

Solar Water Pumping

The sun is the natural source of energy for an independent water supply. Solar pumps operate anywhere that the sun shines, and the longer it shines, the more water they pump. When it's cloudy, they pump less water, but often you need less water when it is cloudy.

Photovoltaic modules, the power source for solar pumping, have no moving parts, require no maintenance and last for decades. A properly designed solar pumping system will be efficient, simple and reliable.

Solar water pumping systems operate on direct current. The output of the solar power system varies throughout the day and with changes in weather conditions. The nature of variable electricity in the form of direct current (DC) is quite different from conventional, steady alternating (AC) current from the utility grid or a generator.

To use solar energy economically, the pumping system must utilize the long solar day, drawing a minimum of power. This means pumping more slowly than conventional pumps. Pumping at rates of less than 6 gpm requires different mechanisms from the conventional (centrifugal) pumps. Small solar pumps are unique, both electrically and mechanically.

The most efficient pumps are "positive displacement" pumps. They pump a certain amount of water with each rotation. If it is cloudy or early morning, the pump will receive less energy and run more slowly. A positive displacement pump will pump approximately half as much water with half as much energy.

Conventional AC pumps are usually centrifugal pumps that spin at a high speed to pump as many gallons per minute as possible. They also consume a large amount of power. If you run a centrifugal pump at half speed, it pumps one quarter the pressure. Their efficiency is very low at low speeds and when pumping against high pressure.

If your water sources are remote from power lines, add up your long-term costs of fuel and repairs on generators, or the cost of utility line extensions. Now consider the savings with a solar pump that needs attention only once every 2 to 20 years depending on the model.

Solar powered pumps can provide an equal volume of water per day without the high and inefficient energy demands of a large capacity AC pump. Instead of pumping a large volume of water in a short time and turning off, the solar pump works slowly and efficiently all day. Often a solar pump will work fine in a well with a recovery rate too slow for a conventional AC pump.

Submersible Pumps

If you are pumping from a well, we have solar pumps that can deliver from 1 gallon per minute to over 75 gpm. The smallest pumps, the low-power diaphragm pumps from SHURflo and SunPumps, operate from two 50- to 100-watt solar modules, depending on the head (vertical distance) they are pumping. They can pump 500 to 1000 gallons per day and lift water 200 feet. These pumps require service every 2 to 4 years.

If you have a higher lift, need more water or want a pump that does not require service for 10 to 20 years, the Grundfos SQFlex pump is a good choice. The SQFlex can lift water over 600 feet and can pump over 20,000 gallons per day at lower lifts. The SQFlex pump can be powered by solar modules, a wind genera-

tor, a fuel powered generator, and inverter or the utility grid or a combination of several of these.

For greater water needs or deeper wells, the Grundfos SQ-series AC submersible pump can easily be powered by an inverter or generator. Larger, custom-designed solar powered pumping systems can be supplied by SunPumps. Contact us if your needs fall outside of the flow or lift specifications found in the following pages.

Surface Pumps

Surface pumps are less expensive than DC submersibles, where applicable. A surface pump is not submersible. It can draw water from a dug well, spring, pond, river or tank, and push it far uphill and through a long pipeline to fill a storage tank or to pressurize it for home use or for irrigation, livestock, etc. The pump may be placed at ground level, or suspended in a well in some cases.

All pumps are better at pushing than pulling. Surface pumps must be placed no higher than 10 or 20 feet above the surface of the water source at sea level (subtract one foot per 1000 feet elevation).

Suction piping must be oversized a bit and not allow air entrapment (much like a drain line) and should be as short as possible. Pumps can push very long distances. The vertical lift and flow rates are the primary factors that determine power requirements.

Pressurization

Many conventional AC powered water systems pump from a well or other water source, into a pressure tank that stores water and stabilizes the pressure for household use. When you turn on water in the house, an air-filled bladder in the tank forces the water into the pipes. When the pressure drops, a pressure switch turns on the pump, refilling and repressurizing the tank. This works fine because of the ability of the AC pump to deliver a volume of water larger than what is required for household use.

An AC pressure pump can work in systems with an inverter large enough to run a standard AC pump. However, this will not work with pumps operating directly from PV modules because the sun may not be shining when you need pressure and thus the pump may not keep up with household use.

There are two ways to solve this problem. A non-pressurized water tank can be located high enough above the house for gravity to supply the water pressure. This can be on a hill or a tower. Water pressure in psi = head (in feet) times 0.433. For reasonable pressure the tank needs to be at least 40 feet above the house. If this is not possible, a battery operated pressure booster pump can fill a pressure tank as needed from a storage tank that is filled by a solar pump during the day. You must use a pump that can deliver the maximum gpm required by the house, or have a pressure tank that is large enough to make up the difference between what the pressure pump can deliver and what is required, for the amount of time it is required. This is called the "drawdown volume" of the tank.

Calculation of Solar Power Needs

If you are using a pump driven directly by solar modules, the array watts should be at least 20% higher than the power required by the pump in your situation. If you use a larger array or a tracking array, the pump will operate at its maximum output for more hours of the day, delivering more gallons per day.

AeroVironment

Universal Solar Pump Controller for AC pumps

The AeroVironment Universal Solar Pump Controller (USPC) is a versatile, rugged, ultra-reliable, high performance variable speed motor controller for solar-powered water pumping applications using standard AC pumps rated from 1/3 HP to 10 HP. The USPC series is available in three power ratings to deliver up to 2, 5 or 10 kilowatts of maximum sustained power. Applications for the USPC include livestock watering, supplying water to villages, and high volume irrigation. The USPC family will power any standard three phase or three wire single-phase pump motor, allowing for the flexibility of using locally made, less costly and more serviceable pumps or fans. The USPC will not operate motors that have internal electronics or centrifugal switches.

The USPC can also be powered by most photovoltaic (PV) technology, including single or polycrystalline silicon and thin film arrays. Maximum array open circuit voltage (Voc) is 600 VDC. The minimum starting voltage is 150 VDC, but the voltage must reach 210 VDC to operate a 120 VAC motor at full power, 350 VDC to operate a 208 VAC motor at full power and 390 VDC to operate a 240 VAC motor at full power. A 600 VDC disconnect is recommended at the input to the controller.

A power conversion efficiency of 97%, with peak-power tracking and variable speed operation maximizes system performance to deliver the most water to an installation. Peak power tracking lets the USPC constantly adjust for peak power out of a solar array.

In very hot weather, delivered power is gradually lowered to prevent overheating. The USPC prevents pump damage with automatic dry well shut down and overload protection. It is housed in an outdoor-rated NEMA 3R steel case and functions in harsh conditions.

The USPC controllers can be also used to operate industrial fans and blowers directly from a PV system.



AeroVironment model	Maximum PV input amps	Maximum PV input watts	Max pump HP 1-phase 120V/240V	Max pump HP 3-phase	Maximum AC output current	Dimensions H" x W" x D"	Weight lbs	Item code	Price
USPC-2000	8	2200	0.5 / 1.0	2	9 A	18 x 9 x 6	17	075-00095	\$4,250
USPC-5000	18	5500	1.0 / 2.0	5	24 A	18 x 9 x 6	18	075-00099	\$5,450
USPC-10000	38	10000	2.0 / 4.0	10	38 A	18 x 9 x 8	22	075-00093	\$9,750

Solar Converters

Linear Current Boosters for DC pumps

Linear current boosters from Solar Converters are used in solar direct pumping applications. They can achieve a 30-90 percent increase in water pumped over connecting the pump directly to the solar modules. We can special order 90V units that can operate 12-, 24-, 36- and 48-volt pumps from several modules in series. This will be useful where the panels must be a long distance from the motor, allowing wiring with a smaller wire size as the current is reduced. The wire savings alone can easily pay for the controller. Call for details.



Solar converters model	Array volts nominal	Current max amps	Item code	Price
PPT 12/24-7	12 or 24	7	075-00124	\$140
PPT 12/24-15	12 or 24	15	075-00126	\$306
PPT 12/24-30	12 or 24	30	075-00128	\$558
PPT 48-10	48	10	075-00136	\$334

Grundfos

SQ AC Submersible Pumps

The SQ series pump features a permanent magnet motor controlled by an electronic frequency converter developed by Grundfos. It starts slowly, without surge, so it can be run on a much smaller inverter or generator than any conventional AC submersible pump. It is a high-efficiency pump and motor with built-in dry-run protection.

This is the ideal pump to use if you are pumping from a well and into a pressure tank, especially for solar-powered homes. They work on modified sine wave or sine wave inverters. Highest volume pumps run on 240VAC. They can be powered by inverter systems with 240VAC output, or by using an autotransformer to step 115 VAC from an inverter to 240 to run the pump. Minimum well diameter of 3 inches is required. Use 2-conductor with ground pump cable.

Warranty is 18 months from date of installation or 24 months from date of purchase, whichever comes first.

Grundfos SQ-Series AC Pumps					Depth to Pumping Water Level (lift) in Feet																		
Pump model	HP	AC volts	Item code	Price	20	40	60	80	100	120	140	180	200	220	240	280	300	340	400	460	520	600	
5SQ05-180	1/2	115 240	075-01425 075-01426	\$971			7.9	7.5	7.1	6.7	6.2	5.1	4.4	3.6	2.6								
5SQ07-320	3/4	240	075-01429	\$1,195							7.9	7.3	7	6.7	6.4	5.7	5.4	4.6	3.4	1.6			
5SQ10-360	1	240	075-01431	\$1,364								7.7	7.4	7.2	6.9	6.3	6.0	5.4	4.4	3.3	1.9		
5SQ10-410	1	240	075-01437	\$1,425									7.9	7.6	7.4	6.8	6.5	6.0	5.1	4.2	3.2	1.4	
5SQ10-450	1	240	075-01434	\$1,376											7.9	7.4	7.1	6.6	5.8	5.0	4.1	2.9	
10SQ07-200	3/4	240	075-01443	\$952				14.8	14.0	13.5	12.8	11.0	10.0	9.0	7.0								
10SQ07-240	3/4	240	075-01445	\$1,025					14.6	14.0	13.5	12.4	11.5	11.0	10.0	8.0	6.5	2.5					
10SQ10-290	1	240	075-01449	\$1,165						14.7	14.3	13.3	12.8	12.3	11.8	10.5	9.5	7.7	3.0				
10SQ15-330	1.5	240	075-01452	\$1,193							14.7	14.0	13.5	13.0	12.7	11.6	11.0	9.8	7.2	3.0			
15SQ05-110	1/2	115 240	075-01458 075-01457	\$969			19.5	17.5	16.0	13.5	11.0												
15SQ07-150	3/4	240	075-01459	\$990				19.0	18.0	17.0	15.5	12.0	10.0	7.0									
15SQ07-180	3/4	240	075-01460	\$1,045					19.5	18.5	17.5	15.5	14.0	12.5	11.0	6.5							
15SQ10-220	1	240	075-01462	\$1,101							19.5	17.0	16.0	15.0	14.0	11.5	10.0	6.0					
15SQ10-250	1	240	075-01461	\$1,118							20.0	18.0	17.5	16.5	15.5	14.0	13.0	11.0	5.5				
22SQ07-160	3/4	240	075-01464	\$1,155			32.0	30.5	28.5	26.5	24.0	17.5	12.0	3.0									
22SQ10-190	1	240	075-01467	\$1,172			33.0	31.5	30.5	29.0	27.5	23.5	21.0	18.0	8.0								
30SQ05-40	1/2	115 240	075-01470 075-01471	\$971	40	30	11																

SPDT Float Switch

The SPDT float switch can be used to control a pump in tank-filling or tank-emptying operation. Contacts located in the float will switch at 12 degrees above and below horizontal. Use a pipe clamp or cable tie to secure the cable to a pipe or weight in tank. The length of cable from clamp to float determines the difference between turn-on level and turn-off level. For larger pumps, use float switch to turn a relay on and off and let relay contacts control pump. Safe for domestic water systems. 2-year warranty.

Single Purpose Float Switches

These SPST switches perform a single function; either on when the tank is full or off when the tank is full.

ON WHEN FULL is used to turn on a pump when a tank is full and pump it down.

OFF WHEN FULL turns the pump off when a tank is full. T switches.

Description of operation	Maximum amps	Item code	Price
SPDT three-wire	5	075-05270	\$52
On when full	13	075-04420	\$46
Off when full	13	075-04422	\$46
On when full	25	075-04407	\$105
Off when full	25	075-04410	\$105



Grundfos

SQFlex Submersible Pumps

This is the ultimate submersible pump for water lifts of up to 650 feet. They can be directly powered by solar or wind power or can be run on an inverter, a generator, a battery or the utility grid, or any combination of these sources. Virtually any source of power, 30-300 VDC and 90-240 VAC, can be used to run the pump. They can operate on a series string of PV modules with a total peak power voltage over 30 volts, but the pumps efficiency will be much higher at voltages over 100 VDC. SQFlex 3 and 6 pumps will fit into a 3" well.

Seven pump models can deliver from 2 gpm at 600 feet to 65 gpm at 20 feet of head with a 1 kilowatt solar array or less. Helical rotor pumps (models 3, 6 and 11) for high head applications and centrifugal pumps for low head applications assure a pump that is efficient for any use. The SQFlex has built-in protection from dry-running, overload and overheating.

SQFlex pumps have a 2 year warranty from the date of purchase. A 5 year extended warranty is available separately and highly recommended.

The Whisper 200-150 V wind generator can be connected directly to an SQFlex pump. Please contact us for information.



Optional Controls

The CU200 interface box communicates with the pump and monitors operating conditions. Built-in diagnostics indicate faults and dry-running, display operating status, power consumption and water level switch input. The water level switch interfaces



with the CU200 control to turn off the pump when a tank is full.

The IO100 is a simple control box with cable terminations and a manual on/off switch. It is a great interface between a solar array and the pump to allow you to turn off the high voltage array when working on the pump.

The IO101 is an interface for using AC backup on a solar pump. An automatic transfer switch disconnects the solar array when AC power from a generator, utility connection or inverter is present. When AC power stops, it automatically reconnects the array to let the sun continue pumping.

The IO102 interface unit is used for systems powered exclusively by a wind turbine or by a combination of wind and PV.

You can use several controls if you need more features than one control can provide.

The SQFlex pumps will not function with a GFCI in the supply circuit, and should not be used where a GFCI is required.

Grundfos SQFlex pumps and accessories	Item code	Price
SQFlex 3 SQF-2 pump - 3"	075-01012	\$2,733
SQFlex 3 SQF-3 pump - 3"	075-01013	\$2,733
SQFlex 6 SQF-2 pump - 3"	075-01015	\$2,733
SQFlex 11 SQF-2 pump - 3"	075-01018	\$2,733
SQFlex 16 SQF-10 pump - 4"	075-01020	\$2,733
SQFlex 25 SQF-3 pump - 4"	075-01021	\$2,733
SQFlex 25 SQF-6 pump - 4"	075-01024	\$2,733
SQFlex 40 SQF-3 pump - 4"	075-01027	\$2,733
SQFlex 40 SQF-5 pump - 4"	075-01028	\$2,733
SQFlex 60 SQF-3 pump - 4"	075-01029	\$2,733
SQFlex Extended 5 Year Warranty	075-01001	\$249
IO100 interface box	075-01039	\$170
IO101 interface box (115V)	075-01036	\$586
CU200 interface for multiple sources	075-01033	\$490
Level switch (use with CU200 only)	075-01042	\$27
Whisper 200 wind turbine - 150V	016-01199	\$2,765
IO102 wind turbine interface box	075-01040	\$513
Tower kit 30 foot for Whisper 200	016-01089	\$585
Tower kit 50 foot for Whisper 200	016-01095	\$813
Auger/anchor (set of 4) for tower guys	016-01119	\$112
Pressure switch (use with CU200 only)	075-01044	\$125

Use the table on next page to choose a pump. Left column shows total head in feet and meters. The top row shows array wattage/number and suggested type of modules. Boxes show seasonal pump performance and maximum flow as shown here:

Select the row with the head (total lift) that most closely matches your application. Move across the row to the column that contains the desired daily volume or peak flow rate. Note the pump model in that block and wattage of the PV array in that column.

60 SQF-3	= Pump model
17,037	= Estimated daily summer volume (GPD)
12,520	= Estimated daily winter volume (GPD)
34	= Peak flow rate (gpm)

NOTE: Daily volume and flow calculations are based on 38° north latitude location, fixed array tilt of 38° and 4.5 kWh/m² (POA) winter, and 7.5 kWh/m² (POA) summer solar insolation. The pump model is optimized for summer operation. Up to 40% more water can be pumped in the summer if the array is on a tracking mount. The output can vary with different locations and years, and is not guaranteed.

Estimated Water Production from SQFlex Pumps (Summer and winter volumes and peak flow rates based on solar array wattage)									
Head	(Module watts)	85	85	85	85	175	175	175	175
feet	X (# of modules)	3	4	5	6	4	5	8	10
(m)	= (Array watts)	255	340	425	510	700	880	1400	1750
6 (2)	Model	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3
	7.5 kWh/m2	17,037	21,485	24,918	27,917	31,023	36,797	39,138	45,690
	4.5 kWh/m2	12,520	15,986	18,732	21,256	25,518	29,229	33,549	39,613
	Max flow	34	41	47	52	55	65	66	76
25 (8)	Model	40 SQF-5	40 SQF-5	40 SQF-5	40 SQF-5	60 SQF-3	60 SQF-3	60 SQF-3	60 SQF-3
	7.5 kWh/m2	6,834	9,853	12,466	15,113	18,582	25,358	29,804	36,941
	4.5 kWh/m2	3,944	6,219	8,305	10,319	12,489	17,744	23,459	29,319
	Max flow	16	22	27	32	41	52	54	65
50 (15)	Model	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	25 SQF-6	40 SQF-5	40 SQF-5	40 SQF-5
	7.5 kWh/m2	3,284	4,406	5,020	5,499	9,120	14,171	17,910	23,566
	4.5 kWh/m2	2,195	3,061	3,803	4,375	6,170	9,060	13,517	18,316
	Max flow	7	9	10	10	20	31	33	44
75 (23)	Model	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	25 SQF-6	25 SQF-6	40 SQF-5
	7.5 kWh/m2	2,524	3,557	4,381	4,910	5,352	8,805	10,871	15,732
	4.5 kWh/m2	1,588	2,343	3,035	3,684	4,314	5,703	8,387	11,880
	Max flow	6	8	9	10	10	19	21	31
100 (30)	Model	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	16 SQF-10	16 SQF-10
	7.5 kWh/m2	1,824	2,708	3,552	4,202	4,794	5,503	7,768	10,016
	4.5 kWh/m2	1,015	1,648	2,277	2,868	3,667	4,445	6,036	7,875
	Max flow	4	6	8	9	9	10	15	18
125 (38)	Model	6 SQF-2	6 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	16 SQF-10	16 SQF-10
	7.5 kWh/m2	1,495	1,977	2,825	3,534	4,268	5,071	6,445	8,792
	4.5 kWh/m2	891	1,370	1,704	2,248	3,012	3,988	4,930	6,823
	Max flow	3	4	6	8	9	10	13	16
150 (46)	Model	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	16 SQF-10
	7.5 kWh/m2	1,319	1,847	2,127	2,380	3,770	4,651	5,121	7,530
	4.5 kWh/m2	758	1,179	1,591	1,888	2,506	3,551	4,180	5,771
	Max flow	3.1	4.2	4.5	4.6	8.3	9.3	9.3	14.4
175 (53)	Model	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2
	7.5 kWh/m2	1,133	1,684	2,008	2,250	3,265	4,233	4,787	5,393
	4.5 kWh/m2	624	1,009	1,407	1,741	2,029	3,058	3,874	4,450
	Max flow	2.7	3.8	4.4	4.5	7.4	8.9	8.9	9.1
200 (61)	Model	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	11 SQF-2	11 SQF-2	11 SQF-2
	7.5 kWh/m2	952	1,514	1,888	2,114	2,352	3,807	4,435	5,064
	4.5 kWh/m2	493	867	1,207	1,583	1,903	2,552	3,536	4,153
	Max flow	2.3	3.5	4.3	4.5	4.5	8.5	8.4	8.8
250 (76)	Model	3 SQF-2	3 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2	11 SQF-2	11 SQF-2
	7.5 kWh/m2	698	905	1,578	1,875	2,125	2,483	3,733	4,344
	4.5 kWh/m2	422	644	890	1,183	1,639	2,017	2,816	3,493
	Max flow	1.6	1.9	3.7	4.3	4.3	4.5	7.4	8.1
300 (91)	Model	3 SQF-2	3 SQF-3	3 SQF-3	3 SQF-3	6 SQF-2	6 SQF-2	6 SQF-2	11 SQF-2
	7.5 kWh/m2	609	865	1,015	1,132	1,884	2,253	2,482	3,453
	4.5 kWh/m2	355	555	750	890	1,282	1,785	2,050	2,700
	Max flow	1.4	2.0	2.1	2.2	4.2	4.4	4.3	6.9
360 (110)	Model	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	6 SQF-2	6 SQF-2	6 SQF-2	6 SQF-2
	7.5 kWh/m2	535	801	953	1,072	1,583	2,010	2,260	2,541
	4.5 kWh/m2	294	484	669	827	918	1,458	1,839	2,108
	Max flow	1.3	1.8	2.1	2.2	3.8	4.3	4.2	4.3
420 (128)	Model	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3
	7.5 kWh/m2	467	724	900	1,013	1,122	1,284	1,314	1,439
	4.5 kWh/m2	247	423	599	762	910	1,062	1,109	1,239
	Max flow	1.1	1.7	2.0	2.1	2.1	2.2	2.2	2.3
500 (152)	Model	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3
	7.5 kWh/m2	367	606	809	931	1,053	1,211	1,257	1,379
	4.5 kWh/m2	180	337	489	651	828	990	1,052	1,186
	Max flow	1.0	1.4	1.9	2.1	2.1	2.2	2.2	2.2
600 (183)	Model	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3	3 SQF-3
	7.5 kWh/m2		406	612	779	898	1,066	1,146	1,260
	4.5 kWh/m2		190	321	454	664	855	952	1,063
	Max flow		1.0	1.5	1.9	1.9	2.0	2.0	2.0

SHURflo

9300 Submersible Pump



Use this lightweight submersible pump for livestock, irrigation or remote home application with low water requirements. The 9300 is a positive displacement diaphragm type pump with very high efficiency, but a much shorter life than centrifugal or helical rotor pumps. Diaphragm should be replaced every two to four years, depending on pumping volume.

The SHURflo 9300 can be operated on a 12- or 24-volt battery, or, with the use of one of the SHURflo Pump Controls, directly on a PV array. The pump can lift 1.3 gpm to 230 feet and can pump nearly 2 gpm from very shallow wells. It measures only 3.75" diameter x 12" long. Performance on a 12-volt battery will be less than half the flow on the accompanying table. 1-year warranty.

The 902-200 controller comes in an outdoor enclosure with water level sensors and sensor wire. It can be operated from a 12V or 24V array. Water sensors hang in the well and are used to prevent dry running in very low yield wells. The 902-100 control must be mounted in a dry location and used with a 24V array.



Array Direct Performance (24V array)

Vertical lift	Minimum solar array size	Flow rate (gpm)	Amps @ 30V
20	2 x 32 watts	1.95	1.5
40	2 x 32 watts	1.90	1.7
60	2 x 50 watts	1.81	2.1
80	2 x 50 watts	1.76	2.4
100	2 x 50 watts	1.71	2.6
120	2 x 50 watts	1.68	2.8
140	2 x 80 watts	1.65	3.1
160	2 x 80 watts	1.63	3.3
180	2 x 80 watts	1.55	3.6
200	2 x 80 watts	1.52	3.8
230	2 x 80 watts	1.36	4.1

Description	Voltage/wattage	Wt. lbs	Item code	Price
SHURflo 9300 submersible pump	12 - 24 VDC	6	075-05817	\$922
SHURflo 902-100 pump controller	24 VDC	6	075-05823	\$164
SHURflo 902-200 pump controller	12-24 VDC	6	075-05820	\$402

LVM

Submersible Pumps



LVM pumps are constructed of polyacetal plastic, enabling them to pump almost any liquids. They are small enough to enter the opening in a five gallon container or a 2-inch well casing. The outlet is a half-inch hose barb. The intake has a removable strainer with another hose barb for inline use. These pumps can be used for most general intermittent pumping applications, like hosing down cars, vans, boats, pumping into and from containers, emptying bilges, etc. LVM 105 comes with battery clips. These pumps are designed for 12-volt operation and will be damaged by array-direct operation if voltage goes above 15 volts. Made in England.

Model number	Current (amps)	Flow rate (gpm) at 0 psi	Pressure (max psi) at 0 flow	Maximum head (feet)	Dimensions (inches)	Weight (lb)	Cable length	Item code	Price
LVM105	4.5	4	14	32	1.5 x 6.54	1.1	12 ft	075-08052	\$89
LVM107	2	2	11	20	1.5 x 5.67	0.5	3 ft	075-08054	\$68
LVM111	6	6	14	32	1.5 x 6.54	1.5	12 ft	075-08058	\$110

Solar Stream

Pulsing Solar Fountain Kit

The Solar Stream LJ-01 solar fountain pump provides a unique feature for any pond, garden pool, or business display. Powered by a 5-watt photovoltaic module, the fountain sends a stream of water 6 feet into the air two times a second in full sun. The pump is a stainless steel cylinder, 6 inches high and 3 inches in diameter. It fits into a 5-inch foam collar that allows the pump to float at the water's surface. An 8-foot cord allows connection to the commercial grade 5-watt photovoltaic module supplied with the kit.

These pumps have only one moving part – a free piston. Electricity from sunlight (from the PV module) charges a capacitor. When the capacitor voltage reaches a fixed level (about 16 volts), an electronic switch feeds the capacitor energy into the pump coil which drives the piston, creating a pulse of water. The more sunlight, the more pulses of water are delivered. 1-year warranty.



Model number	Description	Item code	Price
LJ-01	Solar fountain pump kit	075-08157	\$150

SunPumps

SDS DC Submersible Pumps

SunPumps SDS series submersible pumps are efficient, low voltage, DC powered, diaphragm type positive displacement pumps designed specifically for water delivery in remote locations. They operate at 12 to 30 volts DC which may be supplied from a variety of independent DC power sources. There are two models of SDS pump. The D-series has a dual diaphragm and fits in a 4-inch well. The Q-series is a higher flow pump that fits in 5-inch or larger wells. They can be used to fill an open tank or in pressurized water delivery systems. Simplicity is the key feature of the SDS series pumps. They are easy to install, require very little maintenance and are repairable. Use the table to choose the pump that best meets your flow need at a given head. A PCA-30-M1 controller must be used with all SDS pumps. At 15 volts, flow is slightly less than half of the 30-volt flow.

SDS Pump Flows at 30 VDC																
Item code	075-03017			075-03018			075-03021			075-03023			075-03022			
Price	\$1,048			\$1,048			\$1,187			\$1,187			\$1,187			
Model	SDS-D-128			SDS-D-228			SDS-Q-128			SDS-Q-135			SDS-Q-130			
Head (ft)	Flow (gpm)	Amps	Module watts	Flow (gpm)	Amps	Module watts	Flow (gpm)	Amps	Module watts	Flow (gpm)	Amps	Module watts	Flow (gpm)	Amps	Module watts	
0	1.75	1.66	62	1.40	1.37	51	3.90	1.80	68	5.10	1.94	73	4.40	1.58	59	
23	1.70	1.80	68	1.35	1.57	59	3.70	2.09	78	4.90	2.68	101	4.20	2.32	87	
46	1.65	2.05	77	1.30	1.73	65	3.50	2.70	101	4.60	3.53	132	4	3.05	114	
69	1.60	2.55	96	1.25	1.92	72	3.30	3.33	125	4.40	4.36	164	3.80	3.75	141	
92	1.55	3.08	116	1.20	2.10	79	3.09	3.90	146	4.20	5.26	197	3.60	4.50	169	
104	1.52	3.12	118	1.17	2.20	82	3	4.20	158	4.10	5.68	213	3.50	4.85	182	
116	1.50	3.16	119	1.15	2.28	86	2.90	4.50	169	4	6.12	230				
139	1.45	3.31	124	1.11	2.46	92	2.75	5.03	189							
162	1.40	3.50	131	1.07	2.64	99										
185	1.35	3.70	139	1.03	2.79	105										
208	1.30	3.92	147	1	2.96	111										
231	1.25	4.11	154	0.95	3.10	116										



PCA/PCB Controllers

SunPumps PCA and PCB Series pump controllers are microprocessor-controlled DC power converters designed as the interface between a DC-powered pump and the power source. The DC source may be solar modules, batteries or systems using wind generators. The primary function of the PC series controller is to boost the current of solar modules in low sunlight conditions while holding the voltage of the solar modules at the maximum power point. This allows a pump to start earlier in the morning and stay running longer in the evening. SunPumps PC series pump controllers have many unique features designed specifically for water pumping.

All PC series controllers include a pump speed control circuit, a remote switch circuit, a sensorless low-water cut-off circuit, an electronic circuit breaker, and indicator lights. SunPumps PCA 30-M1D controller uses the same controller board with all the same features as the PCA 30-M1 controller. The only difference is the box is constructed of UV stabilized Super Tuff Delrin instead of aluminum and the current rating is reduced from 8 amps to 6 amps.

Model		PCA-30M1D	PCA-30M1	PCA-60M1	PCB-90BT-M1	PCB-120BT-M1	PCB-180BT-M1
Number of 36-cell modules in series		2	2	4	6	9	12
Number of 54-cell modules in series		1	1	2	4	6	8
Number of 72-cell modules in series		1	1	2	3	4	6
Nominal volts		15, 24, 30	15, 24, 30	30, 45, 60	45, 60, 75, 90	90, 105, 120, 135	135, 150, 165, 180
Maximum open circuit volts		45	45	90	200	250	300
Maximum load current (amps)		6	8	8	10	10	14
Maximum load power (watts)		250	250	500	1000	1200	2500
Brush motor control	Item code	075-03027	075-03029	075-03029	075-03035	075-03041	075-03047
	Price	\$325	\$500	\$609	\$861	\$844	\$934

SPB Piston Pump

SunPumps SPB series triplex piston booster pumps are high quality, positive displacement piston pumps designed for medium to high heads where flow rates are low to medium but reliability is a must. They are surface-mounted pumps designed to pump from cisterns, lakes, rivers or above-ground tanks. They have good suction lift capability, up to 15 feet at sea level. Sunpumps SPB series triplex pump systems come as a complete package including the pump, motor, mounting base, pulleys, geared belt and belt guard. These pumps are custom built and tested for your specific application. SunPumps have pumps in operation boosting water as high as 2300 feet vertically. Call for design help.

Model	Description	Item code	Price
SPB 2.5-23C	3/4 HP Triplex Piston Booster Pump	075-03205	\$3,530
SPB 2.5-23C	1 HP Triplex Piston Booster Pump	075-03208	\$3,558
SPB 2.5-23C	1 1/2 HP Triplex Piston Booster Pump	075-03211	\$3,871
SPB 2.5-23C	2 HP Triplex Piston Booster Pump	075-03214	\$4,556
SPB 2.5-23C	3 HP Triplex Piston Booster Pump	075-03217	\$5,244
SPB 4-23C	3/4 HP Triplex Piston Booster Pump	075-03220	\$4,260
SPB 4-23C	1 HP Triplex Piston Booster Pump	075-03223	\$4,588
SPB 4-23C	1 1/2 HP Triplex Piston Booster Pump	075-03226	\$4,401
SPB 4-23C	2 HP Triplex Piston Booster Pump	075-03229	\$5,337
SPB 4-23C	3 HP Triplex Piston Booster Pump	075-03231	\$6,086
SPB 10-16C	3/4 HP Triplex Piston Booster Pump	075-03234	\$5,159
SPB 10-16C	1 HP Triplex Piston Booster Pump	075-03237	\$5,590
SPB 10-16C	1 1/2 HP Triplex Piston Booster Pump	075-03241	\$5,777
SPB 10-16C	2 HP Triplex Piston Booster Pump	075-03244	\$6,676
SPB 10-16C	3 HP Triplex Piston Booster Pump	075-03247	\$7,013



SCB Pressure Booster Pumps

SunPumps SCB series pressure pumps are multi-stage centrifugals designed primarily for boosting pressure from surface water as long as the water supply is above or no more than 3' below the level of the pump. They are ideal pumps for home pressure systems, sprinkler systems or inline booster pumps. SunPumps SCB series pressure pumps are very high quality, maintenance-free, DC pumps specifically designed for standalone water delivery in remote locations to be powered from batteries. Allow 2 weeks for delivery.



Capacities in U.S. Gallons per Hour at Discharge Pressure or Feet of Lift (head)

Model number	Item code	Price	Nominal volts	Watts required	20	30	40	50	60	70	80	90	100	110	120	psi
					46	69	92	116	139	162	185	208	231	254	277	Head in feet
SCB 6-40P-24	075-03132	\$1,265	24	300	510	420	360	240	80							
SCB 8-40P-24	075-03134	\$1,301	24	400	590	510	470	400	310	210	70					
SCB 10-40P-24	075-03135	\$1,367	24	600	828	714	582	420	222							
SCB 20-25P-24	075-03137	\$1,330	24	900	1483	949										
SCB 12-60P-48	075-03139	\$1,489	48	900	930	870	810	770	710	660	600	520	450	360	220	
SCB 24-50P-48	075-03141	\$1,489	48	1600	2226	1996	1740	1466	1140	683						

SCP Pool Pump



These centrifugal pumps are designed specifically for pool water circulation. The SCP series pumps are equipped with heavy duty permanent magnet, DC motors. The pump ends are constructed from high-performance thermoplastic and are extremely resistant to chemicals as well as mineral and algae deposits. For added protection, a basket strainer is incorporated into the suction side of the pump. They can also be used to fill open tanks, aerate ponds, circulate water for aqua culture or irrigate small farms. Inlet and discharge ports are 2" NPT and they operate at 45 to 90 VDC. SCP 42-47-10 operates up to 120 VDC and can pump 93 gpm at 0 psi. Use with SunPumps Control PCB-120 (075-03041). They weigh 34 pounds.

Model	HP	45 VDC			60 VDC			75 VDC			90 VDC			120 VDC			Item code	Price
		PV min watts	Max GPM	Max PSI	PV min watts	Max GPM	Max PSI	PV min watts	Max GPM	Max PSI	PV min watts	Max GPM	Max PSI	PV min watts	Max GPM	Max PSI		
SCP 48-30-07	3/4				305	60	7	540	76	11	891	90	16				075-03065	\$889
SCP 52-35-07	3/4	225	44	7	480	63	13	806	76	22							075-03067	\$931
SCP 55-50-10	1				400	65	12	750	77	20	1240	91	28				075-03069	\$931
SCP 65-40-10	1				402	70	10	780	91	19	1111	118	25				075-03075	\$963
SCP 42-47-10	1							305	58	8	400	70	12	755	93	24	075-03073	\$963

SC 24-116 Centrifugal Surface Pump

The SunPumps SC 24-116 centrifugal surface pump is the centrifugal section of a convertible jet pump. It will produce 24 gpm at 116 feet of head, operating at 120 VDC. This pump can also be used as either a shallow well or deep-well jet pump with the addition of a jet adapter. This SC centrifugal pump is used as a panel-direct centrifugal booster pump. See the table for basic sizing or call for a complete system quote. Use with SunPump Control PCB-120 (075-03041).

PSI	Head (feet)	Amps	GPM	Motor watts	PV watts
5	12	5.83	42.4	700	875
10	23	11.3	40.7	1360	1700
20	46	11.2	37.1	1310	1686
50	116	9.9	23.9	1195	1494
65	150	8.3	9.2	998	1248



Model	Item code	Price
SJT 12-116	075-03103	\$995

Solar Jet Pump

The SunPumps SJT series pump was designed for use in shallow water wells. It has excellent suction lift capabilities and is primarily used to fill open storage tanks. It operates directly on 250-550 watts of solar modules at 60-90 VDC. Use with SunPumps Control PCB-90 (075-03035).

60 VDC			75 VDC			90 VDC		
Module watts	Flow rate (gpm)	Pressure (psi)	Module watts	Flow rate (gpm)	Pressure (psi)	Module watts	Flow rate (gpm)	Pressure (psi)
195	15.6	0	356	19.4	0	546	23	0
179	11.1	5	338	16.3	5	513	18	10
155	4.3	10	315	12	10	486	14	15
139	0	12	281	6.5	15	450	9	20
			244	0	19	394	0	27



Model	Item code	Price
SJT 12-40	075-03117	\$1,360

SHURflo

2088 Pressure Pumps

These positive displacement diaphragm pumps make excellent household pressure pumps if you need less flow than the booster pumps on the pages 186-187 deliver. The SHURflo 2088 pumps up to 3.6 gallons per minute, is designed for continuous-duty operation with addition of optional heat sink, and can be run dry without harm. It has a built-in pressure switch and half-inch male pipe-thread ports for easy connection to common plumbing fittings. Home pressurization installation requires a precharged water tank. For general water pumping, this pump can self prime to 10 feet and lift water up 100 feet. The 120-volt AC version can run on a 200-watt inverter and can be 1000 feet from the inverter using 12 gauge wire. Dimensions: 4.45" x 12.4" x 5".



SHURflo part #	Description	Voltage	Max gpm	Pressure (psi)	Flow (gpm)	Current (amps)	Item code	Price
2088-443-144	Standard pump - 3.5 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	12VDC	3.5	10	2.83	5.80	075-05625	\$98
				30	2.31	8		
				40	2.02	9.10		
2088-514-145	Premium pump with fan cooled motor 3.6 gpm open flow, 45 psi demand switch, 1/2" MSPT ports, splash-proof motor	12VDC	3.5	10	2.9	5.60	075-05613	\$155
				30	2.3	8.40		
				40	2.07	9		
2088-514-144	High flow pump - 3.8 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	12VDC	3.8	10	3.3	7.90	075-05615	\$160
				30	2.5	10		
				40	2.2	10.50		
2088-414-534	Premium pump with splash-proof motor 3.6 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	12VDC	3.6	10	2.9	5.60	075-05616	\$186
				30	2.3	8.40		
				40	2.07	9		
2088-474-144	Standard pump - 3.0 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	24VDC	3	10	2.8	2.41	075-05628	\$102
				30	1.75	2.73		
				40	1.25	2.91		
2088-573-534	Premium pump with splash-proof motor 3.6 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	24VDC	3.6	10	3.17	3.10	075-05619	\$186
				30	2.63	4.10		
				40	2.34	4.50		
2088-594-154	Standard pump - 3.3 gpm open flow, 45 psi demand switch, 1/2" MSPT ports	120VAC	3.3	10	2.6	0.58	075-05622	\$144
				30	2.08	0.76		
				40	1.85	0.94		

Pump Accessories

Use the 2-gallon pre-charged pressure tank to extend the life of your SHURflo pump. The tank helps provide a smooth flow in your pumped water system and reduces motor heating and pressure switch wear by decreasing the number of on/off cycles. Internal bladder is precharged to 20 psi.

Adapters fit the straight pipe thread on the 2088 pumps and allow connection of tapered pipe thread fitting. Right angle fittings have wingnut fitting that can be tightened by hand. Straight fitting has a hex nut cast into it.

SHURflo part #	Description	Item code	Price
3400-002	Vertical 2-gallon pre-charged pressure tank - stainless steel with 3/4" male NPT port	075-05730	\$130
170-061-20	Twist-on water strainer - 50 mesh screen 1/2" FPST inlet	075-05784	\$10
8-035	Adapter with wingnut - right angle 1/2" FSPT to 1/2" NPT for 2088 pumps	075-05735	\$2
8-155-01	Adapter with wingnut - right angle 1/2" FSPT to 5/8" barb for 2088 pumps	075-05763	\$2
8-205-00	Adapter - straight 1/2" FSPT to 1/2" NPT male for 2088 pumps	075-05760	\$2
34-006	5" heat sink for continuous-duty pump operation	075-05766	\$24

NEW! Aquatec**550 Series Pressure Pumps**

These Aquatec booster pumps provide “town pressure” for remote home water supplies where 12-volt or 24-volt power is available. They have a longer life and greater flow rate than other diaphragm booster pumps and they use less than half the energy consumed by an AC jet pump running on an inverter. The 120-volt version can be used on remote power systems with inverters.

**ADVERTISEMENT**

Aquatec's 550 pressure pumps delivers powerful flow rates at pressures up to 60 PSI. Their patented 5-chamber diaphragm and piston design allows these pumps to operate at very low noise levels and with minimal pulsations. These pumps are designed for intermittent duty, though most models can be run continuously for hours at a time. They are commonly used either to pressurize water from an atmospheric tank, to deliver purified water to a specific point of use, or simply to increase pressure when required.

The built-in pressure switch is set for 60 psi off and 40 psi on. The pumps come with straight threaded male half-inch fittings that snap into the quick disconnect ports. The optional strainer is highly recommended to keep debris out of the pump, insuring long diaphragm life.

All Aquatec 550 Pressure Pumps weigh 8 pounds each.

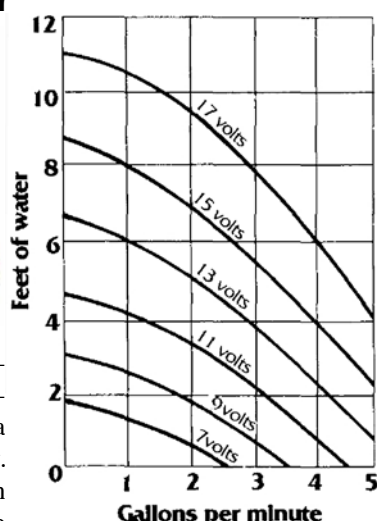
Aquatec model	Voltage	Max. gpm	Pressure (psi)	Current draw (amps)	Item code	Price
5503-AEE-B636	12 VDC	4.10	30	11.0	075-04805	\$112
		3.80	40	13.0		
		3.55	50	14.6		
5503-AEE-B736	24 VDC	4.10	30	5.5	075-04809	\$122
		3.80	40	6.5		
		3.55	50	7.3		
5503-AEE-B656	120 VAC	4.10	30	1.42	075-04813	\$144
		3.80	40	1.60		
		3.55	50	1.80		
Strainer	High flow 50 mesh in-line strainer				075-04821	\$20

Hartell

MD10HEH Circulator



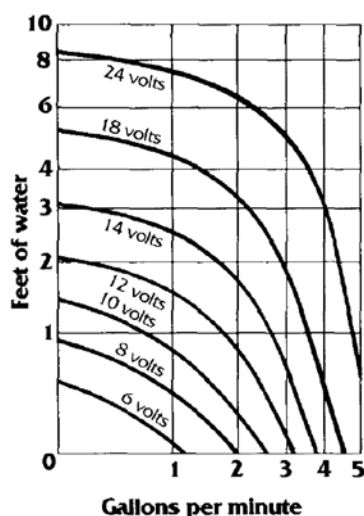
This pump has an electronically commutated, high efficiency brushless motor with a 30,000-hour life expectancy. It may be operated from an 20- to 22-watt solar module or directly from a 12-volt battery system. They work great for closed-loop solar water heating systems and radiant floor heating. The graph shows this pumps performance at various heads and flows, at different input voltages.



MD3DCL Circulator



This pump has an economical brush-type motor that may be used with a 12- or 24-volt battery system, or directly from an 20-watt 12-volt PV module. It has a 7,000-hour life expectancy. It works well as a circulating pump between a tank and solar collector in a domestic hot water system. It also functions well as a circulating pump in a radiant floor heating system that requires less than 5 gpm of circulation. Brushes last for 3-5 years and are easily replaced without removing pump from plumbing.



Model	Operating voltage	Pipe connections	Dimensions (inches)	Item code	Price
MD-10-HEH	6-16 VDC	1/2" MNPT	5.25" x 9"	075-07237	\$389
MD-3-DCL	2-24 VDC	1/2" MNPT	5.25" x 7.75"	075-07241	\$237

EL-SID

Brushless Water Circulators

These tiny brushless, magnetic-drive circulators can be driven by PV modules or 12-volt batteries for closed-loop circulation in solar water heating systems, individual space heat zones and individual loop radiant floor loops. Use of several small pumps in a radiant floor system allows each loop to be controlled by a different thermostat. Model 10PV-12 is designed to be powered by a 10- to 20-watt PV module, in open loop systems and



can pump 3.3 gallons per minute at no head and ½ gpm at 2.5 feet of head at 17 volts input. A 20-watt module should be used for glycol systems. It can circulate water in a well designed solar water heating system with two 4 x 10 collectors. Model 10B-12 is designed to be battery powered and has the same specifications at 12 volts. 10B-24 is designed to operate on a 24 volt battery system. 20B-12 used more power to provide more flow and more had. 20PV-12 requires a 40 watt of PV and is ideal for pumping glycol through 3 or more collectors. It is a good idea to face the module to the east to help this pump start in the morning. Dimensions: 4" x 4" x 5". 30,000-hour life expectancy.

El-Sid Model	Flow (gpm) Maximum	Volts (max)	Amps	Weight lbs	Item code	Price
10PV-12	3.3	20	0.9	2	075-07218	\$280
10B-12	3.3	16	0.45	2	075-07219	\$280
10B-24	3.3	32	0.25	2	075-07222	\$360
20B-12	5	16	1.5	2	075-07224	\$380
20PV-12	5	20	1.5	2	075-07226	\$410

HighLifter

Water Powered Water Pumps

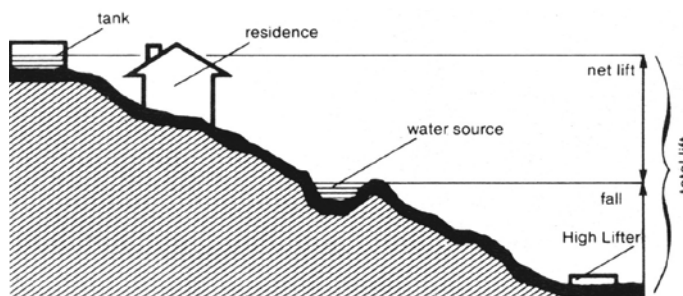
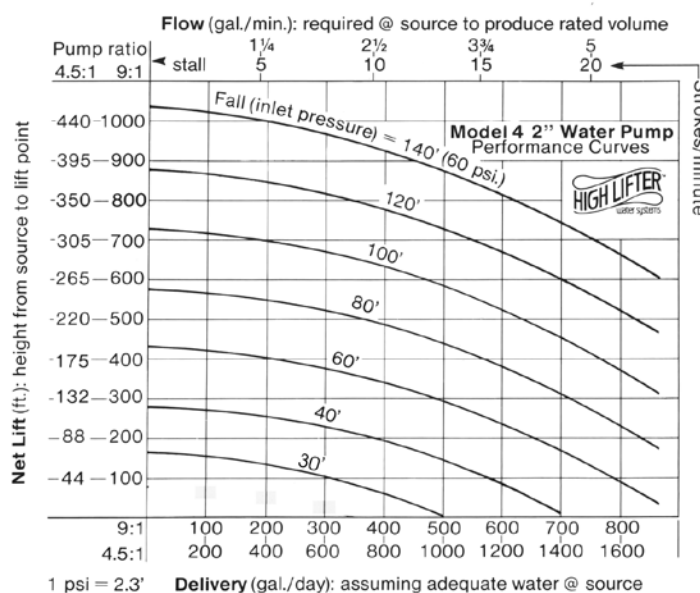
The High Lifter is a powerful water pump designed to move water uphill without using gasoline or electricity. By harnessing the energy of piped water pressure from an uphill source, the High Lifter pump can drive a portion of this water through another pipe to a tank higher than the water source. Pistons provide the pumping action and water is the only lubricant used. With adequate water and pressure it can pump up to 1500 gallons of water per day as high as 300 feet, or it can pump 200 gallons per day as high as 1000 feet. It can also pump smaller amounts on as little as one quart per minute of source water, and can pump to lower elevations with as little as a 30-foot drop from the water source.

It is self-starting and requires no lubrication, priming, or tuning, and is quiet compared to gas engine pumps. Due to its light weight, ease of installation, and lack of fuel requirements, it is ideally suited for hilly or remote terrain. Simply run a pipe downhill to your High Lifter from a pond, stream, or spring, lay out a pipe to your high tank, and start pumping. Designed to be installed and maintained by the user with basic hand tools, the High Lifter requires little attention other than filter cleaning for years of hardworking service. Depending on how clean the water source is, a High Lifter can operate continuously for 1-3 years between piston replacement service, or even longer if the inlet water is processed through a settling tank to remove grit. The High Lifter is an efficient, economical, and reliable way to handle many water pumping requirements. It can be effectively used for domestic water pumping, garden water supply, irrigation, range cattle, etc. All High Lifter parts are made of stainless steel, Teflon, and acrylic, so they are safe for drinking water. Pump is 26" long. 1-year warranty on materials and workmanship.

As illustrated in the graph, the High Lifter responds to both inlet and output pressure. Because the High Lifter utilizes inlet water pressure to pump water, locating the pump farther down from the water source will yield greater delivery or higher pumping elevations. The higher the upper tank is located, the slower the pump will work. If the upper tank is placed too high, the pump will stall (with no damage to the pump) and no water will be pumped.

To determine how much water will be pumped, find the net lift for either the 4.5:1 or 9:1 pump on the left side of the graph. Move across the graph horizontally to the right until you cross the curve for the fall (inlet pressure). From the point where lift and fall cross, move vertically down to the bottom of the graph and read the "Delivery (gal/day)" for the type of pump being used. To get this delivery amount, the input flow to the pump must be equal to or greater than the "Flow (gal/min)" at the top of the graph in line with the point where the lift and fall lines cross. If the input flow is less than this number, the output will be correspondingly lower.

The diagram shows a typical installation using the High Lifter to fill a tank. Note that "net lift is the vertical distance from the water source to the tank.



The picture above shows a typical installation using the High Lifter to fill a tank. Note that "net lift is the vertical distance from the water source to the tank.

Model	Pump ratio	Max output/day	Max net lift	Max total lift	Item code	Price
H44	4.5:1	1500 gal	440 ft.	580 ft.	076-09002	\$1,095
H49	9.1:1	750 gal	1000 ft.	1140 ft.	076-09005	\$1,095