OPERATIONS MANUAL

QED

Environmental Systems

Leaders in Environmental Compliance Products

ADDP

Surface Mounted Automatic Double diaphragm Pump

PO Box 3726
6095 Jackson Road
Ann Arbor, Michigan 48106-3726

(800) 624-2026 — North America Only
(734) 995-2547 — Tele.
(734) 995-1170 — Fax
info@qedenv.com — E-mail
www.qedenv.com

1565 Alvarado Street
San Leandro, California 94577-2640

(800) 537-1767 — North America Only
(510) 346-0400 — Tele.
(510) 346-0414 — Fax

Document No. **600005-06**

The equipment in this manual is protected under U.S. and foreign patents issued and pending:

U.S. Patents:	
Selective Oil Skimmer (SOS)	4,497,370
Specific Gravity Skimmer (SPG)	4,663,037
AutoPump (AP)	5,004,405
Specific Gravity Skimmer (SPG) Product Sensing	5,474,685
Vacuum/Pressure Hydrocarbon Recovery System	4,761,225
SPG PSR technology	5,474,685
AP-2	5,641,272
Genie System	5,704,772
Canada Patent:	
Specific Gravity Skimmer (SPG)	1,239,868

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INTRODUCTION

The Automatic Double Diaphragm Pump (ADDP) system is designed to automatically maintain a fluid level in a well or tank by sensing the fluid level and removing fluid which rises above the sensor. The ADDP system is powered by compressed air and requires no electricity. It is capable of flows from 0 to 15 gallons per minute (GPM), lifting from 22 feet or less below ground at sea level, and pushing with a force of 100 psi (231 feet of water column).

Chapter 1: Equipment

EQUIPMENT

The system is comprised of four basic components:

1) Double Diaphragm Pump
2) Two stage air filter/regulator
3) Well level control valve
4) Hoses and fittings

1) DOUBLE DIAPHRAGM PUMP (DDP)

• **DDP** - The **Double Diaphragm Pump (DDP)** can only be used above ground and pulls fluid from 22 feet or less below ground at sea level.

• **Needle valve -** The **DDP** has an adjustable **needle valve** to control its rate of cycling and quick connect fittings for both power air and fluid in and out. (See Figure 1)

2) TWO STAGE FILTER/REGULATOR

5 and 0.01 micron air filters - Two filters mounted on the aluminum plate remove particulates, oil vapor and water droplets from compressed air. The pump draws air from the 5 micron filter. The level sensor draws air from the 0.01 micron air filter.

• The first **air filter/regulator** (**5 micron particulate filter**) has a gauge and quick connect fittings for the compressed air coming from the compressor. This filter has an **automatic drain valve** which activates when the fluid level rises in the filter bowl. (See Figure 1)

• The second **air filter for the bubbler sensor system** (**0.01 micron oil coalescing filter**) has a **needle valve** to control the air bubbler rate. This filter also has an **automatic drain valve** which activates when the fluid level rises in the filter bowl. (See Figure 1)

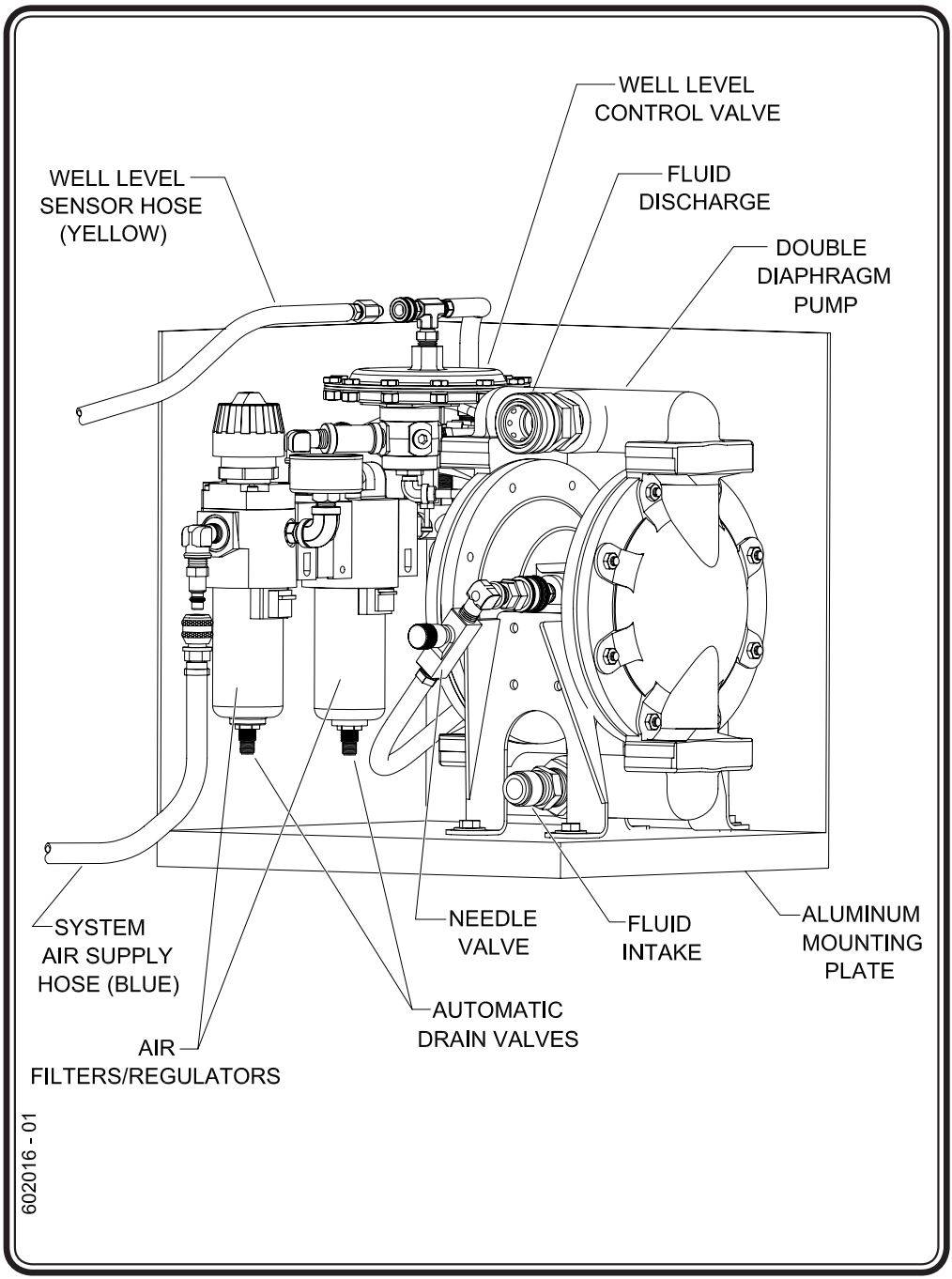


Figure 1 - ADDP System

3) WELL LEVEL CONTROL VALVE

• The **well level control valve** is mounted on top of the **two stage filter/regulator** assembly. It uses a **well level sensor hose** down well to sense the fluid level in the well. It supplies air to the **DDP** when the fluid level rises and shuts the **DDP** off when the fluid level recedes. (See Figure 1)

System with Foot Valve:

• The pneumatic sensor circuit has an **air bubbler** connected to the 1/4 inch **well level sensor hose** via a quick connect. (See Figure 2)

System with Top Loading Cup:

• The pneumatic sensor circuit has an **air bubbler** located inside the **top loading cup**. (See Figure 3)

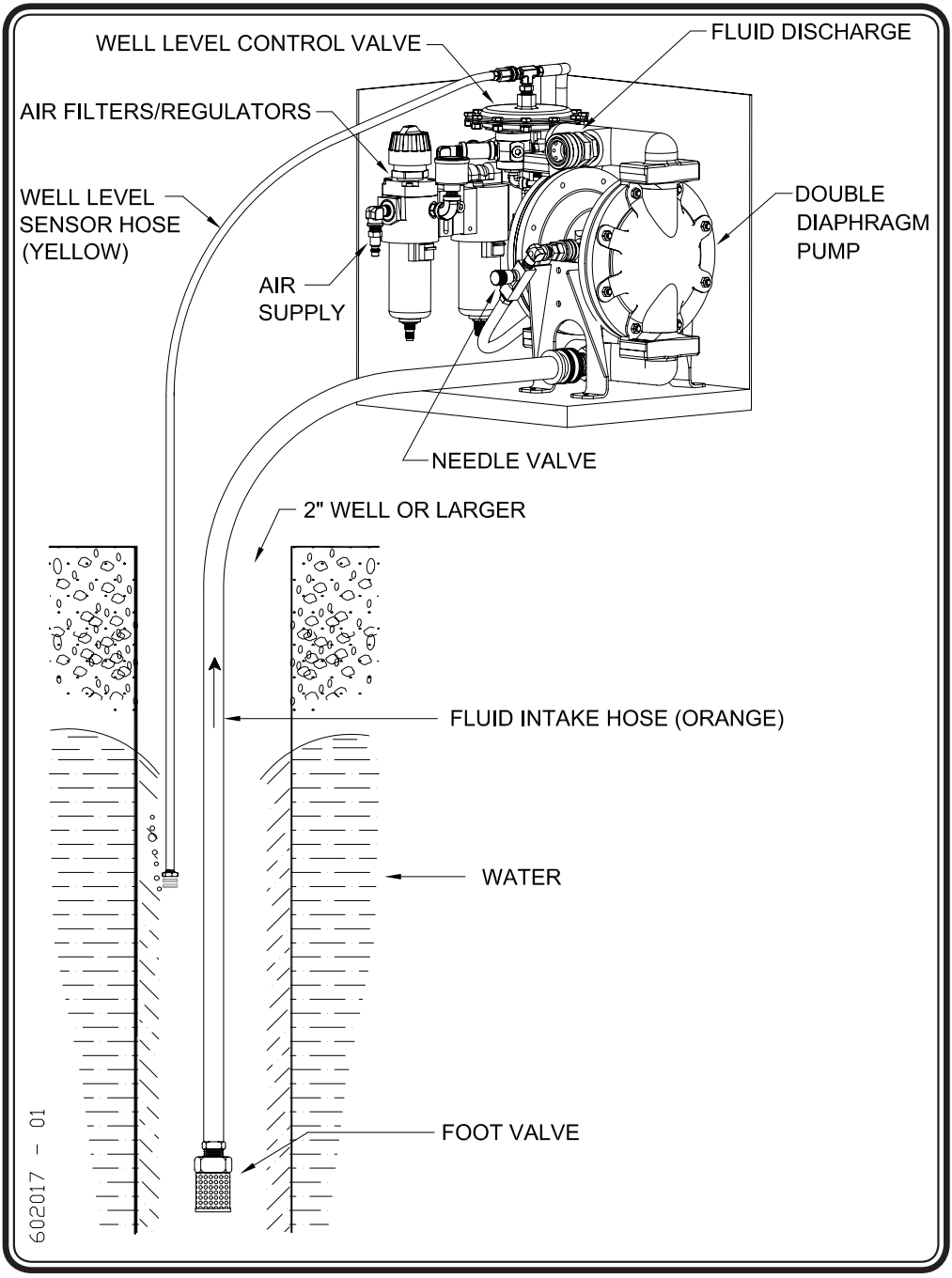


Figure 2 - ADDP System with Foot Valve

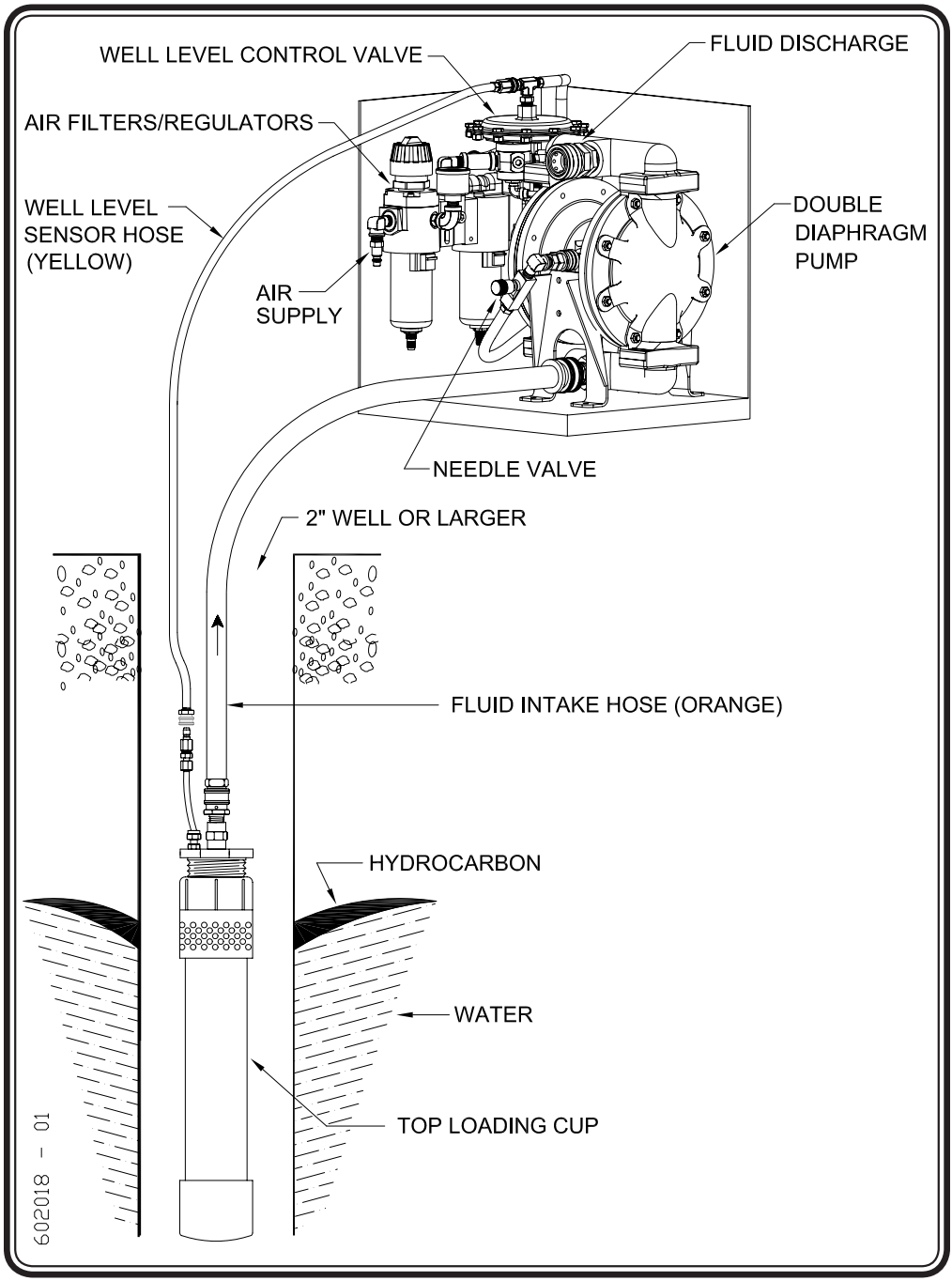


Figure 3 - ADDP System with Top Loading Cup

4) HOSES and FITTINGS

Four types of hoses are supplied with the ADDP system including: **system air supply hose, well level sensor hose, fluid intake hose** and **fluid discharge hose**.

• The **system air supply hose** is a **blue** 3/8 inch I.D. hose with brass MALE and FEMALE quick connects. The **system air supply hose** runs from air compressor to the pneumatic system.

• An **air hose socket with 1/4 inch MPT** allows the **system air supply hose** to connect from the compressor to the **air filter/regulator**.

• The **well level sensor hose** is a **yellow** 1/4 inch I.D. hose with 1/8 inch I.D. straight-through brass quick connect fittings. The hose is connected to the small quick connect on the top of the pneumatic system. The other end of this hose is positioned in the well or tank from which the fluid is being drawn.

• There are two **fluid hoses**, one for **intake** (ribbed), and one for **discharge** (smooth).

• The **fluid intake hose** is 1 inch I.D. or larger. With quick connect fittings, this hose is connected to the **DDP** and runs into the well or tank from which the fluid is being drawn.

• The **fluid discharge hose** is 3/4 inch I.D. or larger. With quick connect fittings, this hose is connected to the **DDP** and runs to the **discharge point**.

• The **foot valve** placed on the end of the **fluid intake hose** keeps the **DDP** from losing prime by preventing fluid from leaving the hose. (See Figure 2)

• The **top loading cup** placed on the end of the **fluid intake hose** draws in hydrocarbon products. The **well level sensor hose** is attached to the quick connect on the **top loading cup**. (See Figure 3)

Chapter 2: Operation

OPERATION

SAFETY FEATURES

The ADDP system minimizes the potential for accident with the following safeguards:

- All components are air-driven.
- All air hoses have automatic shut off quick connects which prevents injury due to accidental high pressure discharge.
- All quick connects are brass to eliminate sparking hazard.
- Air filter bowls are made of zinc. This provides greater chemical resistance, and unlike plastic bowls zinc is less prone to damage if dropped.

Chapter 3: Assembly

ASSEMBLY

NOTE: When operating and maintaining the system, disconnect air and fluid lines cautiously to avoid spilling fluids.

• Wear safety goggles to protect eyes from any splashing or pressure release.

• Wear chemically resistant rubber gloves when pulling the hoses from the well to avoid skin contact with the product being recovered.

• The hose which carries the air from the pneumatic circuit to drive the **DDP** is already connected

• Position the system on a level surface. The fluid level should not be more than 22 feet below the **DDP**.

STEP 1 - LOCKING QUICK CONNECT INSTRUCTIONS

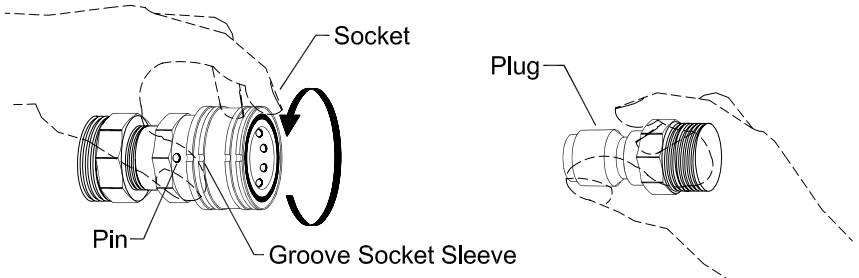
• Follow the instructions on **Figure 4** for properly securing the locking quick connects.

STEP 2 - AIR COMPRESSOR to PNEUMATIC SYSTEM - System Air Supply Hose

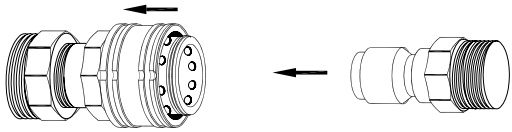
• Connect the FEMALE **air hose socket with 3/8 inch MPT** to the air compressor making sure to use the teflon tape on the threads. (See Figure 2)

• Connect the MALE quick connect on the **system air supply hose** to the FEMALE socket on the air compressor. (See Figure 2)

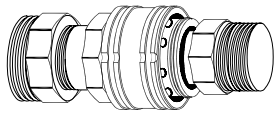
• Attach the FEMALE quick connect on the **system air supply hose** to the MALE air supply quick connect near the **air filter** on the pneumatic system. (See Figure 2)



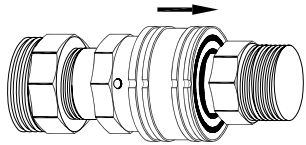
a. Rotate socket sleeve until groove is aligned with the pin close to the hex.



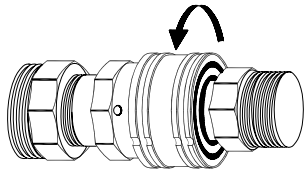
b. Pull socket sleeve against the hex (the pin will be totally covered). Hold in this position for plug insertion.



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



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



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

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Figure 4 - Locking Quick-Connect Instructions

STEP 3 - PNEUMATIC SYSTEM to DOWN WELL - Well Level Sensor Hose

System with Foot Valve:

• Connect the MALE quick connect on the **well level sensor hose** to the FEMALE quick connect on the top of the pneumatic system. (See Figure 2)

• The FEMALE end of this hose is positioned in the well or tank from which the fluid is being drawn. This hose end is usually secured about six (6) inches below the desired fluid level. (See Figure 2)

System with Top Loading Cup:

• Connect the MALE quick connect on the **well level sensor hose** to the FEMALE quick connect on the top of the pneumatic system. (See Figure 3)

• Connect the FEMALE quick connect on the **well level sensor hose** to the MALE quick connect on the **top loading cup**. (See Figure 3)

STEP 4 - DDP to WELL and DISCHARGE POINT - Fluid Hoses

System with Foot Valve:

• Connect FEMALE quick connect of the **fluid *intake* hose** to the MALE **DDP** quick connect. The MALE end of the **intake hose** with **foot valve** is positioned in the well or tank below the desired fluid level. (See Figure 2)

• Connect the MALE quick connect of the **fluid *discharge* hose** to the FEMALE **DDP** quick connect. The FEMALE end of the **discharge hose** leads to a **fluid discharge point**. (See Figure 2)

System with Top Loading Cup:

• Connect FEMALE quick connect of the **fluid *intake* hose** to the MALE **DDP** quick connect. The MALE end of the **intake hose** with **top loading cup** is positioned in the well or tank at fluid level. (See Figure 3)

• Connect the MALE quick connect of the **fluid *discharge* hose** to the FEMALE **DDP** quick connect. The FEMALE end of the **discharge hose** leads to a **fluid discharge point**. (See Figure 3).

Chapter 4: Installation

INSTALLATION

This chapter describes the installation of the air compressor**.**

AIR COMPRESSOR INSTALLATION:

QED Environmental Systems usually does not supply the air compressor. It is best to buy the compressor from a local supplier who provides service.

NOTE: An automatic drain on the compressor receiver tank significantly reduces the load on the air filters, extends the life of the filter elements and reduces system maintenance.

The air compressor provides the air necessary to drive the system. The compressed air passes through a **two stage filter/regulator** and then into the pneumatic system where it powers the **DDP** and controls operation of the system.

NOTE: The information on compressors is for reciprocating piston compressors. A centrifugal compressor produces about twice the air of a piston compressor for the same horsepower.

To select a compressor, follow this formula: a reciprocating piston compressor should not run more than 50% of the time. For every 1.5 Gallons Per Minute (GPM) of water, the compressor should have **1** HP. For every 100 Gallons Per Day (GPD) of fuel, the compressor should have **1** HP. At a minimum, the air compressor should be in the **1 to 1-1/2** horsepower (HP) range with a 20 gallon holding tank. A **1** HP air compressor allows the system to remove 100 GPD of fluids. **1** HP provides approximately 3.5 cubic feet per minute (scfm) of free air.

The **2** and **3** HP compressors should have 60 to 80 gallon tanks. A **5** HP compressor should have an 80 gallon tank and the **7-1/2** HP and **10** HP compressors should have a 120 gallon tank. Storage tanks and automatic pressure shut off switches provide a buffer so the compressor motor can cool between each time the tank is pressurized.

Electrical wiring for the Compressor

All electrical connections should be made by a licensed electrician and in accordance with the electrical code for particular areas. The wiring should provide full motor nameplate voltage and current at the motor terminals during starting.

Wiring hook-up must be made so that the compressor flywheel turns in the proper direction. There is usually an arrow on the flywheel to indicate the proper rotation direction.

Motor overload protection

To prevent motor damage, provide all compressor motors with overload protection. Some motors are furnished with built-in thermal overload protection.

To prevent motor damage due to low voltage or undue load imposed on the motor, larger motors should be used in conjunction with starters that include thermal overload units.

To determine the proper thermal protection (thermal element), consider the load to be carried, starting current, running current and ambient temperature. Recheck electric current characteristics against nameplate characteristics before connecting wiring.

NOTE: Fuses are for circuit protection only, and are not to be considered motor protection devices. Consult your local power company regarding proper fuse size.

In compressors requiring lubricating oil, do not use synthetic oil. Synthetic oil adversely affects the **DDP**. Non-detergent 30 Weight oil is recommended for compressor lubrication.

An automatic drain should be installed on the compressor holding tank to periodically drain the water and oil which collects in the tank.

Do not lubricate the compressed air coming out of the compressor. The **air filters** are designed to remove oil from the compressed air. If there is too much oil in the compressed air, it will reach the control and possibly cause a shut-down.

The compressor should provide between 70 and 200 pounds per square inch (psi) of air pressure to the system. The filter and regulator will accept a maximum of 200 psi air pressure. Maximum air pressure setting on the regulator is 120 psi.

Chapter 5: Start Up

START-UP

Once the hoses are connected and the system is receiving compressed air (between 40 and 100 psi), fluid can be pumped. The rate of the pumping (cycle rate of the **DDP**) can be adjusted by opening or closing the **needle valve** in the air hose going from the pneumatic circuit to the **DDP**. If the flow rate is low, the **DDP** cycling rate should be fairly low. This prevents the **DDP** from running fast and drawing the fluid down too far allowing air to enter into the **intake hose**. This could cause a loss of suction temporarily until the **DDP** pulls the fluid up the hose again. (See Figure 1)

The system will turn itself on and off automatically based upon the fluid level change in the well or tank.

Chapter 6: Maintenace

MAINTENANCE

The **air filters** should be changed periodically depending upon the cleanliness of the air coming from the compressor. Both **air filters** have an **automatic drain valve** that drains the filter bowl of water. The valves function satisfactorily as long as the air is not very oily. Both bowls should be checked for a buildup of emulsified (white solid) oil and water. This build-up will clog the valve.

If the valves become clogged, oil and water can be sent into the pneumatic circuitry. This will not harm the **DDP** if it is detected within a few days. The passage of oil and water into the **DDP's** air side will show up in the air exhaust muffler. Oil and water droplets and perhaps a pool of liquid under the **DDP** will appear.

TWO STAGE AIR FILTER/REGULATOR MAINTENANCE:

If the air is clean and dry, the system should operate trouble-free for years. The **air filters** consist of a **5 micron** and **0.01 micron oil coalescing** filter. All have replaceable elements.

To replace the element in the **5 and 0.01 micron air filters** on the **two stage filter/regulator:**

STEP 1 - SYSTEM AIR SUPPLY HOSE

Disconnect the **system air supply hose (blue)** to the **air filter**, this will depressurize the **air filters** and allow them to be safely serviced.

STEP 2 - ZINC BOWLS

Remove the zinc bowls of the **air filters** by sliding the black button downward and twisting the bowl about 1/10 of a turn. The bowl should slide downward from the upper portion of the filter revealing the filter elements. The elements can be removed by unscrewing them (like a light bulb). When replacing them be sure they are hand tight.

STEP 3 - FLOAT DRAINS

Wash out any deposits and oil build-up from the filter bowls with warm water and soap. Ensure the float drains are operating freely by shaking them. They should rattle. The float drains can be tested by filling the bowls with water, assembling of bowl to the filter and reconnecting to the air supply. The water should drain from the bowls.

AIR COMPRESSOR MAINTENANCE:

NOTE: The following are standard maintenance procedures which the *QED Environmental Systems* "warranty" does not cover. *QED* does not manufacture compressors. Always use the manufacturers instructions and recommendations when installing, using and servicing the compressor. These notes are included as a general guide only.

Although *QED* usually does not supply the compressor, this section is provided to help the operator. If the system receives clean, oil-free air from the compressor, maintenance will significantly be reduced.

Inspection - Check for possible damage in transit. Almost all compressors are shipped with the flywheel unmounted. Do not force the flywheel on crankshaft. Use a wedge in "slot" provided for easy assembly. Belt alignment and tension must be checked carefully.

Placement - A compressor is a source of sparking so it must be placed out of what is considered a hazardous area by local and national fire and electric codes.

Mounting - Install in a clean, dry, well ventilated location away from any source of heat such as a boiler or radiator. If the unit is to be fastened to a foundation, all four feet must be firmly supported and shimmed to remove all stress from unit. Pump flywheel should be mounted towards wall with minimum clearance of 18 inches to allow for circulation of air and additional clearance if required for servicing.

Lubrication - Fill crankcase to level mark on oil gauge with an industrial compressor oil having a minimum of 95 V.I. or SAE No. 30 non-detergent, single grade motor oil. (See Chart). Do not use synthetic oil, as these can damage the **DDP**.

Ambient Temp.	ISO Viscosity CS+	SAE No.
0°F - 40°F	46-68	20
40°F - 80°F	100	30
80°F - 120°F	150	40
Under 0°F Over 120°F	Consult Compressor Manufacturer	

Compressor Maintenance:

Pressure and Speed - Never operate the compressor at pressures or speeds in excess of those recommended by the compressor manufacturer. Every compressor assembly must have a safety valve installed and should be set at either the maximum tank working pressure or 25 psi over the actual pressure of the **pump**, whichever is less.

Daily - Check for unusual noise, failure to compress, overheating, oil leaks, and vibration. Correct before serious damage can develop. Drain all condensate from receiver and traps.

Weekly - Examine intake filter elements and if dirty, remove and clean or replace. Check oil level and add if necessary. Do not fill over level mark on sight glass. Keep compressor clean for efficient operation and appearance.

Monthly - Check and tighten all bolts and nuts are required. Check air connections for air leaks and tighten as required. Check belt tension.

GENERAL MAINTENANCE:

Periodically inspect all hoses and connections for damage. Make sure that the hoses are not split or cracked and listen for leaks in the system.

Soapy water can be sprayed (squirt bottle) on to the control to locate leaks. Dish detergent in water will not damage the controls. A harsh, concentrated cleaner could possibly attach to some portions of the controls.

Chapter 7: Troubleshooting

TROUBLESHOOTING

Problems can possibly occur and can easily be resolved by following the instructions below. If you need assistance, please do not hesitate to call *QED Environmental Systems (QED)* Service Department.

Excessive oil contamination from the air supply or exposure to freezing conditions may cause damage that requires assistance from *QED*.

DDP ceases to draw down the fluid level.

NO AIR TO THE SYSTEM - Re-establish air to the system.

NO AIR TO THE DDP - See if **air bubbler** is still bubbling. Blow into **well level sensor hose** or fitting to simulate high fluid level. (See Figure 2)

- Close and open **needle valve** to clear possible blockage.
- Adjust primary regulator so gauge reads between 40 and 100 psi.
- Change filter elements, if clogged.

AIR BUBBLER DOES NOT BUBBLE - Close and open **needle valve** on far right of pneumatic circuit to eliminate blockage. Adjust **needle valve** so **air bubbler** bubbles about 5 bubbles per second. (See Figure 1)

EVERYTHING HAS PROPER AIR FLOW AND PRESSURE AND SYSTEM DOES NOT FUNCTION - Disconnect the **system air supply hose** from the **DDP** and reconnect. An exhaust of air from the male fitting should be heard when the hose is disconnected. This is to "shock" the **DDP** drive past a position of high friction. (See Figure 1)

How to Contact *QED*

If for any reason you are unable to find what you need in this manual please feel free to contact the *QED* Service Department at any time.

Service Department
QED Environmental Systems
www.qedenv.com

San Leandro Service Center
1565 Alvarado Street
San Leandro, California 94577-2640

(800) 537-1767 – North America Only
(510) 346-0400 — Tele.
(510) 346-0414 — Fax

Ann Arbor Service Center
PO Box 3726
6095 Jackson Road
Ann Arbor, Michigan 48106-3726

(800) 624-2026 — North America Only
(734) 995-2547 — Tele.
(734) 995-1170 — Fax
info@qedenv.com — E-mail

***QED* can be reached 24 hours a day**

We welcome your comments and encourage your feedback regarding anything in this manual and the equipment you have on site.

Thank you again for specifying *QED* remediation equipment.

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Appendix: Equipment List

Equipment list for the Automatic Double Diaphragm Pump (ADDP) System

GENERAL:

Qty	Description
1	DDP-1 Double Diaphragm Pump
1	5 Micron filter with auto drain trap
1	Pressure regulator with gauge
1	0.01 Micron oil coalescing filter for bubbler sensor system with auto drain trap
1	Low Pressure regulator
2	Needle valve
1	Air hose socket with 1/4 inch MPT
1	Well level control valve
1	Foot valve
	or
1	Top loading cup

GENERAL HOSE:

Qty	Ft	Hose Description
1	25	3/8 inch system air supply hose (blue)

DOUBLE DIAPHRAGM PUMP HOSE:

Qty	Ft	Hose Description
1	25	1/4 inch well level sensor hose (yellow)
1	25	3/4 to 1 inch fluid intake hose
1	15	3/4 to 1 inch fluid discharge hose