



INSTALLATION MANUAL FOR THE SIMPLE PUMP SOLAR-POWERED MOTOR UNIT

(BATTERY CONFIGURATION)

LBLD24-4S

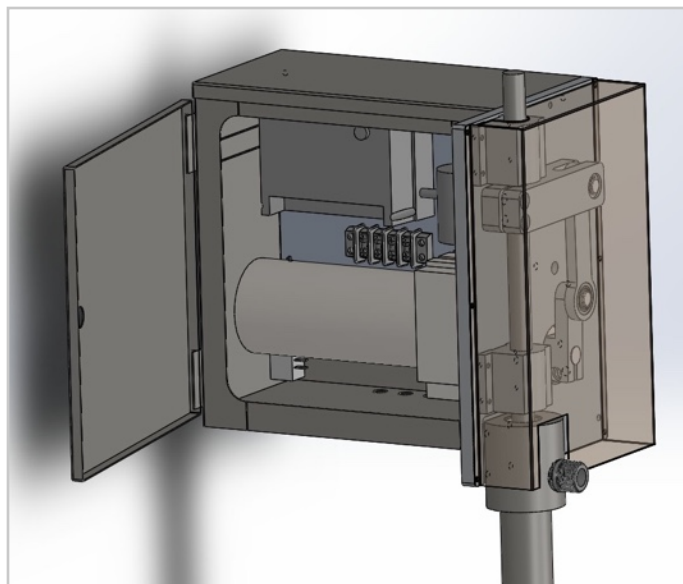
(The following instructions are very detailed, and should tell you everything you need to know. If you have questions, please phone 775-267-1093.)



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SECTION 1: INTRODUCTION

Thank you for purchasing the Simple Pump solar-ready motor.

The motor is a 24-volt DC unit that delivers the most amount of torque available in this size motor.

The linear bearing link drive translates the rotary action of the Simple Pump 24 volt DC gear motor to move the pump rod up and down on a precision ground and polished stainless shaft guided by two linear TEFLON bearing carriers.

Just like the Simple Pump itself, your gear motor assembly and control box have been built giving great care to precision. When moving parts are at work, precision parts move more easily... and this means less wear, and a longer life for the equipment. So, please assemble with Finesse, NOT Force.

If you have any questions, do not hesitate to call Simple Pump - 877.492.8711 ext 6.

SPECIFICATIONS

Motor Rating	.151 HP continuous
Gear Ratio	30:1 @ 91.0% efficiency
Output Torque	195 in/lbs. continuous
Output Torque Maximum	400 in/lbs. @ 45.9RPM @ 16.63 amps
Nominal Output RPM	60.1
Efficiency	64.24%
Full Load Motor Current	7.32 amps
Allowable Voltage Range	24 to 30 VDC
Typical temperature of casing, operating in 72°F ambient	128° Fahrenheit

DC motors operating in ambient temperatures above 100°F lose operating efficiency -- the hotter the ambient temperature, the less efficient. If the temperature at the planned site regularly peaks above 100°F, we recommend operation of the motor in shade.

RECOMMENDED PUMPING CONFIGURATION

The solar-powered Simple Pump is an integrated, standardized system that will provide water at the surface.

What you do after that will vary, depending on your needs. **The recommended configuration is to pump into the ambient (i.e. non-pressurized) storage tank.** Then, if you want to charge a pressure tank, a small transfer pump can move the water from the ambient tank to the pressure tank.

Since needs for tank volume and pumping capacity will vary greatly, we do not provide the ambient tank or transfer motor.

Tanks: See the range of Bushman drinking water storage tanks, on the bottom of this page:
<http://www.loomistank.com/bushman-tanks.shtml>

Transfer pump: Pumps designed specifically for this job are available from a number of vendors, e.g. Dankoff, Surflo and Jabsco. Many such pumps cost less than \$150.

Configuring like this raises the overall reliability and longevity of the system. Transfer pumps include an integrated pressure switch. The switch turns the transfer pump on and off, according to a target pressure.

Pumping into pressure: Pumping into pressure is possible, as long as static level plus any vertical rise plus pumping into pressure is within our maximum total head (225' for the 100CA pump cylinder or 175' for the 125CA. Note that 50psi relates to approximately 110 feet of head.) There are two issues that would need to be dealt with with increasing distance between the motor and the pressure tank... voltage drop between the motor and the pressure switch and the resonant back-pressure wave that can arise. Both of these issues can be dealt with by using a mini-pressure tank (or some other form of hydraulic shock absorber) very close to the motor, and then pumping out to the main pressure tank. Please ask us if you want to consider this possibility.

SOLAR POWER SOURCE

Choose a location as close to the well as possible and practical, to eliminate any voltage drop between components (i.e loss of available power). Keep in mind the power leads provided are 20' in length. (Custom lengths are also available.)

Also keep in mind that the solar panel will be facing south and we do not want it to be shaded by any other structures, plants, trees, or even the pump itself.

Batteries

You will need two 12v batteries, Group 27 or 31 Deep Cycle (from almost any auto parts store) and minimum 100 amp-hour rating.

Lead acid will be the least expensive....maybe \$95.00 each on sale. AGM will be about three times what the lead acid cost but will last longer.

The batteries need to be kept clean and dry at all times, out of the rain, snow, ice, and direct sunlight, to increase longevity. The battery enclosure should be high enough off the ground to avoid rain runoff and snow accumulation.

This system places the battery box in the shade of the solar panel, as shown.



UNPACKING & INSPECTION

Using the 9/64" Allen wrench, remove the six screws that attach the cover.

You will have:

LBLD mechanism with stainless steel drive cover and electrical components cabinet

(2) keys for the cabinet door

3/4" x 36" stainless steel pump rod and 3/4" x 13" stainless steel pump rod extension

(2) 15amp ATO/ATC prong style fuses

(3) 15amp ATO/ATC prong style fuses (spares)

(4) 1/4"-20 x 7/8" SS SHCS fasteners for mounting the LBLD to the pump head

(4) 20 foot solar cables with connectors

#6 gauge jumper cable for connecting two batteries

TOOLS YOU WILL NEED FOR INSTALLATION

(4) Allen wrenches: 9/64", 3/16", 1/4", 5/16"

(2) Channel locks

(1) Medium Phillips screwdriver

A small crescent wrench. (less than 1" mouth)

Portable drill with 3/8" bit and 1/2" bit

Measuring tape

Sharp point marker or pencil

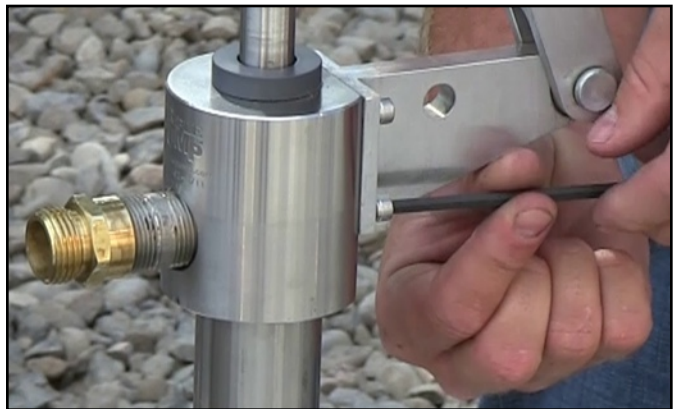
SECTION 2: PREPARING AN EXISTING HAND PUMP FOR MOTOR INSTALLATION

This section presumes you have a Simple Hand Pump is already installed and that it is pumping water with an overall smooth operation.

You should confirm that your pump is delivering at least one gallon of water with approximately 25 strokes with the lever handle system. Starting with a fully functional lever-arm pump, what follows are the step-by-step installation instructions to remove the handle assembly and install the motor.

REMOVE THE LEVER ARM MECHANISM

Using the 3/16" Allen wrench, remove each of the four fasteners holding the lever arm mechanism to the pump head.



Remove the lever arm bracket and lever (they should still be connected) from the 3/4" stainless rod (right).

The direction you turn is the opposite of normal -- turn clockwise to remove, rather than the normal counterclockwise.



IF YOU HAVE A 13" ROD EXTENSION...

Attach it, now, to the top of the current 24" rod.

You now need to make sure that at least 6 inches of riser tube are below the split flange on the cap.

Have a helper hold the riser tube. Use the 3/16" Allen key to loosen the pinch bolt and the 3 mounting bolts on the split flange enough to pull the pump head (including riser tube) up out of the well.

When you see where the bottom of the riser tube is, lower again so that 6 inches are below the split flange. Finally,

- tighten the pinch bolt (on right)
- and then the three mounting bolts.

Then proceed to "Section 3: Installation".



IF YOU HAVE A 36" ROD EXTENSION...

Continue with the next two pages of instructions to replace the current 24" rod with the new 36" rod.

Do this with a helper.

Using the 3/16" Allen key, loosen the pinch bolt and the 3 mounting bolts on the split flange enough to pull the pump head (including riser tube) up out of the well.



While holding the pump head by the riser tube, seat the safety tool securely on the split flange.



Then, slowly lower the bell end of the top drop pipe onto the safety tool (below).



Use a channel lock to remove the riser tube and pump head. This allows access to the 3/4" stainless rod. **Do not** remove the stainless nipple (i.e. the short steel tube connecting the pump head to the top drop pipe).



Disconnect the existing, 24", stainless steel rod from the topmost sucker rod. Install the 36" rod in its place.



Reinstall the pump head and riser tube. Secure it firmly on the stainless nipple.



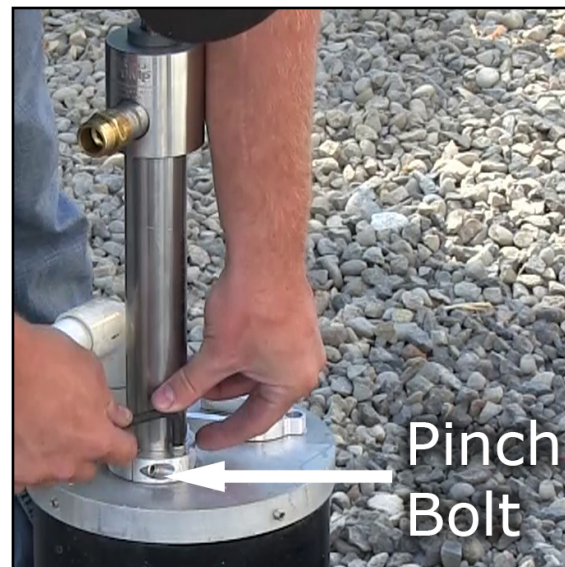
Lift the riser tube (and pump head),
And then remove the safety tool.



Then lower the riser tube so that at least 6 inches of riser tube are below the split flange on the cap.

Finally,

- tighten the pinch bolt
- and then the three mounting bolts.



This ends the preparation of an existing hand pump.

SECTION 3: INSTALLATION OF DRIVE ASSEMBLY

INTRODUCTION

In the previous section, you prepared (if applicable) an already installed hand pump for installation of the solar motor unit. **If you are installing your Simple Pump now, you will start HERE.**

If you did not already, lower the riser tube so that at least 6 inches of riser tube are below the split flange on the cap. Your final step will be to tighten the pinch bolt and then the three mounting bolts.

You are now ready for motor installation.

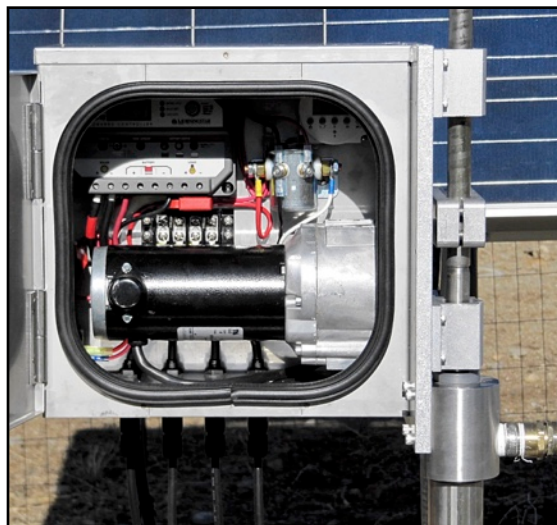
INSTALLATION

Lower the **Linear Bearing Link Drive Mechanism (LBLD)** so that the stainless rod is inserted through three openings. In order, these are:

- The lower linear bearing.
- The yoke.
- The top linear bearing.

Orientation: The DC motor faces away from the pump nozzle. When you lower the LBLD onto the stainless rod, be sure that the four mounting holes below the lower linear bearing are aligned with the four mounting holes on the pump head, that held the lever arm mechanism in place.

Now is the time where a second set of hands might be helpful to deal with the added weight of the control box and to assure easier alignment of the lower linear bearing, yoke, and upper linear bearing as you slide them down onto the $\frac{3}{4}$ " rod extension.



Position the Linear Bearing Link Drive Mechanism

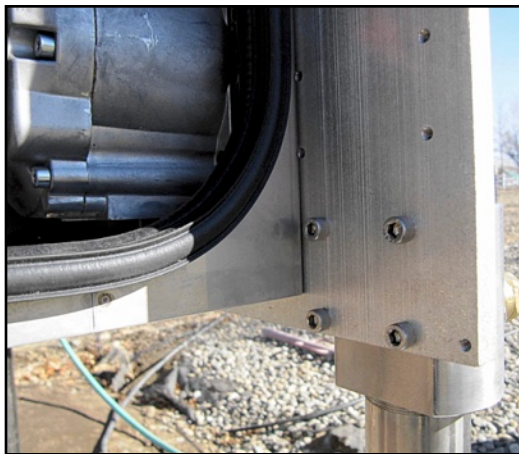
The DC motor faces away from the pump head.

Lower the motor with Linear Bearing Link Drive Mechanism (LBLD) so that the stainless rod is inserted into 3 openings. The stainless rod moves through, in order:

- The lower linear bearing.
- The yoke.
- The top linear bearing.

Align the holes for the four mounting bolts with the four holes on the flat rear of the pump head.

There is 1/4" of space between the bearing housing and the top of the rod gland when the holes are aligned. The rod gland is the topmost exposed component on the pump head.



Screw the four mounting bolts (1/4-20x3/4" SS SHCS) through the holes just aligned, fastening the mounting plate to the pump head. (Left.)

Lift up the 3/4" diameter SS pump rod 2 inches to make sure that the piston is not sitting on the ball at the bottom of the pump cylinder.

Then using a 5/16" Allen wrench, tighten the two stainless steel socket head cap screws on the yoke.

This pinches the yoke so it is fastened to the stainless rod.



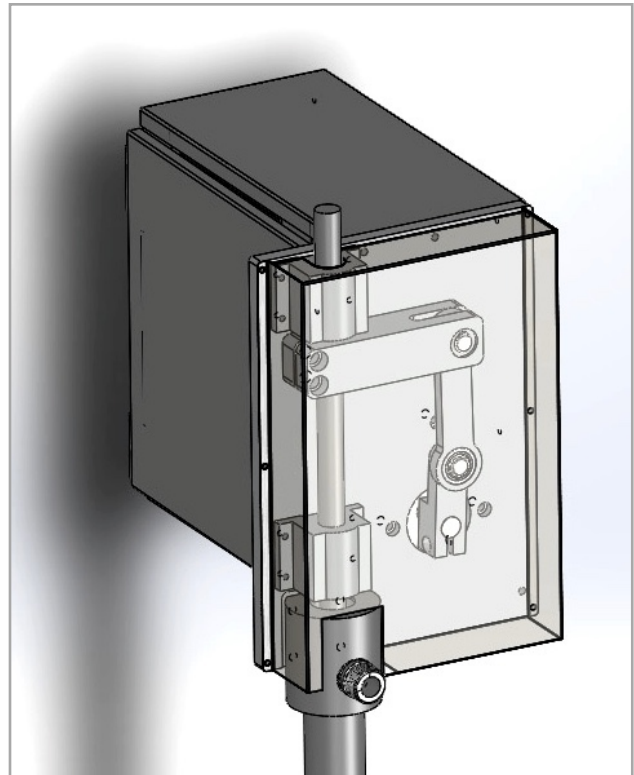
SPECIAL NOTE IF USING 13" EXTENSION

It is equally important for the pump head seals that only the smooth continuous rod pass by the seals on each stroke. Before you tighten the two stainless steel head cap screws on the yoke, lift the $\frac{3}{4}$ " rod so that the joint where the 13" extension couples with 24" extension is clear of the pump head and will not enter the pump head at the bottom of the down stroke.

Attach the cover to the LBLD mechanism.

Use your 9/64" Allen wrench for the (6) 8-32 SS SHCS that attached the cover the mechanism's mounting plate.

Diagram shows how the cover fits onto the mounting plate.



SECTION 4: SOLAR PANEL AND MOUNT

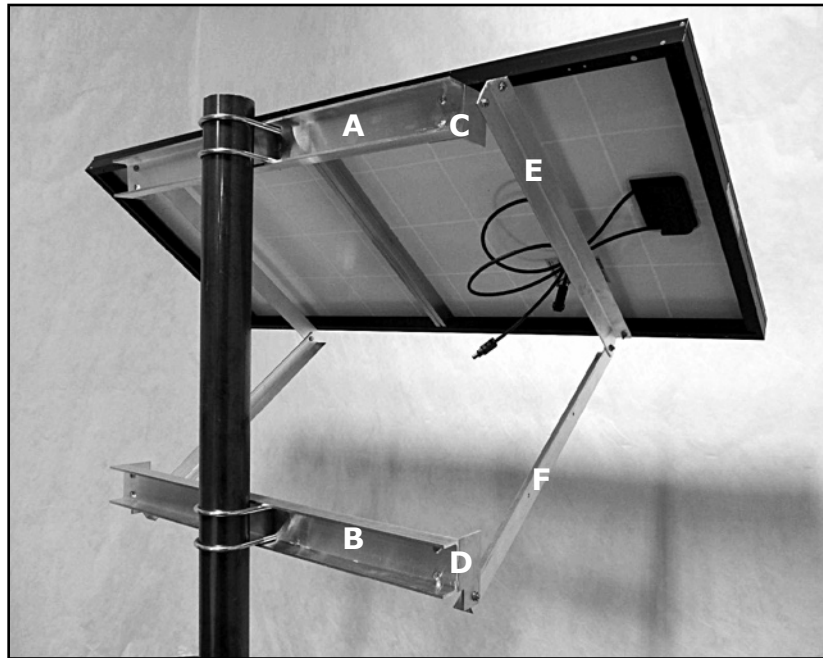


Photo is just one example of a pole-mount system by General Specialities.

You will have purchased your own pole or roof mount hardware. It will have its own assembly instructions. Proceed with that assembly now.

GENERAL TIPS FOR INSTALLING A POLE-MOUNT SYSTEM

The steel pole used must be strong and stable enough to support one, two or three panel, as appropriate for your system. It is critical that, in high wind conditions, the PV cannot spin around or move and break the electrical connections to the control box.

Your unit's instructions take precedence. A few general tips that may be useful are:

We **STRONGLY RECOMMEND** that the mounting pole extend a full 3' below ground level.

- Make your hole 3 feet deep, with post hole digger or by hand.
- Place stabilizing material such as coarse gravel or small rocks around the pole, to a depth of 1.5'.
- With a level, check the pole is vertical. Brace with gravel/rocks as necessary to hold the pole.
- Add at least one full bag of concrete to the hole. (Sakrete is convenient for this job.)
- Four guide wires or ropes at 90 degrees can help hold the pole vertical while the concrete dries.

FINAL STEP: ATTACH BATTERY BOX TO POLE, IF APPLICABLE

(These are general example instructions only. They may or may not apply precisely to the mounting hardware you have purchased. Adapt as needed.)

Center the stainless steel mounting bracket (.120" thick x 1.000" x 5.875" with two .530" holes and two .400" holes) in the 28.50" width of the battery box two inches down from the top edge of the box.

If you have a 3" galvanized mounting pole (single module)...mark the two .400" holes and drill with a 3/8" bit.

If you have a 4" galvanized mounting pole (double module)...mark the two .530" holes and drill with a 1/2" bit.

Rest the battery box on the bottom cross-bracket.

Stabilize and affix the battery box to the pole using the U-Bolt as shown in the photo below.



SECTION 5: ELECTRICAL CONNECTIONS AND OPERATION

BATTERY CONNECTIONS

Be sure that the main switch on the outside of the control box is in the off position!

Always connect batteries first!

There are no connections to be made inside the control box, they have all been made for you at Simple Pump.

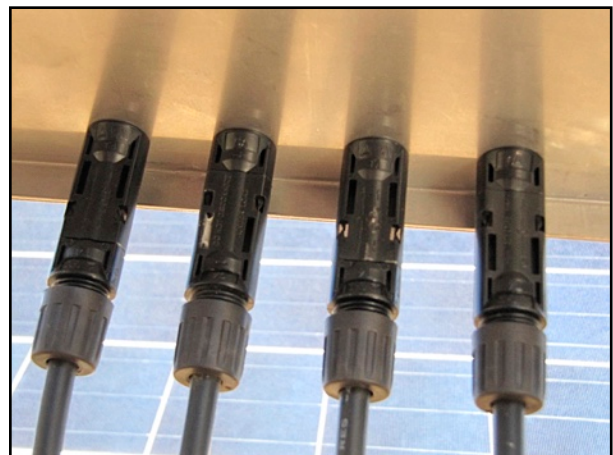
Using your two 12 volt batteries we now need make a series connection of the two batteries to take them from being two 12 volt batteries to one 24 volt bank. You want to get the positive terminal of one battery close to the negative terminal of the second battery.

Using the #6 jumper (included), connect the positive post of the first battery to the negative post of the second battery, and tighten these connections. At this point the negative terminal of the first battery and the positive terminal of the second battery are not being used. Select from the four 20' cables that came with your Solar Package the two cables with ring terminals on one end and MC4 (Solar) connectors on the other end.



Notice that one of the ring terminals is larger in diameter than the other, 3/8" and 5/16". **The 5/16" ring terminal attaches to the empty negative post of the first battery and the 3/8" ring terminal to the empty positive post of the second battery.**

The opposite ends of these two cables plug into the male and female connectors on the bottom of the control box designated battery positive and negative.



NOTE ON GROUNDING

The modules are grounded in the J-box by means of a green bonding wire that attaches to the aluminum frame, which is then bolted to the aluminum bracket, that is bolted to the steel pipe, which is sunk in the ground. Everything else in the system is in an, "above ground", configuration, i.e. not a chassis ground. If the batteries fail or melt down the MorningStar will isolate them from the system with its built in circuit protections. (If the system takes a direct lightning strike nothing will save it.)

SOLAR PANEL CONNECTIONS

You have secured the panel bracket to the pole. You have mounted the solar panel on the bracket and set it to the desired sun angle according to bracket instructions.

SPECIAL NOTE: FOR TWO PANELS ONLY

Two MC-4 Y junction connectors are provided:

(1) PV-AZB4 is a female to double male.

(1) PV-AZS4 is a male to double female.

The positive cables from each panel will plug into the two terminal side of the appropriate connector and leave the Y connector on a single cable, (provided) which will then plug into the control box at the PV positive connector. This leaves the two negative cables coming off of the panels which will plug into the other Y connector and then on to the control box on a single cable to be plugged into the PV negative connector.

You have two remaining two 15' cables, starting at the Solar panel J-box and extending out of it. Using the male and female connectors as your guide, push the cable extensions onto the J-box power leads. Now connect these two cables at the two remaining male, female connectors on the bottom of the control box marked Panel positive and negative. At this point your batteries are charging and the system installation completed.

NOTE: A low-voltage disconnect feature to protect the motor is built in the Morningstar controller. This prevents operation of the motor when voltage is below 23.8 volts. At this voltage even the best deep cycle batteries available would be at 75% discharge and would need to be fully charged before doing any work.

POWERING THE TRANSFER MOTOR

If you are using a transfer motor to take water from an ambient tank to a pressure tank, you can power that motor from the Simple Pump system.

The 4-gang terminal block offers access to 24VDC power for accessories such as a transfer pump, light or other appropriate device that does not exceed the available amperage.

24VDC can be obtained from the terminal block by placing the positive lead to the device on position #1 and the negative lead from the device on position #3 or #4 (with #1 being the furthest terminal position to the left and #4 being the furthest terminal position to the right as you face the terminal block with the door open).

OPERATION

DO NOT TURN ON THE PUMP YET.

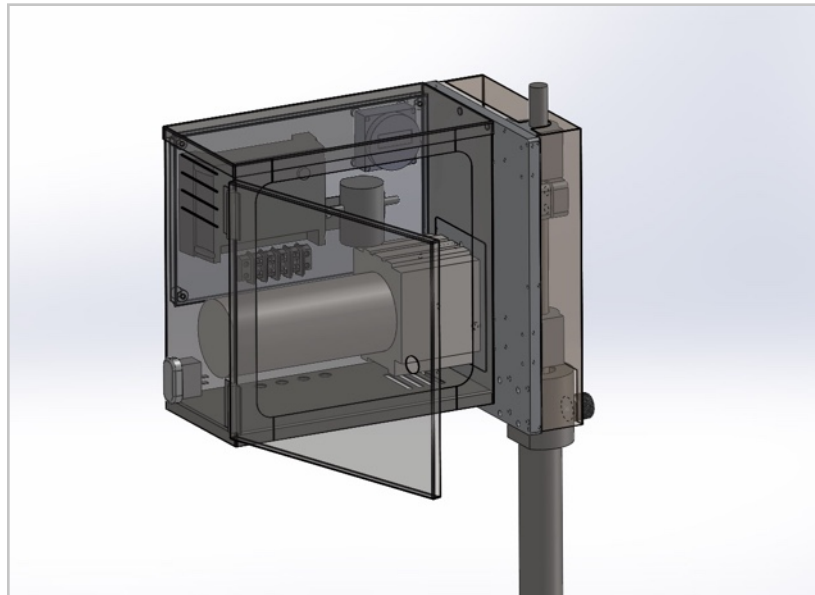
Before operating the pump for the first time we want to make sure the battery bank is fully charged to 100% of its capacity. This will give you time to read the Operator's Manual to both the solar controller and the programmable timer.

Once the solar panel was connected the batteries began to charge; by following the instructions in your Operator's Manual you can now set the battery type and monitor the charge cycle by viewing the digital readout on the meter and the charge status LED's. With the batteries fully charged, you can now turn on the system by putting the rocker switch on the outside of the control box in the on position.

If the pump does not run at this time you will need to set the time and day in the timer, program start and stop times, or use the manual override according to instructions. Once the timer has been programmed, it will start and stop the pump at the selected times or you can manually start and stop using the switch on the timer.

Turn on the power. You are ready to go. During the break-in period, pump from the nozzle or unrestricted through a hose. We recommend a break-in period of six hours.

When you are ready to use the water, be sure to use a **drinking-water quality hose**, or piping.



SECTION 6: APPENDIX

CHANGING BACK TO HAND PUMPING

There are rare but possible circumstances where someone might want to change back to hand operation. For example, if cut off by snow for a week and the motor fuse blows.

In that case, you will reverse the earlier procedure to remove the motor unit. Then depending on the option you have, you will:

- Remove the 13" rod extension to leave the 24" ready for hand operation.
- Or replace the 36" rod with the 24" rod.

TO REMOVE THE 13" EXTENSION

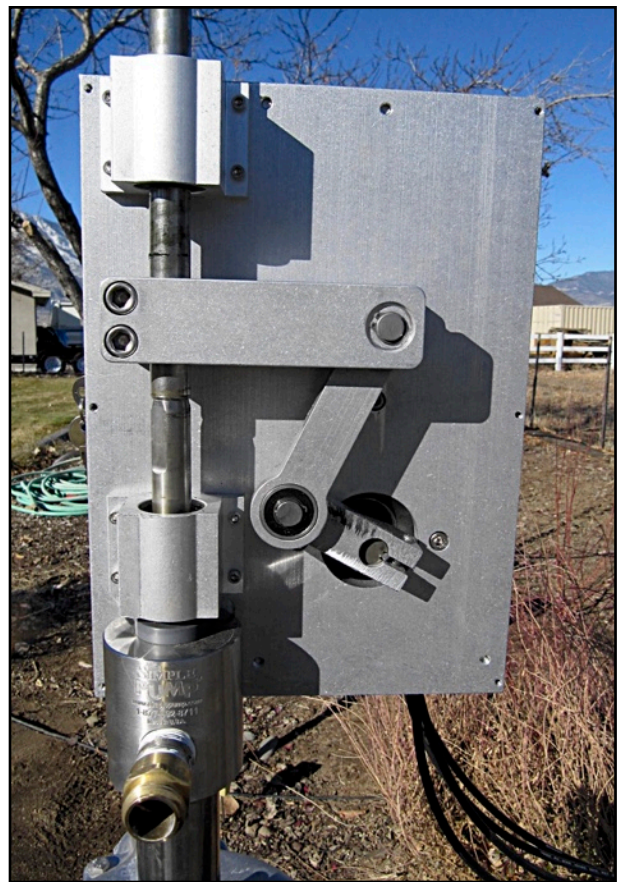
With the motor unit removed from the pump head, all you have left to do is to separate the 13" extension from the 24" extension and reinstall the handle assembly. BE CAREFUL! Lift the $\frac{3}{4}$ " rod up exposing the joint. Using a piece of leather or a thick rag and vise grips, hold on to the 24" section and remove the 13" section. DO NOT LET GO OF THE PUMP ROD! If the pump rod drops into the pump head the only way to retrieve it will be to remove the pump head and riser tube.

TO REPLACE THE 36" ROD WITH THE 24"

Read Section 2. This procedure will be reversed. The pump head will be removed and the 36" rod detached. The 24" rod will be installed and the pump head put back. If it is not clear from reading Section 2 how to reverse the procedure, please contact us for assistance.

ATTACH HANDLE AND PUMP WATER

Now, from either the 13" or 36" section just above -- Screw the handle back onto the pump rod and the handle bracket to the pump head with the four stainless steel screws. You are ready to pump water again. The handle screws on to the pump rod in the OPPOSITE direction to regular screws and bolts... **you turn counterclockwise to tighten.**



ONGOING MAINTENANCE

As long as the Motorized System with the LBLD is pumping correctly and not causing the motor to overload, no maintenance is required for the LBLD motor component.

The pump's seals must be replaced periodically — typically every 3 to 7 years. (It can be more frequent for industrial applications, or any application pumping water with a significantly non-neutral pH, or high particulate levels.) Note that all of these are those that must be replaced on any Simple Pump system, no matter what configuration -- driven by hand or motor. If the flow rate of your pump starts to fall, replacing the seals may be the solution. Information about the periodic replacement of seals can be found in the INSTALLATION AND MAINTENANCE manual for the hand-operated system.

There is no requirement to oil any of the LDBD system components.

Optionally, if you have the cover off, you can apply a bit of lubricating oil on the two points where ball bearings in the drive move during operation. **However, do not under any circumstances apply oil to the linear bearings, or the 3/4"x36" stainless steel rod that moves within those two linear bearings.** Also, there is no need to lubricate any component or surface on the motor itself.

CIRCUIT PROTECTION / FUSE

As long as the gear motor system is pumping correctly and not causing the motor to overload, no maintenance is required. If the mechanism experiences a problem, the motor protection internal to the charge controller will trip. A 15 amp fuse is present and is intended to protect the control circuits only.

It is extremely important to replace the fuse with only a 15 amp ATO/ATC automotive style fuse. The motor normally operates in the range of 100-150° F depending on workload and ambient temperature. Refer to the charge controller operations manual for additional trouble-shooting tips.

If the charge controller shuts down in an overload situation for any reason -- turn the rocker switch off before removing the drive system cover. Lift the stainless rod up and down, by hand. How freely it moves indicates what the motor is working against. A possible reason for difficult movement is pump binding....one of the u-cup seals may not be seated in the machined groove.

Remove the motor mechanism and stroke the pump rod by hand. It should require about 40 lbs. of lifting effort for each 100 feet of static water level depth. If the effort is any more than this, remove the pump head and try again to determine if the problem is in the head.

WARRANTY

The gear motor assembly is warranted against defective materials and workmanship for one year from the date of purchase. The motor load must not be exceeded, and all instructions must be adhered to.