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Author: Colin Money Penny

Name: Building a dual pump system for an open boat

Description:

I decided to build a dual pump system for my 14 foot solo open boat as I was tired of having to pull over in an eddy to empty the water. I came up with this design after having various discussions with my fellow paddlers. The building of the battery pack would be the most complicated part of the whole process.

Tools:

- power drill
- soldering iron
- utility knife
- wire cutters
- wire crimper for connectors
- marker
- cutting board

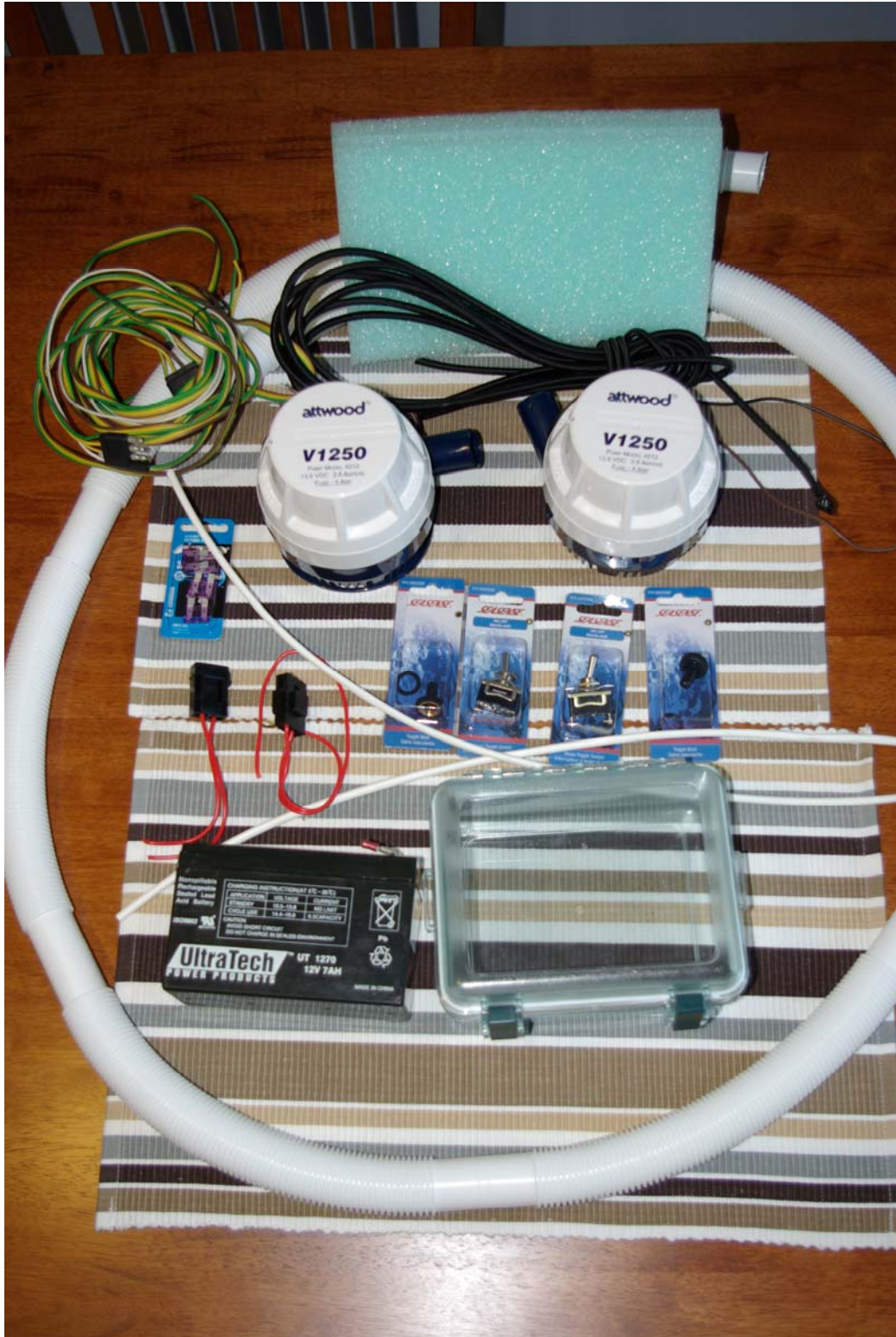
Parts list:

- one - crushproof / waterproof case to hold everything
- one - 12 volt 7 amp sealed lead acid battery (I bought an extra for a pre-charged spare)
- one - 12 volt trickle charger for battery
- two - fuse holders – small car fuse type
- two - 3 amp fuses – small car fuse type
- two - switches
- two - rubber waterproof boots for the switches
- two - Attwood V1250 marine bilge pumps
- four feet of bilge pump hose for pumps
- one - piece of foam to fit inside of case
- 10 feet of ¼ inch shock cord
- one - trailer hitch wiring harness
- two - crimp on wiring connectors to attach wire to battery
- some electrical tape
- some shrink tubing to seal the soldering joint on the wiring
- some marine goop to seal a hole in the case

Battery notes:

- the lead acid battery I have probably weighs almost five pounds but they are cheap to buy
- there are other options for rechargeable batteries which vary in physical size, power output, and cost:
 1. cordless drill
 2. NiCad
 3. NiMH
 4. LiON – least weight but most expensive

Picture of parts that I used:



Building the battery pack:

I chose the Attwood V1250 pumps for a reason as they have the best performance for the lowest amperage usage. They pump 1250 gallons of water per hour using a maximum of 2.6 amps. The lower amperage results in a longer run time per charged battery. Most other pumps on the market draw 4 amps or more for run time. These pumps can also run dry which means they will not burn out if no water is flowing through them.

I used the smaller 3 amp car type fuses. Do not use the glass type fuses as they will easily break if the battery pack is dropped, bumped, etc.

I would highly recommend that you build the battery pack for use with a dual pump system even if it is only to be used with a single pump. The cost difference is minor (one switch, fuse holder, and fuse) and the benefit is it is easily moved from one boat to another that might have a dual pump. The secret of the move ability is the use of a standard trailer hitch wiring harness. I also recommend that you use two separate switches with separate fuses. I look at this as an insurance policy as you will still have one of your pumps working if a switch or fuse fails due to Murphys Law. Make sure you also carry spare fuses inside the battery pack

I kept the switches built into the battery pack itself in order to make it one complete compact easily transportable unit. I never have to worry about mounting any switches inside the boat itself. I just reach behind my saddle and flick the switches on or off as required.

Step 1:

Cut the foam piece to fit inside the case. This piece of foam will be used to keep the battery from shifting around inside the case.



Step 2:

Remove the foam from the case. Attach the wiring connectors on the battery.

Place the battery on top of the foam leaving at least a half inch around the bottom and sides of the battery. IMPORTANT – you also have account for the size / locations of the switches as they also need room inside the case. See pictures in step 4.

Trace around the battery with a marker.



Step 3:

Cut out the outline of the battery in one piece from the foam. Put foam outline and battery back into case and check it for fit.

DO NOT throw away the piece you just cut out as it will be used for padding between battery and the lid of the case.





Step 4:

I had to take the size of the switches including the rubber boots into consideration for their location. You want to make darn sure that you have everything in the correct location before drilling the holes into the case for attaching the switches.

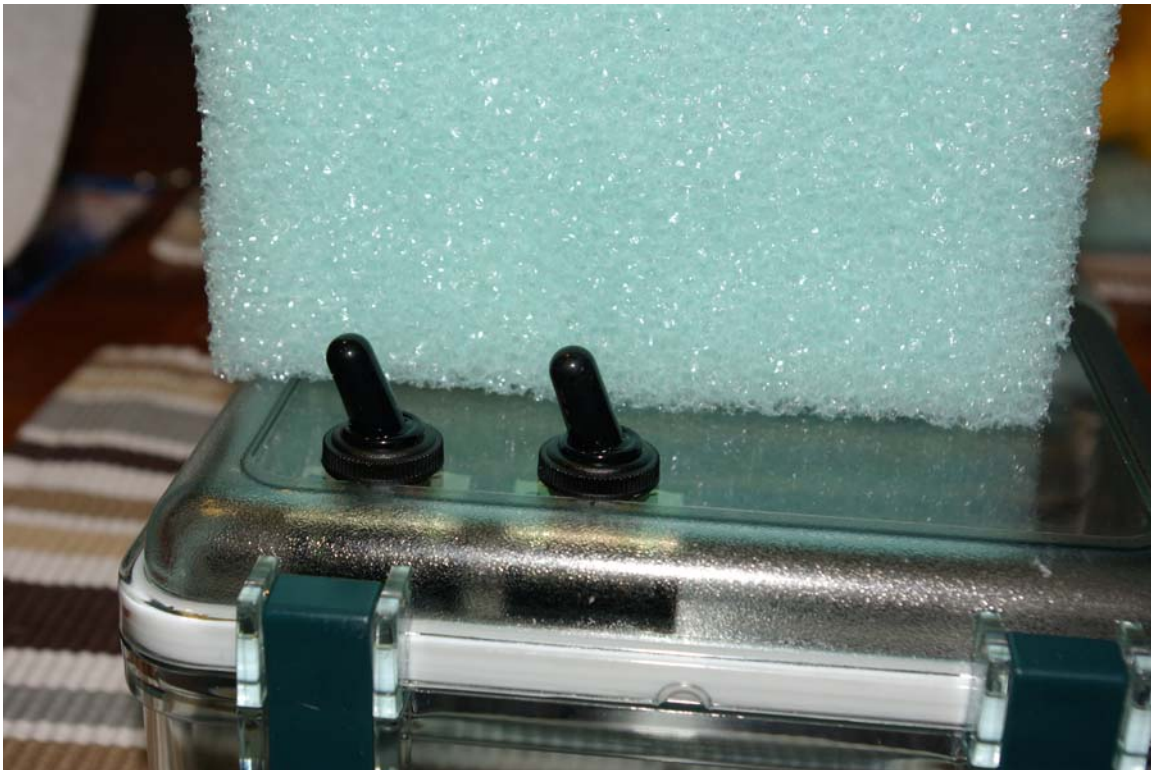
Side view show switches before drilling the holes in the case (the foam is only there to show the switches better in the picture)



Top view showing switches before drilling holes in the case:



Side view after holes are drilled and switches are mounted to the lid of the case. I mounted the switches so the on position will be to the left in this picture. (note: the case will be mounted in the boat so the switches will be in the on position when they are pulled up see Step picture in step 6) :



Step 5:

It is now time to make all wiring connection inside of the battery pack.

Here is the general overview:

The male connector side of the trailer wiring harness will be used for the pumps.

The female connector side of the trailer wiring harness will be used for the battery case.

The negative (-) side of the battery will be connected directly to the green wire on the trailer wiring harness.

The positive (+) side of the battery will be connected to the wires on one side of the fuse holders. The wire from the other side of the first fuse holder will connect to first switch. The wire from the other side of the second fuse holder will connect to second switch.

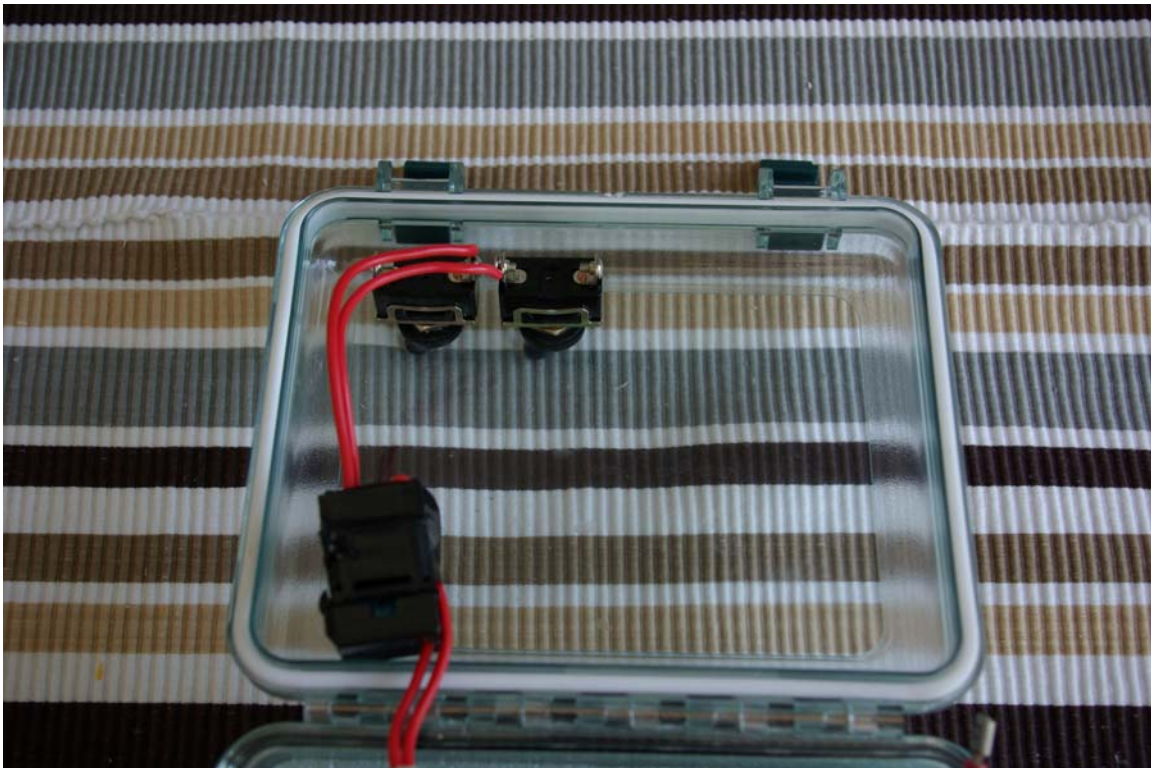
The yellow wire of the trailer wiring harness will be connected to the other side of the first switch.

The brown wire of the trailer wiring harness will be connected to the other side of the second switch.

IMPORTANT – don't cut off any extra length of wire until you are absolutely sure the lid will close. You might have to route the wires around the battery, fuse holders, etc in order to get the case to properly close. All connections should be made with the soldering gun and covered with the shrink wrap tubing to make them watertight as possible.

Step 5A:

Connect one side of each fuse holder to the one side of each switch.

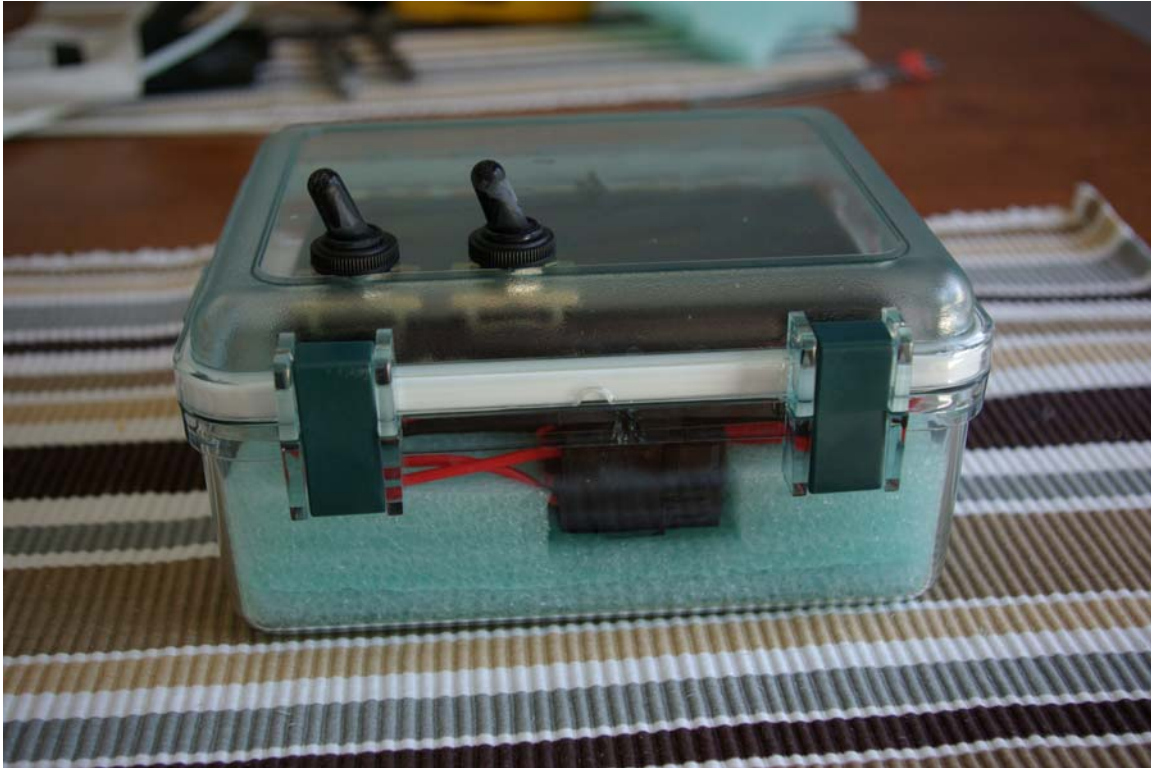


Step 5B:

Join the two wires on the other side of the fuses together with another piece of red wire.

Attach the wire connector onto the end of the red wire. This will be used to attach it to the positive (+) side of the battery.

You will most like have to cut a small section out of the foam on the front side of the case for the fuse holders to fit into.



Step 5C:

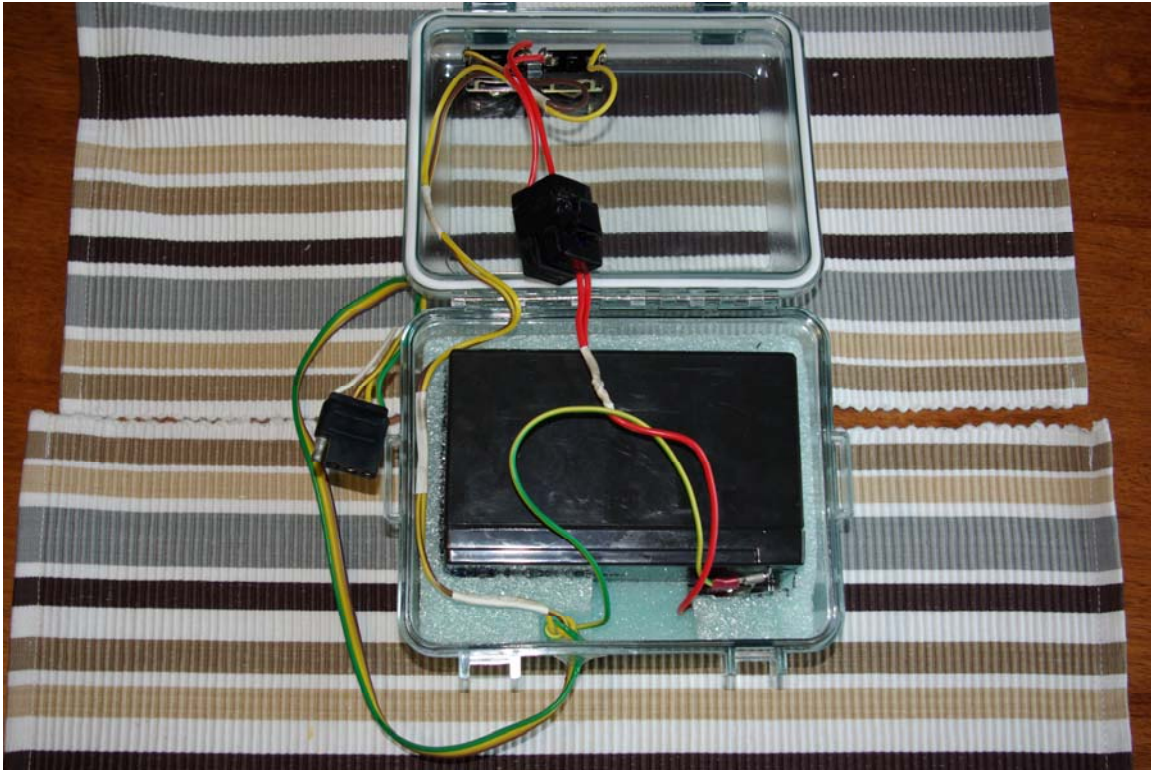
Drill a hole in the front of the case for the female side of the trailer wiring harness.

You will have to determine the location of the hole based on the wiring harness not interfering with the switches or the fuse holders.

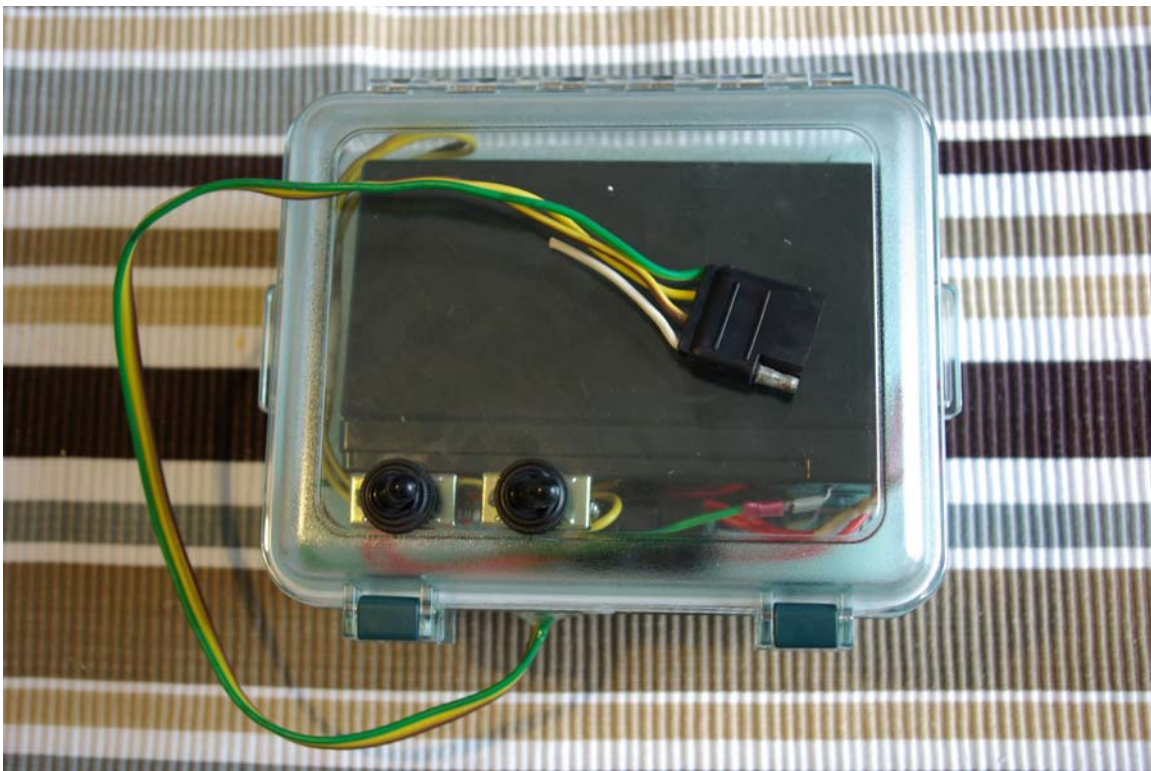
Tie a knot with the wire on the inside of the case once the fire is pushed through the hole. Apply a liberal amount of marine goop around the wires on the inside of the case ensuring the hole is sealed. Let this sit overnight in order to properly set up. Apply a liberal amount of marine goop on the front side of the hole and allow it to properly setup as well.

Step 5D:

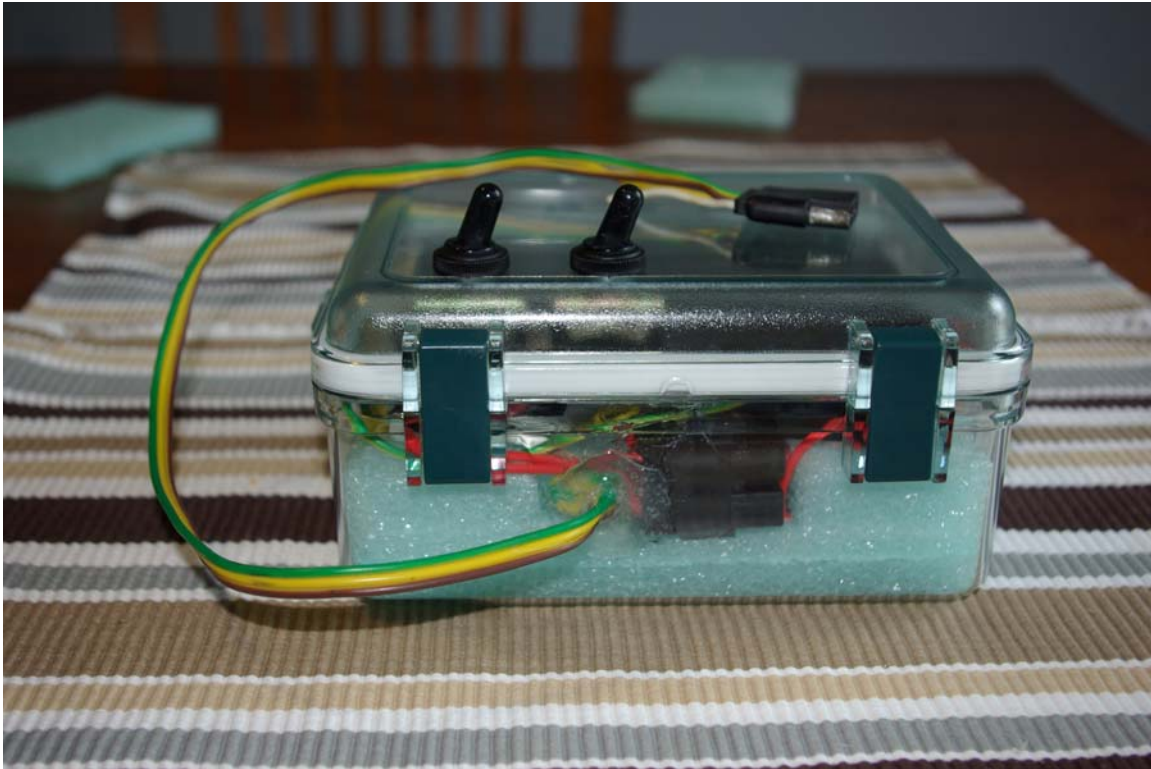
Connect the yellow wire of the trailer wiring harness to the other side of the first switch and the brown wire to the other side of the second switch. Attach the wire connector to the green wire of the trailer wiring harness and connect it to the negative (-) side of the battery.



Top view of completed case:



Side view of completed case with switches in the off position:



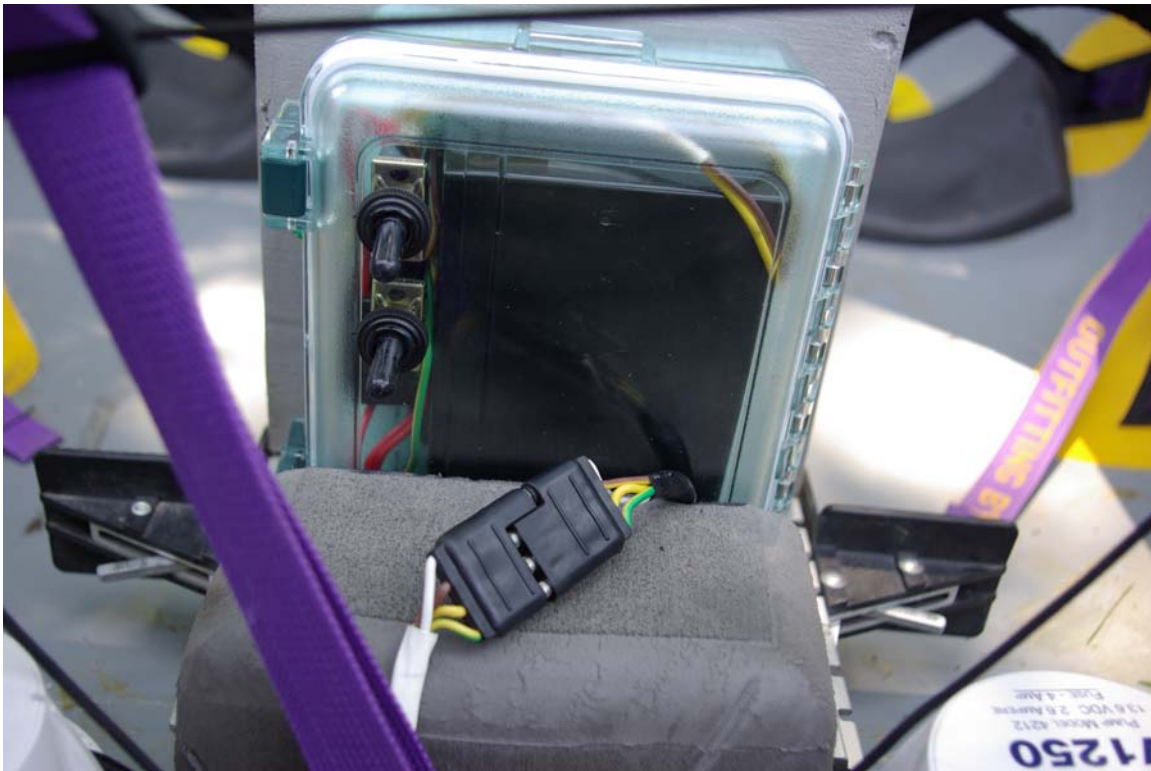
Step 6:

Mounting the battery pack.

I mounted the battery pack between the back of the saddle and the rear block for the foot pegs. I had to cut out a little bit of the rear block to make it fit. I also cut out a piece of mini-cell foam block to fill in the gap between the saddle and the rear block (not shown). This gives the battery pack a flat surface to sit on thus preventing it from flopping around.

The battery pack is held in place by a strap with a buckle (not shown) that is threaded through the top of the case and around the foot rails. I also used a small bungee cord (not shown) as an extra backup to the strap. The bungee cord just clips onto each side of the foot rails and holds the battery pack snugly in place.

Front view of battery pack in place (less the strap and bungee cord):



Side view of battery pack in place (less the strap, bungee cord, and bottom foam support piece):



Step 7:

Mounting the pumps into the boat.

I mounted the pumps into the boat using shock cord and tying them in between the D-rings behind my rear foot block.

I opted not to use or glue in the mounting brackets that came with the pumps. I always have bad luck with things like that breaking. However you could use ABS glue to attach the mounting brackets to your boat in the event you want to use them.

I also found out that I can get another $\frac{1}{4}$ inch of water out of the boat by mounting the pumps flush to the bottom of the boat without the brackets. This $\frac{1}{4}$ inch might not seem like much for some people but is a lot for me considering the larger surface area of a fourteen foot boat.

IMPORTANT – make sure you test the pumps first by connecting them directly to the battery before drilling any holes in them. Make sure you place the pumps into the boat first so the discharge outlet is facing towards the side of the boat before marking the spot for the holes.

I drilled four holes into the white part of the pump. This is only a cover and does not affect the discharge of water at all as the pump impeller is built into the blue base.



I threaded the shock cord through the pump and tied them in between two D-rings.

View of pumps in place, discharge hoses attached, and wired together:



I attached two feet of discharge hose to each pump and tied the other end of the hose to the each side of the gunwale. The shorter the hose the better as the pumps will not be over worked by having to pump water a long distance. I trimmed the hoses once I was happy with their location.

I don't recommend running the hoses to the back of the boat. Two 5/8 inch hoses full of water surprisingly weigh a lot and we are after all trying to minimize the weight of water in the boat by getting rid of it.

I could not bring myself to drill two big holes in my boat and installing a through the hull connector. I figured this would make the boat harder to sell later if I decided that I wanted to keep the pump system as it is currently installed in a non-destructive manner.

Step 8:

Wiring the pumps together using the male side of the trailer wiring harness.

IMPORTANT – All connections should be made with the soldering gun and covered with the shrink wrap tubing to make them watertight as possible.

I connected the green wire from the harness to both black wires of the pump which in my case are the negative (-) wires. Check the wiring diagram for your specific pump incase they are different.

I connected the brown wire from the harness to the positive (+) brown wire on the first pump.

I connected the yellow wire from the harness to the positive (+) brown wire on the second pump.

Test the battery pack and pumps by connecting the wiring harness together.

Turn on the first switch. Only the first pump should turn on. Turn off the first switch.

Turn on the second switch. Only the second pump should turn on. Turn off the second switch.

Turn on both switches at the same time to make sure both pumps are working together.

Step 9:

Testing the pumps with water.

Fill up your boat in the pool, river, or lake.

Turn on the pumps and make sure everything is working ok.

I am able to pump about eight inches of water out of my boat in about ninety seconds.



My boat ended up traveling the entire distance of my pool under its own power.

That's it your done ;)