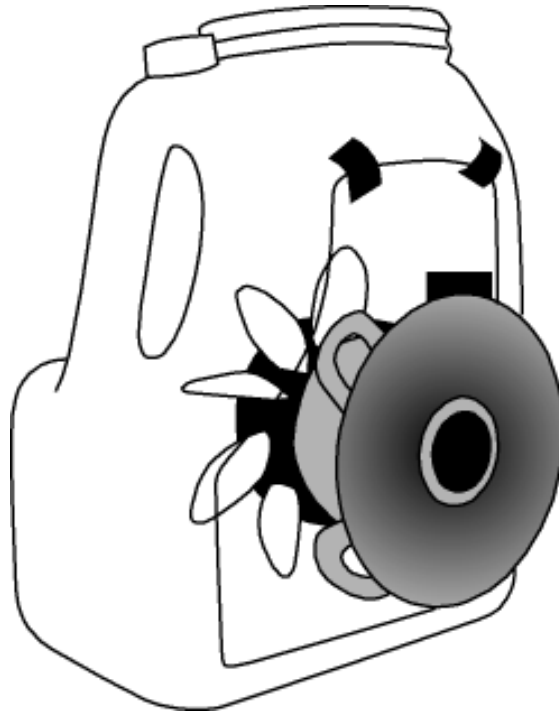


Make Your Own Hydropower

ASSEMBLY GUIDE



MATERIALS LIST

	<u>MASTER KIT</u>	<u>BASIC KIT</u>	<u>ASSEMBLY GUIDE</u>	<u>SUPPLIED BY USER</u>
Turbine Assembly				
Styrofoam Cylinder	X	..... X		
Plastic Spoons (8)	X	..... X		
Dowel	X	..... X		
Glue Gun	X			
Template			X	
Marking Pen				X
Turbine Installation				
Plastic Container	X	..... X		
Threaded Rod	X	..... X		
5 Hex Nuts	X	..... X		
Glue Gun	X			
6 Plastic Washers	X	..... X		
Stator				
Multimeter	X			
Paper Fasteners (4)	X	..... X		
Wire Coils (4)	X	..... X		
Foam Core	X	..... X		
Plastic Coil Protector				
Template			X	
Sand Paper				X
Needle-nosed Pliers				X
Scissors				X
Glue Stick				X
Rotor				
CD/double faced tape	X	..... X		
Magnets (4)	X	..... X		
Tolerance Card	X	..... X		
Compass	X	..... X		
Glue Gun	X			
Eye Protection				X
X Marking Pen				X
Completion/Testing				
Compass	X			
Multimeter	X			
Alligator Wire Clips	X			
LED Light	X	..... X		
Wire Connectors	X	..... X		

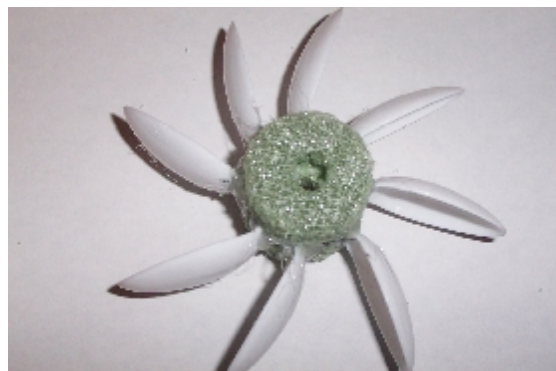
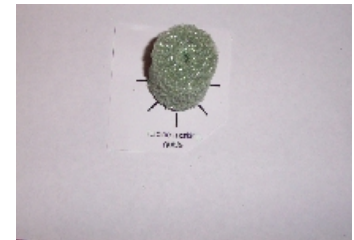
TURBINE (WATER WHEEL) ASSEMBLY INSTRUCTIONS

- Materials:**
- 1 Green Styrofoam cylinder (cut with center hole pre-drilled)
 - 8 Plastic spoons (pre-cut, ready for installation)
 - 1 Template to mark Styrofoam cylinder for spoon insertion
 - 1 Marking pen
 - 1 Glue gun and glue stick
 - 1 Threaded rod, 3/8" plastic



Green Styrofoam cylinder (for base of turbine)

1. Place green styrofoam cylinder on template and lightly mark each of the 8 positions where spoons will be installed. **CAUTION: Handle the styrofoam cylinder with great care as it is very fragile.**
2. **Insert the threaded rod into the center hold of the styrofoam cylinder before inserting the spoons.** The shaft will provide support to the Styrofoam cylinder and will keep spoons from penetrating too far into the cylinder.
3. Push each of the 8 spoon (handles first) into the green styrofoam cylinder until they are near or touch the dowel. Position each one of the spoons carefully and do no twist, or try to reposition them.
4. Using the glue gun, carefully glue around each spoon, attaching the spoon firmly to the styrofoam cylinder. The **finished turbine** should look like the picture below.



TURBINE (WATER WHEEL) INSTALLATION INSTRUCTIONS

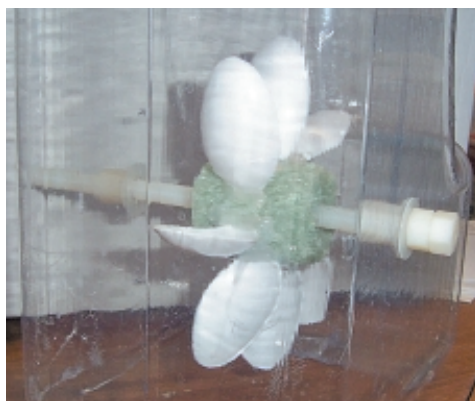
- Materials:**
- 1 Container
 - 1 Threaded rod, plastic
 - 4 Hex Nuts, plastic
 - 2 Washers, plastic
 - Turbine (constructed)
 - Glue Gun and glue



5. The turbine needs to be installed in the Clear Acrylic plastic container. The hole for the turbine shaft is pre-drilled and the bottom cut-away.
6. Place the turbine into the clear container through the access hole in the bottom of the container. The turbine should have the **concave surface of the spoons exposed to the top of the container**. This allows water entering the top of container to fill the spoons turning the turbine.
7. Slide the threaded rod through the center hole of the container, through the center of the turbine and out the other side of the container to provide a shaft for the stator and rotor that will be placed later. In earlier containers, the hole will need to be enlarged to accommodate the 3/8" threaded rod. (Insert the point of a knife blade into the hole and turn the knife until the size of the hole accommodates the threaded rod).
8. Insert a plastic washer over each end of the threaded rod. Thread two Hex Nuts onto one end of the threaded rod until second Hex Nut is flush with end of rod, then lock the two nuts. (Hold inside nut and tighten outside nut against inside nut).
9. Thread a second set of Hex Nuts onto the other end (long end) of the threaded rod. Thread both nuts up against the washer on the side of the container, adjust and lock the nuts, allowing the rod to turn free. This will keep the shaft from moving back and forth through the container as it is turned by the water flowing over the turbine.
10. Adjust the turbine to the center of the shaft (dowel) and firmly attach the turbine to the shaft (dowel) with the glue gun. Access through the bottom opening with the glue gun, and rotate the turbine shaft as you glue it solidly to the shaft.

ALWAYS MAKE SURE THE GLUE GUN IS VERY HOT BEFORE

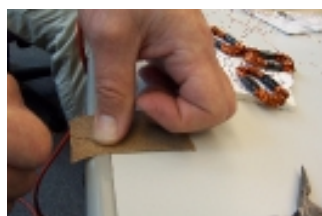
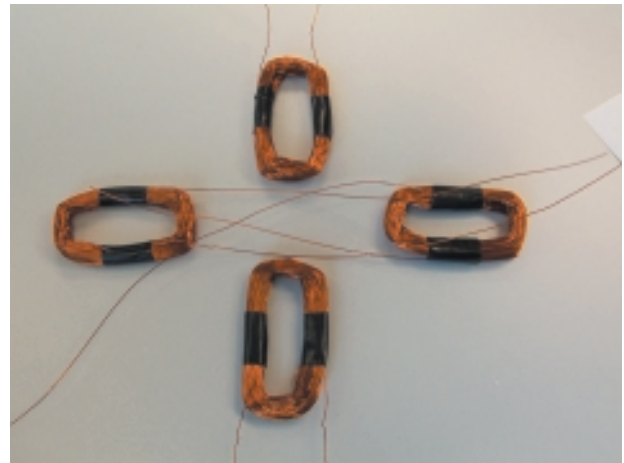
USING. Plug in the gun 5 or more minutes before using to get full effect of glue.



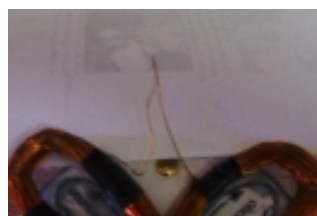
STATOR ASSEMBLY AND INSTALLATION INSTRUCTIONS

Materials: Template for Stator
 4 Wire Coils (pre-wound)
 1 Foam Core Board (pre-cut & drilled)
 Glue Stick
 1 Piece Sand Paper
 Needle-Nosed Pliers
 Scissors
 4 Brass Paper Fasteners
 Multimeter (check connections for continuity of current & ohms)

- Place the 4 coils of wire in position carefully matching the arrows and directions on the template, illustrating the direction of the coil windings. **Note: two coils opposite each other have their wires extended to the center, and the other two coils opposite each other have their wires extended away from the center. (This is of major importance in the construction of your generator).** Do not alter the coils thickness as the coils have been pressed to help maintain a close tolerance between the stator and rotor. DO NOT COVER THE CENTER HOLE OF FOAM CORE BOARD WITH THE COILS.
- When you have carefully positioned the coils **correctly** on the template, glue them in position on the template with the glue gun. **Carefully check if the direction of the coils is correct. As the diagram shows, their placement causes the current to move clockwise over one coil and counterclockwise over the next.** Trim 6 of the 8 wires (as shown on templates) to about 6 cm (60mm) in length, with the cutter on the pliers. **DO NOT TRIM THE SET OF WIRES THAT COME OFF OF THE STATOR (arrows on template indicate), THESE LONG WIRES WILL CONNECT TO THE LED.**
- Using the sandpaper, carefully clean about 20 mm (2 cm) at each end of each wire, until the coating is removed and wire end is bare. **Note: the fine 29 gauge wire is very brittle, if sanded too much.** The illustration below shows how to bare the wire by pulling wire across the sandpaper.



Cleaning coil wires



Wire twist of bare ends

4. As shown on template, **twist wires together to create a continuous connection** (except two serving as connectors, as indicated in template). Tape wires together firmly with electrical tape. **Make sure no wires or loose ends are exposed above the coils.** After taping the wires together, you can then carefully tape or hot glue the paired wires flat against the container, keeping them out of the way and also for easy access, in case you need to repair connections.
5. **A critical test can now be made with the multimeter to check for continuity of flow and resistance.** Read instructions on multimeter for setting. Set multimeter for sound/continuity of current. **The turbine will not produce current if there is not continuity of current.**



PROCEDURE FOR CHECKING STATOR CONNECTIONS WITH MULTIMETER



Note connection with green & white alligator clips. Note Multimeter settings readout with sound, indicating good connection.



Note white alligator clip next to twisted pair. Note Multimeter readout with no sound indicating bad connection.



Note White Alligator Clip moved to next twisted pair.



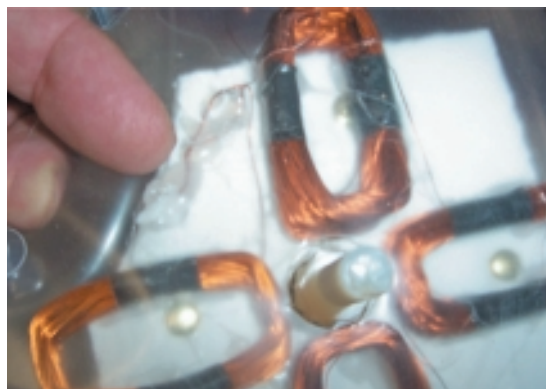
Note final Alligator Clip to the final test for connection and continuity.

If indication of any of these checks proves negative, you know which twisted pair has lost connection and requires repair.

6. Place the stator on the shaft and slide stator against the outside wall of the container. Rotate the stator to expose the two (connector) wires extending from the coil in an upward position toward the top of container where they may connect with the LED.
7. Using a sharp pair of scissors, carefully push one point of the scissors through the four slots marked on the template. Continue pushing the point of the scissors until you pierce the wall of the container (careful not to puncture your hand).
8. When the slots for the brass paper fasteners are lined up, glue the stator to the container. Push brass paper fasteners through each slot. Reaching inside the container, while holding stator firmly from the outside, spread each of the brass fasteners to help secure the stator to the wall. Finish product should resemble the following pictures. The finished product should resemble the following pictures.



9. Using the clear plastic cover, slide it over the shaft through the center hole in the plastic. Carefully place it down to cover all of the coils and wire connections. Hot glue the plastic cover to the plastic container. Make sure the plastic is smooth and wrinkle free over the coils and the center hole is large enough to allow shaft to turn free.



Slide cover over shaft, hot glue to container

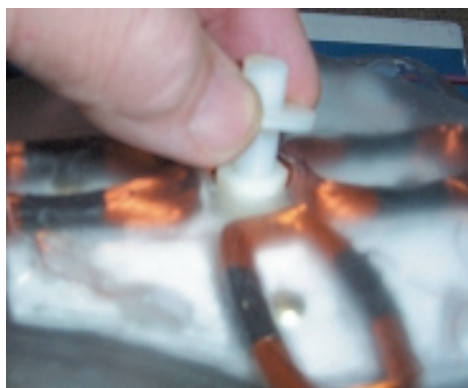
ROTOR ASSEMBLY AND INSTALLATION INSTRUCTIONS

Material: Eye Protectors
1 CD
Marking Pen
4 Magnets (2 marked N; 2 marked S)
Compass
Glue Gun & Glue
1 Tolerance Card (between coils and Magnets)
1 Hex Nut, Plastic
4 Washers, Plastic

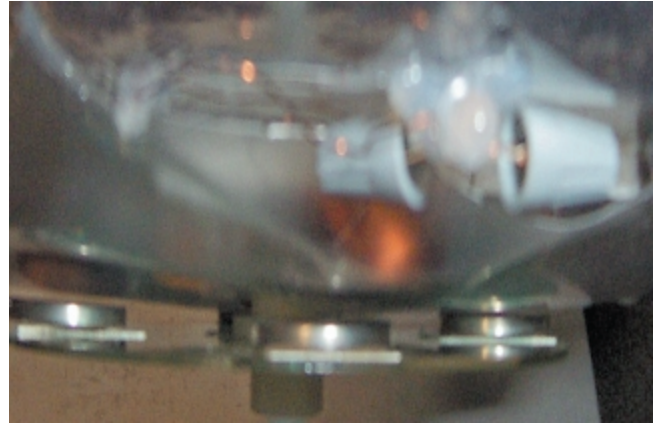
1. The CD has double faced tape positioned where the magnets are to be placed.
2. Using the compass determine the side with north polarity of two of the magnets and mark the side with south polarity on two other magnets, using the compass. Mark Poles with pen. CAUTION: Do not allow magnets to come together. They are very difficult to separate.



3. Position the magnets on the rotor over each of the taped areas of the CD surface with **alternating polarities (important)**, as indicated on template. Peel off the protective layer over each of the pieces of tape and **press the magnets firmly onto the tape**.
4. Slide three plastic washers (to set space) against the Hex Nuts on the rod next to stator.

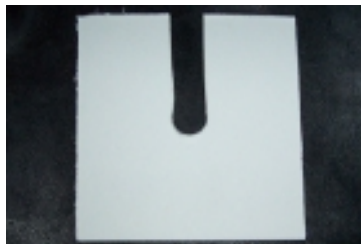


- Place the rotor (magnet side down) onto the shaft. Place a plastic washer over the shaft and center on the hole of the CD. Thread a Hex Nut up against the CD, adjust the space against the three inside washers and lock the nut against the outside nut of stator. You will need to reach and hold this hex nut with needle nosed pliers and/or reach through opening in container to hold shaft from turning.



Above photo is viewed from above container to show the spacing of the rotor to the stator, when in final position.

- Always use tolerance card between rotor and stator to store hydro generator.



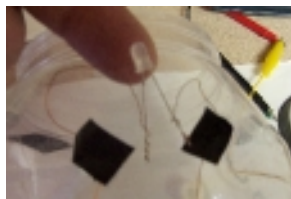
- When you have checked carefully that the rotor turns without striking the coils, your hydro generator is ready to try, using the multimeter connected to the two connector wires extending up from the stator. **Note: magnets will catch and/or attract any wire or loose metal objects.**
- As you spin the shaft by hand, you can see the digital read-out of milivolts – volts on the face of the multimeter, when **meter is set to volts AC, marked V~.**

LED, COMPASS AND/OR MULTIMETER INSTALLATION INSTRUCTIONS

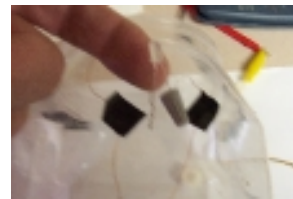
1. Hold the LED to the face of the container above the stator, with the terminals extending down, where they can be easily attached to the CONNECTOR wires from the stator.



LED & Connectors



LED Wire Twisted



LED Connected

2. Position the compass on the container between LED, stator and rotor. Hot glue the base of the compass to the plastic container. Notice this compass is now capable of registering the magnetic field generated as the hydro generator is put in motion.
3. The multimeter can be connected at any time using the alligator clamps, to register the output of your hydro generator.



Compass position



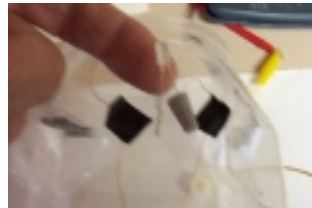
Multimeter connection

COMPLETION OF MODEL

1. Connect LED to the two connector wires using the two gray twist on connectors. As volts are generated, the LED light alternately flashes green and yellow as the AC current is produced.



LED



LED Connection

2. Spin the shaft by hand and check light for production of electricity.
3. As the turbine is turned the compass needle will register the electro-magnetic field generated.



Compass Position



Completed Model

TESTING OF MODEL

1. Connect multimeter to the two connector wires using the 2 alligator clip wires.
2. Place the model under a faucet and turn the faucet on. Position the model so the stream of water flows over the turbine blades (spoons) causing the turbine to turn.
3. Increase the flow of water until the LED begins to flash.
4. When connected you can check the output of your hydro generator while a fast stream of water is passing over the turbine blades and turning the turbine. It takes about 1.7 volts to light the green light on the LED, and about 2.1 volts to light the yellow light of the LED. If you have successfully constructed an efficient model you will see a greenyellow, green-yellow flashing LED. This is indicating the alternating current (AC) produced.
5. **Caution:** keep the stream of water flowing through the top of the container and out the bottom, so water does not build up in container.
6. Keep outside of the model as dry as possible.

