



INSTALLATION INSTRUCTIONS FOR THE MOTORIZED SIMPLE PUMP SYSTEM (SCOTCH YOKE DRIVE OPTION)

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(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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INTRODUCTION

Thank you for purchasing a Simple Pump Motorized Pump with Scotch Yoke Drive (SYD). It is designed for use with the Simple Pump model 100 and 125 hand pumps. When assembled and installed on the Model 125, this gear motor and drive is capable of delivering between 1.6 and 3.1 gallons of water per minute (GPM) at a total head of up to 150 feet. Installed on the Model 100, it delivers between 1.0 and 1.5 GPM at a maximum total head of 225 feet. The greater the head, the lower the rate of flow.

“Total head” is the sum of:

- The depth of the well’s static water level.
- The vertical rise above from the pump head to the point of delivery.
- An additional 100 feet equivalent for pumping your pressure tank to 45psi.

The motor is available in two models, 12 volt and 24 volt DC. These instructions cover both versions.

SPECIFICATIONS

WHEN POWERED WITH 12V DC

Motor Rating	.140 HP continuous
Gear Ratio	30:1
Output Torque	154 in/lbs. continuous
Output Torque Maximum	175 in/lbs. @ 56RPM @ 16.3 amps
Nominal Output RPM	57%
Efficiency	59.5
Full Load Motor Current	14.6 amps
Allowable Voltage Range	11.5 to 15 VDC
Typical temperature of casing, operating in 72°F ambient	110° Fahrenheit

WHEN POWERED WITH 24V DC

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	110° Fahrenheit

RECOMMENDED OPERATING ENVIRONMENT AND APPLICATIONS

AMBIENT TEMPERATURE

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.

CONSISTENT SOURCE OF DC POWER

As with any DC motor, precaution must be taken to prevent operation under low voltage conditions -- below 11.5V with the 12VDC model, 23.5V with the 24VDC model.

IDEAL APPLICATION TO MINIMIZE WEAR

Ideally, when pumping from any significant depth, you should not operate the Motorized System (LBLD Option) configured to pump into a pressurized system. The most difficult part of delivering water to a pressurized system is moving it out of the well. Once at ground level, the water can be delivered to

pressure by a low-cost booster pump. The only other additional cost is the tank for ambient storage, i.e., not under pressure.

The water lifted out of the well is pumped into the ambient storage tank by the Motorized System. Booster pumps designed specifically to pump into a pressure tank are available from a number of vendors, e.g. Dankoff, Surflo and Jabsco. Many such pumps cost less than \$150.

Configuring like this also raises the overall reliability of the system. Most notably, booster pumps include an integrated pressure sensor. It signals the booster pump to turn the pump on and off, according to a target pressure, when water is demanded from the pressure tank.

By contrast, any Simple Pump provides water with a pulsed delivery, and therefore varying pressure, making the task of regulating flow to the pressure tank more difficult.

UNSUPPORTED APPLICATIONS

Operating the Motorized System (LBLD Option) in certain configurations voids its warranty.

- ▶ Pumping into pressure greater than 50 psi.
- ▶ Directly connected to batteries without a low voltage disconnect that prevents the supply of current below 11.5V or 23.5V, depending on whether the motor accepts 12VDC or 24VDC as input.

SUPPLYING POWER RELIABLY

The task of supplying power above the 11.5V and 23.5V (for 12VDC and 24VDC systems) thresholds is more complex than many anticipate, particularly with solar-powered systems. Because most configurations using the Simple Pump Motorized System are powered using solar panels, only solar is discussed in this section.

Keeping voltage above 11.5 or 23.5 volts seems simple: Provide enough power, with a device to regulate its delivery. However, a number of factors influence what constitutes “enough power” when considering how to configure an off-grid application:

- ▶ Days of autonomy: The total number of days the system must provide power without sunny days, in the worst-case scenario. For example, if the system will be used throughout the year, with expected water usage the same throughout the year, the radiation expected on the winter solstice is used to for the worst-case calculation.
- ▶ Solar radiance: Factor in both how far north (latitude) and expected cloud cover.
- ▶ Daily water used. If more water is used when radiation levels are higher -- e.g., more for gardening starting in March -- then projected water consumption must be compared against expected radiation at multiple points in time throughout the year.
- ▶ Location: Separate from how much solar radiance a location receives, those north of 45° N (about as far north as Columbus, Ohio, should also have a system that can be pivoted manually, to account for the sun’s much lower angle in the sky in winter.
- ▶ Distance between power source and consuming machine.
- ▶ Worst-case cold: If batteries are used, requirements can jump up to 1.6 times more than would be required in a warm climate.

PROFESSIONAL HELP?

If this is more complex than you planned, there are alternatives.

Anyone with NABCEP (North American Board of Energy Practitioners) certification, *and* experience configuring off-grid systems, is almost certainly qualified to help. However, while all NABCEP-certified professionals must learn about off-grid systems, most pursue grid-tie solar systems -- a very different field. This is why it is important to ask about recent experience.

SECTION 1: CONTENTS AS SHIPPED AND TOOLS REQUIRED

CONTENTS OF BOX

DC gear motor and Scotch Yoke mechanism with cover, delivered as one piece.

White protective over wrap on cover to be removed before installation.

(2)-6-32X5/16" Pan Head Phillips machine screws in 18-8SS with internal washer -- to be removed to remove cover.

(4) 1/4-20x1" SS SHCS mounting bolts

(3) 25A ATO/ATC automotive-style fuses (for 12V system), OR

(3) 15A ATO/ATC automotive-style fuses (for 24V system)

TOOLS REQUIRED

(1) Allen wrench

3/16" Allen wrench for (4) 1/4-20 SS SHCS that attach the mechanism to the pump head.

Also used for removing the Crank Arm Roller.

(1) Channel lock (for removing the lever arm)

(1) Medium Phillips screwdriver for fastening electrical leads to terminal strip.

SECTION 2: UNPACKING, INSPECTION AND PREPARATION

Carefully remove the Motorized SYD mechanism, bolts (in poly bag) and fuses from the shipping box.

Using the medium Phillips screwdriver, remove the two screws that attach the cover. The picture on the right shows the Motor with SYD already installed, with a screwdriver loosening one of those two screws. (The other screw is in the corresponding position on the right-hand side.)

Remove the white protective over wrap from the cover.



Once the cover is removed, you will see the yoke (photo to right). It is installed inside of the SS enclosure, padded with 1/8" foam for protection in shipping.

Remove the yoke and its packing materials. You will require the yoke early in the installation process.



SECTION 3: PREPARING YOUR EXISTING PUMP

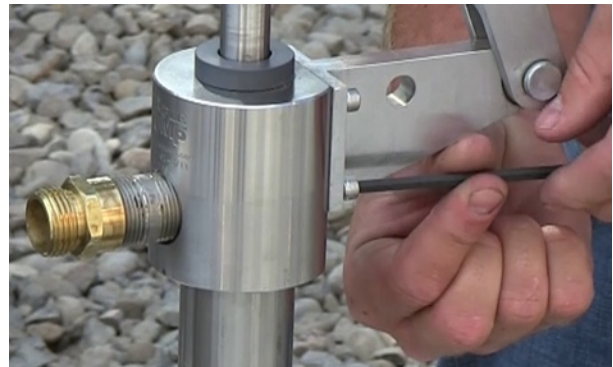
Your Simple Hand Pump should already be installed and pumping water without any binding and with an overall smooth operation prior to attempting to install this motor assembly.

You should confirm that your pump is delivering at least one gallon of water with approximately 25 strokes with the lever handle system (model 100L). If you have the model 125L, your pump should be delivering about one gallon of water in approximately 14 complete strokes.

Once proper pumping function is confirmed, remove all hardware on the top of the pump head. Starting with a fully-functional lever-arm pump, what follows are the step-by-step installation instructions.

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 steel rod.

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



Push the pump rod fully down. The length of the white arrow in the picture should be no higher than 3¾" from the top of the stainless steel rod down to the shoulder (metal top) of the head (left).

If this is not the case, an adjustment in pipe length may be required.

SECTION 4: INSTALLATION

Now that you have confirmed that the stainless pump rod protrudes no more than 3³/₄" above the metal top of the pump head, you are ready to install the MOTORIZED Simple Pump System (SYD option).

Position the yoke above the stainless steel rod so you can screw it onto the rod. Using the channel lock, clamp the rod on its flat surface as you tighten the yoke onto the rod.

Once again, the direction you screw is the opposite of normal -- turn counterclockwise to screw on, rather than the normal clockwise.

ATTACHING THE MOTORIZED SYSTEM

Prior to installing the mechanism, position the yoke at 90 degrees to the water exit -- parallel to the flat plane of the pump head with the four holes. The side of the yoke with the flat face should be pointing in the direction of the water exit.

The aluminum piece that is anchored in the middle of the gear motor mechanism, with five holes in it, is the crank arm. Move the gear motor mechanism toward the Scotch Yoke with the crank arm pointed down.



Bring the cam roller (attached to the crank arm) into the cam track part of the yoke (the cam track is the hole in the yoke that is oriented at around 45 degrees), while also positioning the top of the Scotch Yoke (on its grooved side) into the guides at the top of the gear motor mechanism.

The picture shows the cam roller in the middle position. You will find break-in easiest if, prior to installation, you fasten the cam roller in the position that is closest to the center of rotation, using the 3/16" Allen wrench.

Then, elevate the entire gear mechanism, until the mounting holes are aligned with the 4 screw holes on the back of the pump head (see photo on left).

SECTION 5: ELECTRICAL CONNECTION

Notice there is a terminal block on the inside of the stainless enclosure in the photos. Make the necessary electrical connections there.

The photo on the right shows the terminal block covered by a rectangular stainless steel junction box. This junction box arrives attached to the motorized system with SYD mechanism. In the other picture, it was removed prior to this installation, so that the electrical connections could be made.

The junction box has a 7/8" diameter access hole intended to accommodate 1" electrical conduit for the two wires feeding the unit with 12VDC or 24VDC power.



Attach your positive and negative power leads to the terminal block so that the final output rotation is counter-clockwise. This rotation direction will provide a constant tightening torque on the driven cam roller and will prevent the cam roller from walking off of the crank arm.

A counter-clockwise rotation direction will also take advantage of the up angle on the scotch yoke and will reduce the amperage draw slightly.

Make sure that the wiring from your power source is at least 16 gauge, and can maintain a minimum of 11.5 volts with the 12VDC motor at a full load of 15 Amps, or 23.5 volts with the 24VDC motor at a full load of 8 amps.

Note that with greater the distance to the power source, higher gauge wire may be required. (You may need professional advice on this.) Also, at 24 volts, line loss is significantly lower compared to 12 volts.

SECTION 6: INITIAL OPERATION AND BREAK-IN

Once the power has been connected, install the fuse and attach the cover.

The cam roller is shipped to you in the position that is closest to the crank arm's center of rotation. In this position, the pump will generate about 1.5 gallons per minute (GPM) with a 4" stroke. Run the gear motor for two hours at this setting.

Once the pump has run for 2 hours at the 4" stroke setting, disconnect the power, open the cover and move the roller to the second position (with a 5" stroke). Run the pump for 2 hours in this setting.

During the break-in period, leave the pump outlet open or pump through a drinking-water quality hose unrestricted. We recommend a break-in period of at least 4 hours.



CAUTION: At all times, make sure that nothing is setting or stored on top of the gear motor.

FLOW CAPACITIES AND PRESSURE WITH MODEL 125CA PUMP CYLINDER

Maximum Total Head	Flow Rate (GPM)	Pump Stroke Setting
150 feet (65 psi)	2.0	4"
123 feet (53 psi)	2.4	5"

FLOW CAPACITIES AND PRESSURE WITH MODEL 100CA PUMP CYLINDER

Maximum Total Head	Flow Rate (GPM)	Pump Stroke Setting
200 feet (87 psi)	1.3	4"
160 feet (69 psi)	1.5	5"

SECTION 7: MAINTENANCE & TROUBLE-SHOOTING

PROTECTION FROM WEATHER

The standalone motor assembly is intended to be used indoors or under similar protection. (Other models with cabinets are for outside use.) Alternatives could be

- a small roof with open sides
- a small pump "house" that just covers the well head and pump
- a full-sized pump house

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 bearing failure for any reason, the motor protection fuse will blow. It is extremely important to replace the fuse with only a 25 amp ATO/ATC automotive style fuse (if 12VDC version) or 15 amp ATO/ATC automotive style fuse (if 24VDC version). Using a higher amperage fuse will overheat the motor and damage the gears. The motor normally operates at around 100-110° F.

If the fuse has blown for any reason, remove the cover and the crank arm roller. Lift the yoke up and down, by hand. How freely the yoke moves or does not move is an indication of what the motor is working against. Typical reasons for difficult movement are:

MISALIGNMENT

Loosen the (4) attaching screws on the pump head and make sure that the assembly is aligned before re-tightening. Make sure that there is no metal-to-metal contact, except at the rollers.

SEIZED ROLLER

Check all rollers for free movement.

PUMP BINDING

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

After this routine check, reassemble the system and repeat the start-up procedure.

ONGOING MAINTENANCE – OILING

The cam roller is made from hardened steel with a 2000+ lbs rating. The steel yoke is made from CR steel. The contact between the two should be oiled and cleaned with a little WD-40.

SECTION 8: WARRANTY

The Motorized Simple Pump System (Scotch Yoke Option) is warranted against defective materials and workmanship for a period of 1 year from the date of purchase. The motor load must not be exceeded and all routine maintenance recommended in these instructions must be adhered to.