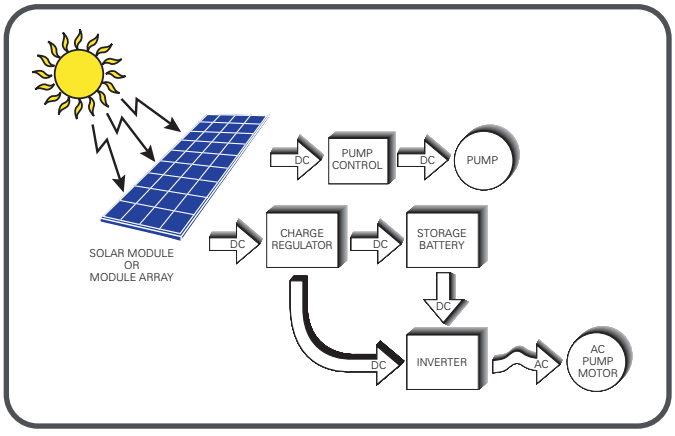
WATER PUMPING

How does the sun power a pump?

The photovoltaic effect produces a flow of electrons. Electrons are excited by particles of light and find the attached electrical circuit the easiest path to travel from one side of the solar cell to the other. Envision a piece of metal such as the side panel of a car. As it sits in the sun, the metal warms. This warming is caused by the exciting of electrons, bouncing back and forth, creating friction, and therefore, heat. The solar cell merely takes a percentage of these electrons and directs them to flow in a path. This flow of electrons is, by definition, electricity.

Photovoltaics or solar electric cells convert sunlight directly into electricity. This electricity is collected by the wiring in the module, then supplied to the DC pump controller and motor, which, in turn, pumps water whenever the sun shines. At night, or in heavy cloud conditions, electrical production and pumping ceases.



Where do solar pumping systems work?

Solar pumping systems work anywhere the sun shines. The majority of the continental U.S. enjoys plenty of sun to operate a pumping system economically.

The intensity of light varies greatly throughout the day. Morning and afternoon sunlight is less intense because it is entering the earth's atmosphere at a high angle and passing through a greater cross section of atmosphere, which reflects and absorbs a portion of the light.

We measure sun intensity in equivalent full sun hours. One hour of full sun is roughly equivalent to the sunlight on a clear summer day at noon.
The sunlight or insolation levels also vary seasonally. Fortunately, most needs for water correspond with the sunniest seasons of the year – spring, summer and fall.

Small to medium solar electric pumping systems are easily portable. By mounting the solar system on an axle or trailer, a system can be moved from well to well. This increases the economic return of a system by increasing the seasons of use. It may also correspond with the rotation of grazing areas.

Economics of Solar Water Pumping

The economy and reliability of solar electric power make it an excellent choice for remote water pumping. Cattle ranchers in the Western U.S., Canada, Mexico, and Australia are enthusiastic solar pump users. Their water sources are spread over many miles of rangeland where power lines are few and refueling and maintenance costs are substantial for generator use.

If your water source is 1/3 mile or more from the power line, solar is a favorable economic choice. This fact is reinforced by a number of Rural Electric Co-Operatives across the U.S. These Co-Ops actively advocate the use of solar pumps, as the cost to extend new lines is subsidized by other rate payers.

A solar pump minimizes future costs and uncertainties. The fuel is free. Moving parts are reduced to as few as one. A few spare parts can assure you many years of reliable water supply at near-zero operating costs.

Mounting Structures and Array Placement

Solar modules should be located in a sunny spot where no shading occurs. Even shadows from a tree limb, tall grass, or fence rails can substantially reduce power output.

For these reasons we typically mount the solar modules on a pole or ground mount above any obstacles. Remember the solar array can be placed some distance from the water source if shading is a problem. Wire size can be increased to compensate for longer cable runs and the associated voltage drop.

Windmills: Yesterday's Answer to Remote Water Delivery

There are still thousands of windmill water pumping units standing in the western U.S. Regrettably, many are inoperable. These pumpers were very valuable for remote (off grid) sites, with the proper minimum wind conditions, and manpower was plentiful and cheap. Windmills, though potentially long lasting, need dedicated maintenance. The downhole leathers require inspection and high winds can cause mechanical damage to the blades. Parts for these mills are expensive and sometimes hard to find.

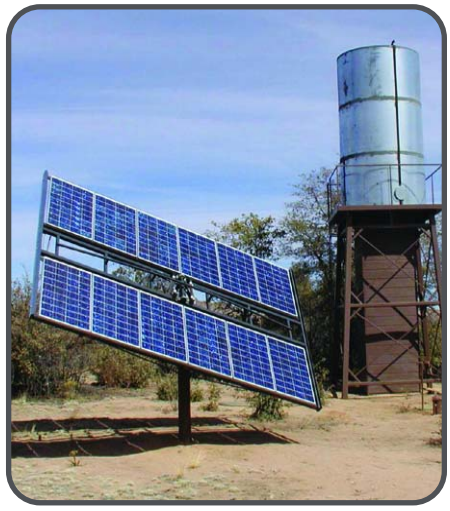
Solar water pumping systems have many advantages over windmill water pumpers. Though the initial cost of solar powered systems can be similar to that of a windmill (however, in many cases far less) the life time costs are much lower. Windmills must be used where there is a steady, constant wind for maximum results while solar pumps operate anywhere the sun shines. Solar pumping systems can be installed in less than a day by an individual or small crew and can be portable, while windmills (because of the need to erect a tower) can take a larger crew a much longer time to install. Windmills are secured to the ground and are stationary. Solar powered water pumping systems are the modern day upgraded version of the windmill which uses natural resources to deliver water in off grid locations.

Solar power and water pumping are a natural. Generally, water is needed most when the sun shines its brightest. Solar modules generate maximum power in full sun conditions when we typically need larger quantities of water. Because of this "sun synchronous" matching, solar is an economical choice over windmills and engine driven generators for most locations where utility power is non-existent. Owners of solar water pumping systems enjoy a reliable power system that requires no fuel and very little attention.

Fixed vs. Tracking Mount Structure

Fixed Mount structures are less expensive and tolerate higher wind loading. By fixing the modules due south, less water is pumped than a tracking system which orients the modules towards the sun as it arcs across the southern sky.

Tracking mount structures keep the modules at a 90 degree angle to the sun all day long. This provides more power to the pump over a longer period of the day, which produces 20 to 40 percent more water daily in the summertime.



Trackers offer a great advantage when pumping water. Passive single axis trackers are known for their excellent reliability and service life. They take no power from the system as they operate from the heat of the sun striking the frame members, causing freon to move from one cylinder to another. Passive trackers come with a 10 year warranty and are highly recommended in all but the windiest locations. High winds can pull the array off the correct sun angle and will negatively affect power production if winds are consistent.

Why we don't recommend batteries in water pumping systems

While batteries may seem like a good idea, they have a number of disadvantages in pumping systems. They reduce the efficiency of the overall system. The solar modules operating voltage is dictated by the battery bank and is reduced substantially from levels which are achieved by operating the pump directly. Batteries also require additional maintenance and under and over-charge protection circuitry which adds to the cost and complexity of a given system. For these reasons, only about five percent of solar pumping systems employ a battery bank.

Gas Fired Generators vs. Solar Energy

Generators are commonly used to provide power beyond the power line. We have several economic studies of solar versus generators as a power choice. These studies consider all costs involved: modules, mounting structure, pumps, miscellaneous components, installation, operation, maintenance, yearly inspection, component replacement and salvage value. With this we can determine a life cycle cost and a present value. One such comparison was done by the Bureau of Land Management at Battle Mountain, Nevada specifically comparing solar water pumping systems. For one 3.8 gpm system with a 275 foot design head, the PV system cost only 64% as much over 20 years as the generator system did over only 10 years. This remote solar site also used only 14% as many labor hours.

In 1989, Sandia National Laboratories noted that photovoltaic pumping systems in remote locations would often be cost effective compared to generators, even with 5 times the initial capital cost. Low end generators, which are initially inexpensive, require consistent maintenance and have a design life of approximately 1,500 hours. Small to medium sized solar pumping systems often initially cost less than a durable slow speed engine driven generator. Most larger pump systems initially cost more than generator systems, but tend to be far more economical in the end.

System Type	Advantages	Disadvantages
Solar Electric Power System	◆ Low maintenance ◆ Clean ◆ No fuel needed ◆ Easy to install ◆ Reliable long life ◆ Unattended operation ◆ Low recurrent costs ◆ System is modular and can be matched closely to need	◆ Relatively high initial cost ◆ Lower output in cloudy weather
Diesel (or Gas) Power Systems	◆ Moderate capital costs ◆ Can be portable ◆ Extensive experience available ◆ Easy to install	◆ Needs maintenance and replacement ◆ Maintenance often inadequate, reducing life ◆ Fuel often expensive and supply intermittent ◆ Noise, dirt and fume problem ◆ Site visits necessary
Windmill	◆ Potentially long-lasting ◆ Works well in windy site	◆ High maintenance ◆ Costly repair ◆ Difficult to find parts ◆ Seasonal disadvantages ◆ Need special tools for installation ◆ Labor intensive ◆ No wind, no power, no water

Water Pumping Questionnaire

To help design your water pumping system, please complete this form. With this information your dealer can supply an accurate cost estimate and equipment list.

1. **Well and water depths**
   from ground level to end of bore hole _____ft.
   from ground level to water surface (static level) _____ft.
   from ground level to draw down level _____ft.

2. **Pumping distance & height**
   from well head to top of storage tank or outlet pipe:
   Horizontal distance from well head to storage tank ____ft.
   Vertical _____ft.

3. **Well recovery or recharge rate**
   How many gpm will the well produce continuously? ___gpm

4. **Well casing size**
   Inside diameter _____inches

5. **What is the water for?** _____
   examples: domestic, livestock, drip irrigation

6. **Seasons of use and water required daily**

Jan.	_____ gpd	May	_____ gpd	Sep.	_____ gpd
Feb.	_____ gpd	June	_____ gpd	Oct.	_____ gpd
Mar.	_____ gpd	July	_____ gpd	Nov.	_____ gpd
Apr.	_____ gpd	Aug.	_____ gpd	Dec.	_____ gpd

7. **Do you have a pump installed presently at this site? If so, please describe pump system and use.**

8. **Is the water clear, silty, high mineral content or have any other special considerations?** _____

9. **Is there an existing storage tank at the site?**
   If yes, what is the capacity? _____ gals.
   Pipe diameter well to tank _____ inches.

10. **Do you have good, unobstructed sunlight available near the water source?**
    If not, how far away from the water source? _____ ft.

11. **What is your site elevation?** _____ **ft.**

12. **A single sketch can save a thousand words, please draw us a picture and include any other factors not covered.**

Daily Water Requirements

Each person, for all purposes	75 gal/day
Cow/calf pair	10 to 30 gal/day
Each horse, dry cow or beef animal	10 to 20 gal/day
Each milking cow	35 gal/day
Each sheep	2 gal/day
Each hog or 100 chickens	4 gal/day

These figures are generalizations, many factors affect water consumption, such as forage, moisture content, etc.

KYOCERA SOLAR, INC.

Kyocera SD Series Water Pumps

The Kyocera SD Series of submersible solar pumps are highly efficient, low-voltage, DC powered, diaphragm-type positive-displacement pumps designed specifically for water delivery in remote locations.

SD 3-70 & SD 6-35

They operate on 12 to 30 volts of direct current that may be supplied from a variety of independent power sources including solar panels and/or batteries. Power requirements can be as little as 35 watts. Constructed of marine grade bronze and 304 stainless steel, these pumps are the highest quality submersible pumps in their class.

Kyocera's SD series pumps can be installed below water level in a pond, river or cistern, or installed by hand into a ground water well. They can be used to fill an open tank or in a pressurized water delivery system.

Simplicity is the key feature of the SD series pumps. They are easy to install, require very little maintenance and are completely field serviceable.

The SD series pumps are designed for use in stand-alone water delivery systems. They are pollution-free, corrosion-resistant and quiet. It is the ideal way to provide water for livestock, remote homes, campsites, small farms or any other need beyond the commercial power grid.

Product Name and Description	Part Number	Flow Rate lpm/gpm	Max. Total Dynamic Head (meter/ft.)	Price	Shipping Weight (lbs.)
SD 3-70	85221	up to 3.0/0.8	70/230	$879.00	21.0
SD 6-35	85222	up to 6.0/1.6	35/115	$879.00	21.0
SD 12-30	85220	up to 12.0/3.15	30/100	$959.00	23.4

KYOCERA SOLAR, INC.

Kyocera SC Series Water Pumps

The Kyocera SC Series of submersible solar pumps are high quality, maintenance-free, DC powered pumps designed specifically for water delivery in remote locations.

SC 500 Series

They operate on 140 to 1000 watts of direct current at 30 to 120 volts. The power may be supplied from a variety of independent sources including solar modules and/or batteries.

The motors are state of the art, brushless DC, permanent magnet type constructed from marine grade bronze and 304 stainless steel. Designed with a pump motor face, they bolt directly to standard 4.0 inch diameter submersible pump ends. Internal pressure equalization allows motor submergence to any depth without damage to seals.

The pump ends are multi-stage centrifugal. They are manufactured by Goulds Pumps, Inc., constructed from 304 stainless steel and plastics. The impellers and diffusers are constructed from a rugged thermoplastic and are extremely resistant to mineral and algae deposits. Field replacement of the pump end is easily accomplished without the use of specialized tools.

The SC series pumps can be installed below the water level in a well, lake, river or cistern. They can be used to fill open tanks or used to pressurize water systems with heads up to 550 feet (167 meters). They are designed for use in stand-alone water delivery systems. They are pollution-free, corrosion resistant, permanently lubricated and quiet. There is no better way to provide water for livestock, remote homes, campsites, small farms or any other need beyond the commercial power grid.

Product Name and Description	Part Number	Optimal Flow GPM (LPM)	Optimal Head Feet (Meters)	Power (Watts)	Diameter in (cm)	Total Weight lbs (kg)	Pump Outlet Connection Size	Price
SC 500 15-60	85750	3.70 (14)	203.4 (62)	550	3.75 (9.53)	26.0 (11.8)	1-1/4" NPT	$1907.00
SC 500 25-40	85751	6.08 (23)	137.8 (42)	550	3.75 (9.53)	25.0 (11.4)	1-1/4" NPT	$1837.00
SC 500 35-35	85752	9.25 (35)	108.3 (33)	550	3.75 (9.53)	25.0 (11.4)	1-1/4" NPT	$1771.00
SC 500 40-25	85753	11.1 (42)	88.6 (27)	550	3.75 (9.53)	24.0 (10.9)	1-1/4" NPT	$1832.00
SC 1000 15-105	85754	4.49 (17)	374.0 (114)	1050	3.75 (9.53)	33.0 (14.8)	1-1/4" NPT	$2182.00
SC 1000 25-85	85755	6.34 (24)	315.0 (96)	1050	3.75 (9.53)	32.0 (14.3)	1-1/4" NPT	$2102.00
SC 1000 35-70	85756	8.98 (34)	236.2 (72)	1050	3.75 (9.53)	31.0 (13.9)	1-1/4" NPT	$2041.00
SC 1000 45-60	85757	11.62 (44)	193.6 (59)	1050	3.75 (9.53)	29.0 (13.0)	1-1/4" NPT	$1956.00
SC 1000 60-45	85758	16.11 (61)	147.6 (45)	1050	3.75 (9.53)	29.0 (13.0)	1-1/4" NPT	$2028.00
SC 1000 105-30	85759	22.45 (106)	98.4 (30)	1050	3.75 (9.53)	31.0 (13.9)	2" NPT	$2137.00

KYOCERA
KYOCERA SOLAR, INC.

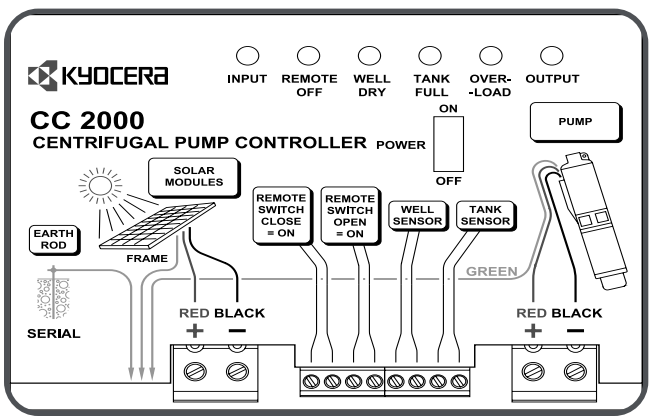
Kyocera Pump Controllers

The CD 300 and CC 2000 pump controllers are designed to connect solar modules to Kyocera Solar's SD and SC series submersible motors and pumps. The controller provides current boosting combined with true Maximum Power Point Tracking (MPPT) of the solar modules. The pump controller's microprocessor constantly monitors the incoming solar power and boosts current to operate the solar modules at their peak power point and maximize pump output. The controller is entirely self-configuring and requires no setup or adjustment by the user to ensure proper operation.

In addition to solar modules, the controller will also operate from 12 or 24 Volt (CD 300) and 24 to 144 Volt (CC 2000) battery banks for use in a broad range of applications. The CD 300 and CC 2000 controllers are only intended for use with Kyocera Solar pump motors.

The controller's unique design simplifies control and troubleshooting of pumping systems. Inputs are provided for remote switches and Kyocera Solar's unique water level sensor. Indicators provide convenient information about voltages, switch and sensor status, and overload conditions.

Kyocera Solar's newly designed pump controller is user friendly. It is designed to provide maximum power under varying conditions and requires no programming by the user. We are proud to introduce the Kyocera Solar line of pump controllers and are confident you will be satisfied.



CC 2000

CC 2000 Cover

Product Name and Description	CD 300	CC 2000
Part Number	**85223**	**85224**
Price	**$559.00**	**$669.00**
Ambient Temperature	-20 to 50°C	-20 to 50°C
Max. Solar/Input Voltage (total VOC @-20°C)	50V	300V
Max. Output Current - Current Boost Mode	10A	14A
Max. Output Power - Current Boost Mode	300W	2000W
Max. Output Current - Voltage Boost Mode	5A	-
Max. Output Power - Voltage Boost Mode	150W	-
Input Current Limiting	12A	15A
High Temperature Protection	85°C	85°C
Solar and Pump Wire Sizes	0.5 - 16 mm² (6 -20 AWG)	0.5 - 16 mm² (6 -20 AWG)
Sensor and Remote Wire Sizes	0.2 - 2.5 mm² (14 -24 AWG)	0.2 - 2.5 mm² (14 -24 AWG)

KYOCERA SOLAR, INC.

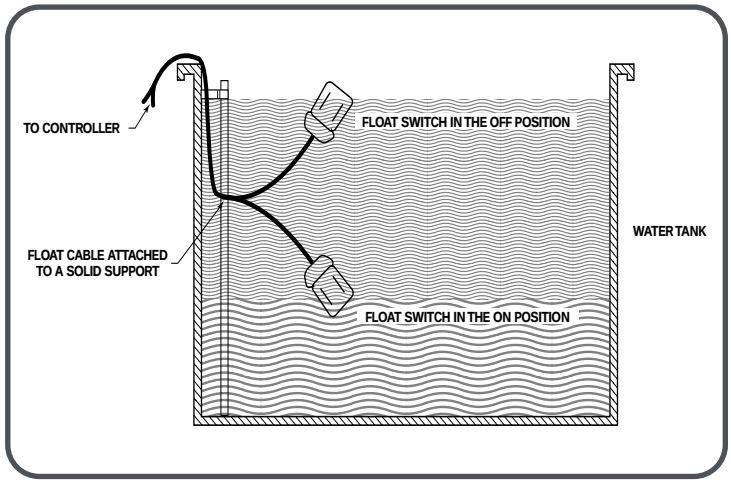
Kyocera Water Pumping System Accessories

Water Sensor, Float Switches and Submersible Pump Wire

All of the pumping systems we list have water sensing circuitry included. A float switch or SS 100 Water Sensor is all that is required to enable this function.

This can be used in one of two ways. First, a float switch can be used to turn the pump on and off when the storage tanks are low or full.

Secondly, an SS 100 Water Sensor can be placed near the pump to shut the pump off if the water falls below a certain level and start the pump again once water has reached a normal operating level. This sensor can be utilized either at the water source or on the storage tank.



Product Name and Description	Part Number	Price	Shipping Weight (lbs.)
Float Switch (open on rise)	85931	$66.00	3.0
Float Switch (close on rise)	85932	$33.00	3.0
SS 100 Water Sensor (150' wire included)	85230	$152.00	3.0
Splice Kit (SS 100)	85235	$14.00	1.0
#12-2 Submersible Pump Wire, 0.16lb./ft.	43403	$50.00/50ft.	-
#10-2 Submersible Pump Wire, 0.211lb./ft.	43433	$75.00/50ft.	-
#8-2 Submersible Pump Wire, 0.28lb./ft.	43423	$100.00/50ft.	-
#6-2 Submersible Pump Wire, 0.48lb./ft.	43453	$150.00/50/ft.	-
SS 100 Water Sensor Cable #20-2	43397	$0.55 / ft.	-

Float Switch

Repair Kit

Product Name and Description	Part Number	Price
Kyocera SD 12-30 Minor Repair Kit	86100	$148.00
Kyocera SD 6-35 Minor Repair Kit	86110	$122.00
Kyocera SD 3-70 Minor Repair Kit	86120	$145.00
Kyocera SD 12-30 Major Repair Kit	86105	$320.00
Kyocera SD 6-35 Major Repair Kit	86115	$228.00
Kyocera SD 3-70 Major Repair Kit	86125	$260.00
SDS-D-128 Minor Repair Kit	85960	$64.00
SDS-D-228 Minor Repair Kit	85970	$67.00
SDS-Q-128 Minor Repair Kit - Round	85951	$109.00
SDS-Q-128 Minor Repair Kit - Square	85950	$77.00
SDS-D-128 Major Repair Kit	85962	$254.00
SDS-D-228 Major Repair Kit	85972	$255.00
SDS-Q-128 Major Repair Kit - Square	85952	$287.00
SDS Pump Puller	85915	$79.00
D Series Rebuild Tool Kit	85916	$308.00

Drop Kit

Product Name and Description	Part Number	Price
SD 6-35 / 3-70 Drop Kit		
50' Tube, 75' 12-2 Cable	85254	$125.00
100' Tube, 125' 12-2 Cable	85258	$161.00
150' Tube, 175' 10-2 Cable	85262	$267.00
200' Tube, 225' 10-2 Cable	85266	$288.00
225' Tube, 275' 10-2 Cable	85268	$400.00
SD 12-30 Drop Kit		
50' Tube, 75' 12-2 Cable	85272	$180.00
100' Tube, 125' 10-2 Cable	85276	$245.00

Splice Kit

Product Name and Description	Part Number	Price
SD Series Splice Kit	85946	$11.00
SC Series Splice Kit	85902	$8.00
Water Sensor Splice Kit	85235	$14.00

Sand Shroud

Sand shrouds protect SD pumps by eliminating destructive sand intrusion into the pumps. Constructed of rugged PVC and polyethylene. Also includes reusable nylon coated stainless steel ties.

Product Name and Description	Part Number	Price
SD 3-70 / 6-35 Sand Shroud	85226	$129.00
SD 12-30 Sand Shroud	85225	$142.00

Sensor Splice Kit

SD 12-30 Drop Kit

SD 3-70/ 6/35 Sand Shroud

Grundfos Submersible Water Pumps

Grundfos SQFlex

For high head applications, Grundfos SQFlex pumps are an efficient, cost effective means of solar water pumping. The SQFlex line is capable of pumping water from a maximum rated depth of 390 feet. Input power can be AC or DC from sources such as solar, wind, a generator, or standard grid power. Dry run protection is integral to the pump and alleviates any potential damage from draw down in the well. Sizing software which incorporates solar data from around the globe is a quick and accurate tool to size Grundfos water pumping systems.

Product Name and Description	Part Number	Flow Rate lpm/gpm	Price	Shipping Weight (lbs.)
3 SQF-2 Helical rotor pump	80296	up to 3.0/0.8	$1529.00	21.0
6 SQF-2 Helical rotor pump	80297	up to 6.0/0.16	$1529.00	21.0
11SQF-2 Helical rotor pump	80292	up to 11.0/2.9	$1529.00	21.0

Grundfos SQFlex

Grundfos Controllers an Accessories

Product Name and Description	Part Number	Price	Shipping Weight (lbs.)
IO 100 Controller for use w/out generator or float switch	80294	$115.00	3.3
IO 101 Controller for use with generator	80293	$327.00	4.4
CU 200 Controller for use with float switch	80295	$258.00	4.4
Float Switch	80298	$20.00	1.0

New Products for Water Pumping System!

Call 1-800-544-6466
for more information.

Shurflo Pressure Pumps

The versatility of this pump makes it an excellent choice for use as an array direct or battery based domestic pressure pump. The built-in adjustable pressure switch activates the pump at 25 PSI and shuts off at an adjustable 40 to 50 PSI. This allows the unit to easily be used in a vacation cabin pressure tank type system. It will fill a cistern from a shallow source of water, such as a creek or pond and will self prime up to 10 feet (subtract 1 foot of lift for every 1000 feet above sea level). Because of their positive displacement diaphragm design, this pump will not be hurt by running dry for short periods of time nor be harmed by dirty or silty water.

PUMP #80125

Head (ft.)	Flow Pressure	GPM	Power Consumption in Watts
0	Open Discharge	3.60	70.0
23	10	3.23	73.0
46	20	3.04	89.0
70	30	2.85	104.0
93	40	2.68	116.0

Product Name and Description	Part Number	GPM Open Discharge	Price	Shipping Weight (lbs.)
Continuous Run Rated - 12VDC	80125	3.6	$159.00	11.0
8000 - 100ft. Lift 12VDC	80000	1.5	$90.00	5.0
8000 - 200ft. Lift 12VDC	80010	1.5	$114.00	5.0
Standard Duty - 12 VDC	80011	2.8	$135.00	10.0
Standard Duty - 24 VDC	80160	3.3	$136.00	10.0
Standard Duty - 115 VAC	80129	3.3	$183.00	10.0
Dual Head Pump - 12 VDC	80169	5.6	$249.99	28.0
Dual Head Pump - 24 VDC	80171	6.5	$259.99	28.0
12V Pump/Accumulator Combo - 3.8GPM	80173	3.8	$299.99	19.0
12V Pump/Accumulator Combo - 5.6GPM	80174	5.6	$395.00	20.0
24V Pump/Accumulator Combo - 6.5GPM	80176	6.5	$399.99	20.0
Rebuild Kit - Diaphragm	80003	-	$24.00	0.65
Rebuild Kit - Valve Kits	80005	-	$13.00	0.09
10" Filter housing with one 10-micron Filter	81390	-	$54.00	3.0
(2) 10" Refill for PN 81390 10-micron Filters	81391	-	$14.00	2.0

Pressure Pump 12 V

Pump/ Accumulator Combo

SHURflo Bilge Pumps

Piranha™ Bilge Pumps

Smart. Reliable. Attractive. Efficient. Everything you are looking for in a bilge pump. Our tough, high density nylon housing and heavy duty water cooled motor gives the SHURflo Bilge Pump unparalleled reliability. Installations are a snap with our unique swivel base plate and extended 6' tinned wire assembly. All Piranha™ Series Bilge Pumps have a removable cartridge for easy cleaning. Ideal for pumping ponds, hot tubs, and water falls.

Product Name and Description	Part Number	Max Amp Draw	GPM	Price	Shipping Weight (lbs.)
380 Bilge Pump - 12 Volt	80166	2.0	6.3	$17.95	30.0
500 Bilge Pump - 12 Volt	80167	2.2	8.3	$22.95	30.0
1000 Bilge Pump - 12 Volt	80168	3.9	16.6	$33.95	30.0

Bilge Pump

SHURflo
First in Fluid Innovation

SHURflo AquaTIGER™ SS

Agua Tiger SS

This high quality SHURflo Stainless Steel pump is a centrifugal pump designed for general plumbing applications where a flooded intake is provided. Typical applications include livewell filling and circulation; liquid transfer, shower/ hot tub pump-out, fish box and high flow washdrawn systems.

Product Name and Description	Part Number	GPM	Price	Shipping Weight (lbs.)
Aqua TIGER SS 12V	80177	21	$169.15	38.0

AquaTIGER SS

SHURflo
First in Fluid Innovation

SHURflo Submersible Pump 9300

Submersible Pump 9300

Compact, powerful, easy to install and highly reliable, thousands in service. Diaphragm type positive displacement pump with unique watertight electrical connectors. Delivers up to 2 gpm. Can deliver water from 250 feet. Uses up to 100 watts of peak solar power.

Product Name and Description	Part Number	GPM	Price	Shipping Weight (lbs.)
Submersible Pump 9300	79850	2	$745.00	6.0

Submersible Pump 9300

Wind Generators

The Perfect Compliment to Any Solar System

Electricity produced by wind generation can be used directly, as in water pumping applications, or it can be stored in batteries for household use when needed. Wind generators can be used alone, or they may be used as part of a hybrid system, in which their output is combined with that of photovoltaics, and/or a fossil fuel generator. Hybrid systems are especially useful for winter backup of home systems where cloudy weather and windy conditions occur simultaneously.

The most important decision when considering wind power is determining whether or not your chosen site has enough wind to generate the power for your needs, whether it is available consistently, and if it is available in the season that you need it. The power available from the wind varies as the cube of the wind speed. If the wind speed doubles, the power of the wind (ability to do work) increases 8 times. For example, a 10 mile per hour wind has one eighth the power of a 20 mile per hour wind. (10 x 10 x 10 = 1000 versus 20 x 20 x 20 = 8000).

One of the effects of the cube rule is that a site which has an average wind speed reflecting wide swings from very low to very high velocity may have twice or more the energy potential of a site with the same average wind speed which experiences little variation. This is because the occasional high wind packs a lot of power into a short period of time. Of course, it is important that this occasional high wind come often enough to keep your batteries charged. If you are trying to provide smaller amounts of power consistently, you should use a generator that operates effectively at slower wind velocities.

Wind speed data is often available from local weather stations or airports, as well as the US Dept. of Commerce, National Climatic Center in Asheville, N.C. You can also do your own site analysis with an anemometer or totalizer and careful observation. Installation of generators should be close to the battery bank to minimize line loss, and 30 feet higher than obstructions within a 300 foot radius. The tower should be well grounded.