



INSTALLATION MANUAL FOR THE SIMPLE PUMP PANEL-DIRECT MOTOR

LBLD86.6PD2

(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 Direct motor unit.

You will now be able to pump water using light energy harvested directly from the sun, converted to electrical energy in the solar modules, and regulated to the motor requirements by a Linear Current Booster. Based on local weather conditions each day, once enough light energy is available to meet the motor load demand, the system will start to run, and continue to run as long as there is enough light energy.

The run window can vary from season to season, changing with the angle of the sun, day to day and hour to hour, with passing clouds or a clear sky.

The system is designed for topping off stock tanks, storage tanks for watering agricultural, and any application where a set amount of run time is not critical, can vary from season to season, or with the size of a herd, especially in very remote locations. The system will start and stop on it's own, every day, unattended.

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 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.

Open Flow application: Pumping into pressure is not recommended. Designed for open flow applications only.

SOLAR POWER SOURCE



CRITICAL NOTE: The custom Solar Converters PPT48-12 MUST be supplied with solar energy from these particular panels:

Three thin-film technology, (Scion) nominal 80VDC, 150 watt, model number TS150C2. Your local solar store may be able to supply these. Or they are available from:

Pacific Energy Alternatives: Sparks, NV: Greg Lafayette: 775-233-8605

Choose a location as close to the well as possible and practical (ideally within 15'), to eliminate any voltage drop between components (i.e loss of available power).

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

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 OR 3/4" x 13" stainless steel pump rod extension

(1) 15amp ATO/ATC prong style fuse

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

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

(2) solar cables with connectors

(2) Three-way branch connectors, one male, one female

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.

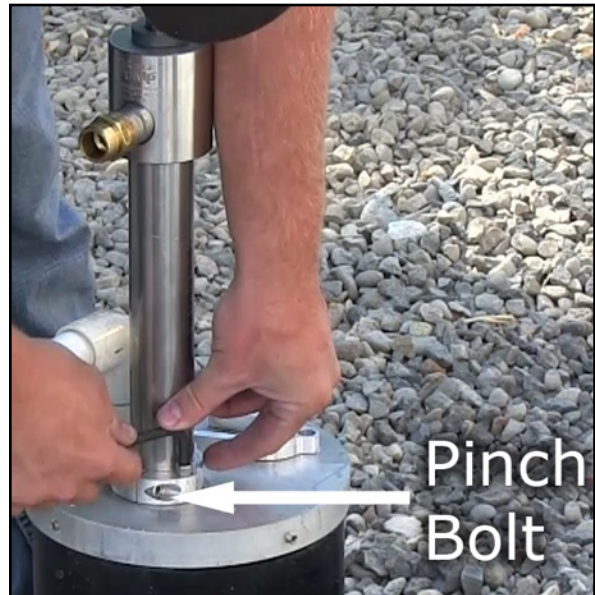
You now need to make sure that at least 6 inches of riser tube are below the split flange on the cap.

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 system. **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

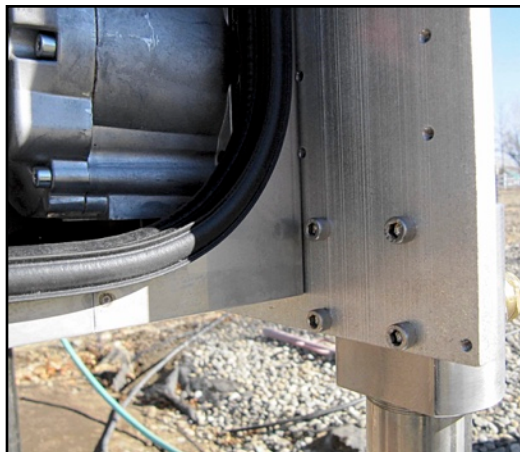
The DC motor faces away from the pump head.

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

READ THIS SECTION CAREFULLY BEFORE PROCEEDING.

It is equally important for the pump head seals that only the smooth continuous rod pass by the seals on each stroke.

Before you lower the control box onto the pump rod and pump head; first, rotate by hand the lever arm which is attached directly to the motor shaft so it is pointing directly at the ground and parallel to the pump rod.

This puts the connecting piece between the lever arm and the yoke also parallel to the pump rod and the yoke at 90 degrees to the pump rod. This positions the motor drive at the very bottom of the pump stroke.

Now loosen the four Allen bolts at the upper and lower guide bearings so that the bearings can be moved with little effort by hand. Loosen or remove the two 5/16 Allen bolts on the yoke and using a large flat blade screw driver gently spread the opening in the yoke to clear the pump rod.

Now you can slide the control box into its final position. A second set of hands would be helpful at this point to help take some of the weight and to guide the control box into position. Lower the control box over the pump rod passing the pump rod thru the lower guide bearing first, the yoke and then the upper guide bearing aligning the pump head with the four mounting holes on the adaptor plate and secure.

The pump piston is now resting on the stainless ball on the bottom of the pump cylinder. To prevent damage to the pump cylinder, pump head seals, and insure proper operation we must now raise the pump rod lifting the piston off the bottom and bringing the joint where the rod extension meets the main pump rod clear of the pump seals.

Lift the pump rod so that the rod extension joint clears the top of the lower guide bearing one inch and tighten the two 5/16 bolts on the yoke. You will have raised the pump rod about four and a half to five inches insuring that at the bottom of the pump stroke the piston will not hit the bottom of the cylinder and the extension joint is always clear of the pump head seals.

At this point you are ready to mount your solar array. We will come back to this at start up.

DO NOT ATTACH THE SAFETY COVER AT THIS TIME. PROCEED TO SECTION 4.

SECTION 4: SOLAR PANELS 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.

SECTION 5: ELECTRICAL CONNECTIONS AND OPERATION

NOTE ON GROUNDING

The modules are grounded in the J-box by means of a green bonding wire that attaches (in a typical pole-mount system) 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 **sees ground thru DC negative**. (If the system takes a direct lightning strike nothing will save it.)

WARNING AND SPECIAL INSTRUCTIONS

DUE TO THE INTERNAL CIRCUITRY OF THE LINEAR CURRENT BOOSTER IT IS ALWAYS ON UNLESS YOU SWITCH IT OFF WITH THE EXTERNAL SWITCH ON THE SIDE OF THE CABINET OR WITH A FLOAT SWITCH.

BY PRESSING THE TOP OF THE EXTERNAL ROCKER SWITCH DOWN YOU CAN SHUT OFF THE LINEAR CURRENT BOOSTER CIRCUITRY.

SHUT OFF THE LINEAR CURRENT BOOSTER NOW. YOU WILL TURN IT BACK ON AT START UP.

SOLAR PANEL CONNECTIONS

You have mounted the solar panels on the mounting system and set it to the desired sun angle according to those instructions. Your motor unit came with two three-way branch connectors to parallel the three modules in your solar array as follows:

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

You have two remaining 20' cables, the red positive cable plugs into the positive connector marked positive on the bottom of the control box, the negative to negative. Your system is now ready to operate.

For float switch operation please call 877-492-8711 (ext 6) to discuss.

OPERATION

DO NOT TURN ON THE PUMP YET.

Recheck all of your work.

With hand clear, switch the rocker switch back to the down position. With sunlight hitting the panels the system will activate and move to it's run mode and stay there until someone turns it off again.

After several minutes the system will try to start. If there is not enough power to run the motor the system will enter a time delay sequence, reload the start capacitors and after several minutes try to start again.

SPECIAL NOTE:

1. There is a 3-minute time delay before the system will start (during full sunlight hours) after the rocker on/off switch is turned on.
2. If you wish, the 3-minute time delay can be avoided by leaving the rocker switch in the "on" position, then disconnecting and reconnecting the MC4 connections on the underside of the SS control cabinet. The in-rush of DC voltage from the PV will bypass the time delay. This should be done only under unusual conditions as both MC4 connections must be done at the exact same time and this is not easy to do.
3. The rocker switch is wired so the switch is "on" when the three pimples on the rocker are against the SS cabinet and the smooth portion of the rocker is away from the cabinet.

The startup process will continue over and over until there is enough solar energy provided by the modules to reach the regulated output window already built into the Linear Current Booster. If the system fails to start in the early morning or starts slow and runs at half speed for a while there is nothing wrong with the system and no harm is taking place to any of the components.

Once the booster is provided with enough solar energy the RPM of the motor will automatically ramp up to over 60RPM and stay there unless the sun is shaded by passing clouds or a thick cloud cover, at the end of the day performance will fall off and stop for the night and resume with the morning sun.

You are now ready to turn on the system. After the system has run for several minutes and you are satisfied that there are no binding issues and the upper and lower guide bearings have had a chance to self locate turn off the system. Now tighten the upper and lower guide bearings and secure the safety cover. You can now turn the system back on and leave it on.

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 Linear Bearing Link Drive (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 LBD 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. **Never use a larger fuse.**

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. Other parts of the motor unit have warranties as specified in your original quote.