Simple DC System for Hydroponic Watering

By James Dunn

With today's technology, a simple watering system for hydroponics can be built with a battery and direct current pump. This makes setting up a hydroponic garden possible in remote areas such as deserted islands, deserts, mountain or forested areas far from the electrical power grid system.

A water pump is considered crucial to a hydroponic system unless you intend to hand water the plants once a day. Using a water pump reduces risk associated with hand labor and allows the garden owner some freedom from work and worry. A hand watering system can also be boring if it is desired to water the plants four times a day. The system should be automatic and allow the garden owner to leave for three or four day periods and let the garden continue to grow and flourish.

When you use electric devices, pumps, timers and lights, there are two basic choices, AC or alternating current or DC direct current.

AC is the 110 volt power we have in our homes. It is usually delivered through power lines that deliver the power to the home and costs money from the local supplier.

DC power is the type of power we have in our cars and boats where electricity is delivered by a battery. In cars this is most often a 12 volt battery.

There are lights, timers, fans, and pumps designed for a 12 volt DC battery system. These items can usually be found in a local hydroponic store, a marine supply store, an auto parts store or a store specializing in aquarium equipment.

Pumps – The most economical submersible pumps for hydroponic systems are the bilge pumps ranging in costs from 20 to 40 dollars. They are used to pump excess water out of boats and can be attached to a timer. There is also a more expensive DC pump used to pump water in RV plumbing systems. It costs about $80.00 and can be outside the water tank.

Timers – There are many DC timers available from aquarium supply stores and a few have their own battery power supplies. One of the best ius a 12 volt seven day programmable timer, usually costing about $60.00. This timer can be set to run the pump a few times a day for a set number of minutes.

Other DC devices – There are also DC light bulbs, heaters to heat air or water, and fans to circulate air. All of these devices are available through recreational vehicle supply stores although most require quite a bit of energy to run and are expensive to purchase.

Our car batteries are 12 volt batteries called cranking batteries that retain enough charge to start the engine. Once the car engine is started the alternator continues to keep the battery charged and supplies power to the DC electrical devices in the car. The power is stored by the battery and if any lights or electrical devices are left on when the car is not running, they will use battery power and perhaps reduce the power in the battery so low that it will no longer start the car.

There is another type of 12 volt battery called a deep cycle battery. These batteries are usually built differently and can withstand being drained low more often. While a cranking battery may only be effective after being drained 30 times, a deep cycle might be able to continue after being drained 100 times or more. Deep cycle batteries are used in solar power systems, or systems built for boats and recreational vehicles.

A 12 volt deep cycle battery is used as the basic source of power. One battery is sufficient for a simple system, but there is a wide range of effectiveness of deep cycle batteries. When purchasing a battery, there should be a rating called amp hours, and for many this is about 100 amp hours. That means the battery can be used for 100 hours to power a device that uses one amp per hour of operation.

The Pump Battery System

Each DC electrical device uses a number of amps (or current) per hour. A power hungry device like a heater or refrigerator might use five or six amps per hour, and a DC light might use a single amp per hour.

The DC pump used in your system uses about 1.5 to two amps per hour of operation. In this time these pumps will deliver a certain amount of gallons per hour, usually about 400 to 500 gallons. A two amp pump can be run for 50 hours before draining a 100 amp hour battery. The DC pumps have different levels of height they can reach, but the typical bilge pump will pump water four feet high. A system designed where the reserve tank is three feet below the system and the watering tank is six inches above will allow for efficient operation.

That is of course, the theory. In reality, it is best to recharge the deep cycle battery before it is reduced to 50% of charge. This allows the battery to last longer and offers insurance that the pump will have power to work. So the actual operation of the pump should be no more than 25 hours.

Depending upon the size of the hydroponic system being watered, most systems only require the pump to be run three to six times a day, for periods of 10 to 15 minutes. For a 500 GPH (gallons per hour) pump that means 80 gallons will be delivered to the system for a 10 minute cycle and 120 gallons for a 15 minute cycle. That is if the pump is

allowed to pump with full strength for the running time. Any valve between the pump and the system will allow that flow to be reduced.

If a hydroponic system is run four times a day for 15 minutes, the amount of power used should be two amps per day, and allowing the battery to reduce charge should allow a system to run for 25 days without requiring a recharge. This is in theory and it would be less if the timer in the system requires energy from the battery also.

In fact, the battery systems can be problematic and should be monitored every four or five days, and the hydroponic system itself should be designed to have that much residual water for each plant. That is a safer system, so even if the pump and battery system do not work, the plants will have enough water to last the times between being checked.

The plant container in a remote system should contain enough water for the plant to survive for four or five days without receiving any additional water. Even if the plant used up most of the nutrients in the water, the extra may help them survive until the mechanical system can be restored.

Another option to increase the reliability of the system is to place two or more batteries in parallel, that is hook positive poles to positive poles and therefore increase the time available for the hydroponics system, or increase amp hours. But even using this option, it is safest for your plants to design a system that will keep the plants alive even if the pump does not work, at least for some time.

Recharging the Deep Cycle Battery

The battery can be continuously recharged by a power producing device. There are several options available.

A battery recharger – There are battery rechargers on the market that can be plugged into the household AC system that will then recharge a battery. A few of these costing about $80.00 have voltage regulators in them which will prevent overcharging the battery. The drawback is that they have to be plugged into an AC system. This can be used to charge batteries that are then transported to the remote site.

Solar power – There are photovoltaic panels that use the sun the produce electrical power. These range in size from 60 watts to about 140 watts and cost about $300 to $400.00. They can be used to power the battery but need a voltage regulator in the circuit to prevent overcharging the battery.

One drawback to solar power is that it needs sunshine to work. Cloudy days and rainy days do not provide power and if a shadow falls on any part of the panel it may work very poorly or not at all. Even when the solar cell works well it may only deliver two to three amps per hour to the cell, and may not keep up with battery use from the pump.

Wind power – A wind generator of 60 to 400 watts can be used like the solar cell to produce power from the wind. These cost about $300 to $400 and have a similar drawback to the solar cells that they work only if there is wind from five to 15 miles per hour.

Generator – A gas or diesel powered generator can be used to provide energy for the battery. These also require a voltage regulator and cost from $500 to $1500 for small systems. The drawback is they use fuel, are usually noisy and are really oversized for a small system. Most of these generators need to be started by hand, some even requiring a pull cord to start. They are not usually easily or cheaply set up into automatic systems providing recharge when needed.

Perhaps a system that combines methods of recharging is best, such as a system with both a wind generator and a solar panel.

Hydroponic System to
Attach to the Pump

Whatever type of hydroponic system is used to deliver water to the plants, it is probably safer to have two water tanks for the nutrient water, one with the water and pump at ground level and one four foot or less above the ground level pump.

This tank will then use gravity and a valve to deliver the nutrient water to the plants that will then go through the system and then through gravity flow back into the ground level tank.

A system that is provided 120 gallons of nutrient water four times a day can probably supply about 200 plants that use a liter of water a day. The amount of water required per plant varies according to plant type and size, and the temperature and sun conditions of the day.

On a sunny hot day the plants will require twice the water as on a cooler cloudy day. The plants transpire this water to keep themselves cool. So a system should be sized to have enough water for the plants on a very hot day.

A three times a day system with 240 gallon of water being delivered to the plant system should easily supply 200 plants with enough water to last the day. Of course the water supply tank would also have to be sized to have enough water in reserve.

Once a pumping operation is established the hydroponic system can be pvc tubes, black plastic bags, or other plant holders. The water supplied to the plants can be either pumped to the plants with any excess being allowed to go to soil, or the extra waters gathered and returned to the watering tank.

Internet resources

http://elifritz.members.atlantic.net/hydroponics.htm

http://www.powerboat-reports.com/sample/bilge.html

http://www.rain.org/~philfear/how2solar.html

http://www.qsl.net/xq2fod/Electron/solarreg/Solarr~1.htm

http://www.dcbattery.com/faq.html#6

http://www.marine-electronics.net/techarticle/battery_faq/b_faq.htm#11