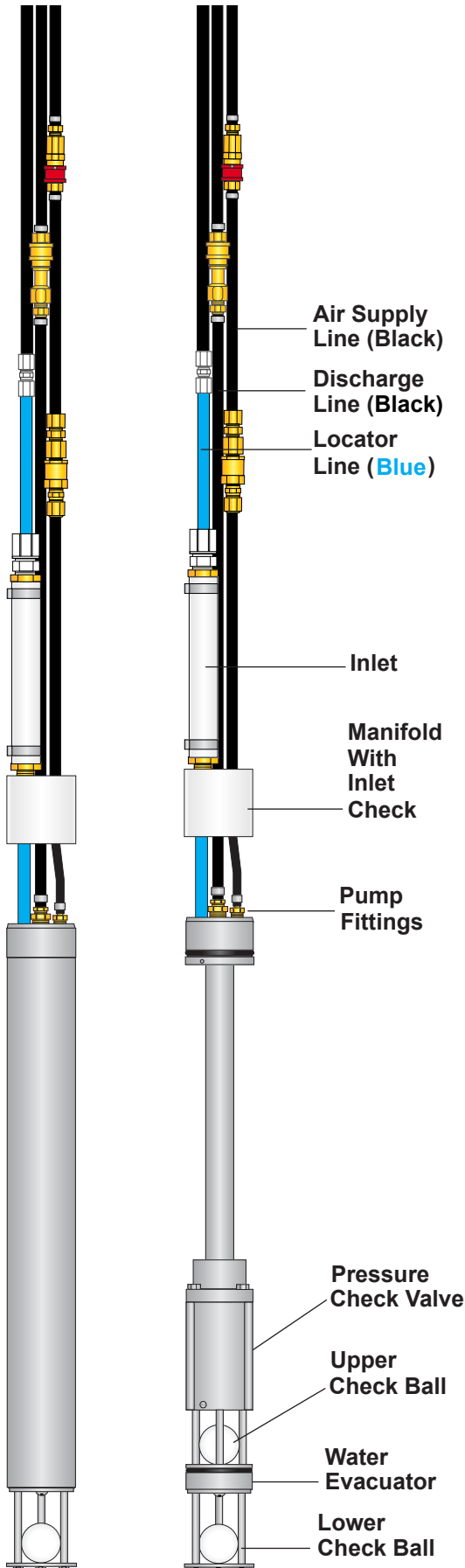
Up or add key.



Down or subtract key.

NOTE:

Display turns off after five minutes of nonactivity. Press any key to turn display back on.



Pump Type: Positive Air Displacement

Dimensions:

Pump O.D.: 1.75" (45 cm)

Length: 26" (67 cm)

Weight: 2.5 lbs. (1.13 kg)

Materials: Stainless Steel, Brass, Delrin, Polypropylene, and Viton O-rings.

Fittings: Brass Compression

Tubing:

Discharge Size: 3/8" O.D. (9.5 mm)

Air Supply Size: 3/8" O.D. (9.5 mm)

Level Gauge: 1/4" O.D. (6.3 mm)

Pump Performance:

Operating Pressure Range: 50-120 P.S.I.(350-840 kPa)

Maximum Lift: 200 Feet (60 m)

Estimated AirFlow Rate: 0.5-1.0 SCFM at 50 PSI (350 kPa)

Separator Flow Rates

Up to 200 GPD (757 LPD) possible with 6" (15 cm) or more of product submergence over inlet. Rate will vary depending on conditions.

Discharge Amount

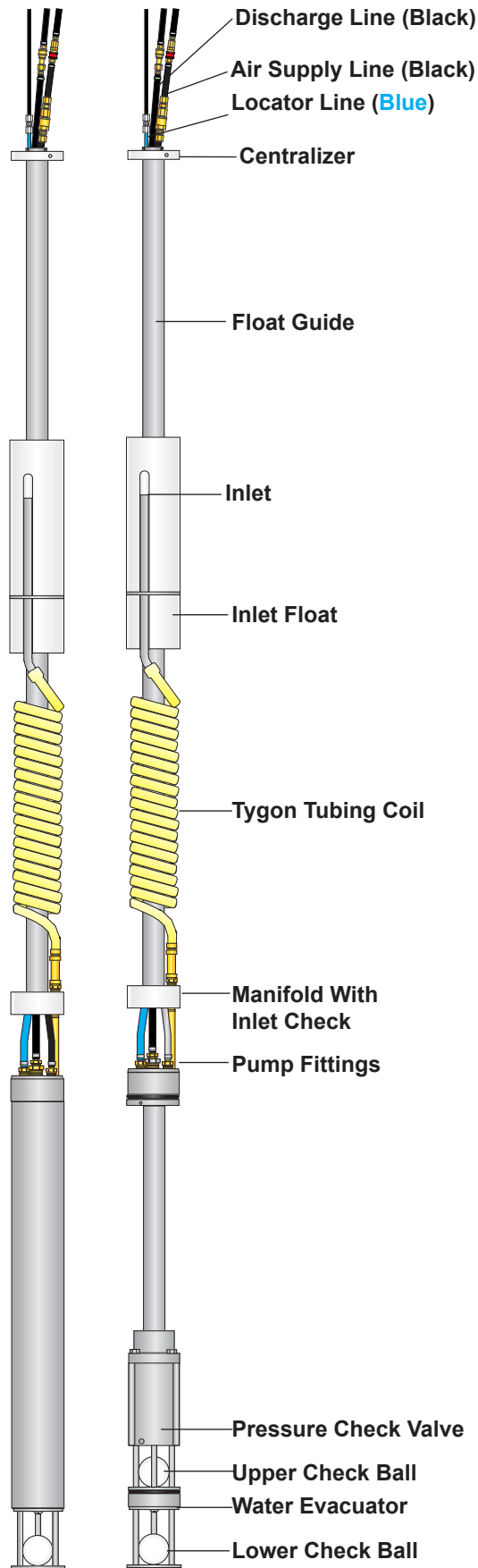
Maximum product volume per cycle 280 ml, varies depending upon amount of water that enters and is expelled by the separator. **The in-well separator will only discharge product to the surface.**

Product Pumped Density

0.7 -0.90 g/cc

Viscosity Range

The In-Well Separator is recommended for liquids with kinematic viscosities < 100 centistokes. Suitable liquids that may meet the viscosity recommendations are gasoline, JP4, JP5, Kerosene, Diesel Fuel, #2 Fuel Oil, SAE 10 (and above) Motor Oil, and Hydraulic Fluids. Incompatible liquids include water soluble fluids such as cutting fluids.



Pump Type: Positive Air Displacement

Dimensions:

Pump O.D.: 1.75" (45 cm)

Length: 47" (119 cm)

Weight: 3.5 lbs. (1.58 kg)

Materials: Stainless Steel Brass Delrin, Polypropylene, and Viton O-rings.

Fittings: Brass Compression

Tubing:

Discharge Size: 3/8" O.D. (9.5 mm)

Air Supply Size: 3/8" O.D. (9.5 mm)

Level Gauge: 1/4" O.D. (6.3 mm)

PUMP PERFORMANCE:

Operating Pressure Range: 50-120 P.S.I. (350-840 kPa)

Maximum Lift: 200 Feet (60 m)

Estimated AirFlow Rate: 0.5-1.0 SCFM at 50 PSI (350 kPa)

SEPARATOR FLOW RATES

Up to 60 GPD (227 LPD) possible with 6" (15 cm) or more of product submergence over inlet. Rate will vary depending on conditions.

DISCHARGE AMOUNT

Maximum product volume per cycle 280 ml, varies depending upon amount of water that enters and is expelled by the separator. *The in-well separator will only discharge product to the surface.*

PRODUCT PUMPED DENSITY

0.7 -0.90 g/cc

VISCOSITY RANGE

The In-Well Separator is recommended for liquids with kinematic viscosities < 4 centistokes. Suitable liquids that may meet the viscosity recommendations are gasoline, JP4, JP5, Kerosene, Diesel Fuel, #2 Fuel Oil. Incompatible liquids include #3 (and above) Fuel Oil, SAE 10 (and above) Motor Oil, and Hydraulic Fluids.

CONTROLLER

*C100M Solar/Electrical/Pneumatic Controller
110V AC 0-100 P.S.I.

*For more technical data see the tech/data sheet for the MPS 360

The optional Float Screen kit may be installed on a AIWSFI12 Ferret pump to decrease cleaning frequency in wells with suspended grits and solids. Screen installation is not recommended for wells with bio-fouling (diesels, weathered fuels, etc.) or very viscous fluids because this may actually increase the service frequency required for cleaning.

1. **Wrap screen around the float so that the edges do not terminate over the float's inlet slot.**
2. Install C-clips to hold screen in place. C-clips install by spreading slightly and sliding them around the screen. Make sure the c-clips are within the grooves provided, this will ensure proper clearance within the well.

NOTE: When installing screen take caution to not move inlet tube.

