

## How to Build a Hydrophone

### Introduction:

It was once thought that the oceans were a silent place. However, if you were to drop a hydrophone or underwater microphone into the seas, you would soon discover that the underwater world is quite noisy. A hydrophone picks up acoustic signals and then transfers the sounds into a receiver that allows you to hear them. The following instructions allow you to inexpensively (under \$40) build your own hydrophone. Use this hydrophone to hear sounds in your aquarium or go down to the beach and drop it in the water to discover the many different sounds that can be heard underwater.

### Materials:

Quantity	Radio Shack Item #	Description
1	270-092c	Condenser Microphone Element**
1	278-513	Audio Cable, 2 conductors (#24) plus shield** 25+ feet
1	274-286a	two conductor, 1/8" mono phone plug**
1	277-1008c	Mini Audio Amplifier/Speaker**
1 roll	64-2352	black tape, rubber electrical (NOT PVC tape!)
1	270-402	Battery holder, fits 1 "C" cell**
1	23-871	Battery, "C" cell, Alkaline**
3 ft	NA	Wire, Insulated, #24. 1 ft of orange, white, blue**
1	NA	35mm plastic film canister
1/4c	NA	Vegetable or mineral oil
1	NA	9V battery for amplifier/speaker**
1	NA	Soldering iron and solder**
1	NA	Wire stripper**
1	NA	Silicone Seal

\*\* These items can be found at Radio Shack

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### Instructions:

1. Strip the end of the audio cable so the three wires are exposed (blue, white & ground {copper}). Strip the ends of the two wires (blue & white) about 1 cm.
2. Strip the ends of the wires connected to the microphone element so that three wires are exposed (red, white & ground {copper}).
3. Make a hole in the lid of the film canister about the width of the audio cable and thread the audio cable through the hole.
4. Connect the wires by twisting the two together, as follows:
  - Signal from the audio cable to the signal from the microphone element (white to white)
  - Power from the audio cable to the power from the microphone element (blue to red)
  - Ground wire from the audio cable to the ground wire from the microphone element
5. Strip the other end of the 25ft audio cable so the three wires are exposed. Strip the ends of the two wires (blue & white).

6. Strip both ends of two of the insulated #24 wires (make sure you have two different colors, i.e. orange and white).
7. Connect the wires as follows:
  - One end of the insulated #24 wire to the audio cable signal wire (white to white)
  - One end of the other colored insulated #24 wire to the ground wire from the audio cable (orange to ground)
  - Power from the audio cable to the wire from (+) end of the battery pack (blue to red)
8. Strip a centimeter long piece in the middle of the 2<sup>nd</sup> insulated #24 wire (orange, ground) about an inch down from the end.
9. Connect the wire from the black (-) end of the battery pack to part of the orange, ground insulated #24 wire (black to orange).
10. Feed the other ends of the two insulated #24 wires through the cover of the phone plug.
11. Connect the signal insulated #24 wire (white) to the smaller piece of the phone plug (white to phone plug), by feeding it through the little hole in the phone plug and twisting.
12. Connect the ground wire (orange) to the longer piece of the phone plug (orange to phone plug).
13. Add batteries to the battery pack and speaker/amplifier, put the phone plug into the speaker and test connections. \*\*Remove batteries and continue if it works, if not, find the wiring fault.
14. Solder the ends of the 2 insulated #24 wires to the phone plug (white and orange).
15. Put the cover onto the phone plug.
16. Solder all wire connections
17. Using the black rubber electrical tape, tape around each of the soldered ends, so that no piece of the wires is exposed.
18. Put silicone seal over the end of the audio cable, which connects with the end of the microphone element (these ends should already be soldered and taped).
19. Put silicone seal underneath the lid of the film canister where the hole was made for the audio cable. Put a blob of silicone seal on the top of the lid as well.
20. Fill the film canister with mineral oil, to the very top of the canister.
21. Place the lid on the film canister; try not to get any air bubbles. Having an air bubble may cause the film canister to compress and change shape due to the pressure in deep waters. This should be done over a sink so excess mineral oil can spill over.
22. Wipe film canister down with soap and water to remove excess mineral oil.
23. Using the black tape, tape the lid onto the film canister.
24. Plug the phone plug into the amplifier/speaker.
25. Attach a weight to the film canister. This will allow the film canister to sink.

**Notes:**

- The first couple of times the hydrophone is placed into water, a little of the oil may leak from the lid of the film canister. This oil is leftover from the assembly process. Place the hydrophone into a container of water to get rid of this leftover oil before putting it into the a fish tank, seawater, etc.
- It is important to attach a weight a little above your hydrophone. The oil in the canister allows the hydrophone to float therefore a weight (heavy rock, lead fishing weight, etc.) will enable the hydrophone to be pulled to a good depth.

**References:**

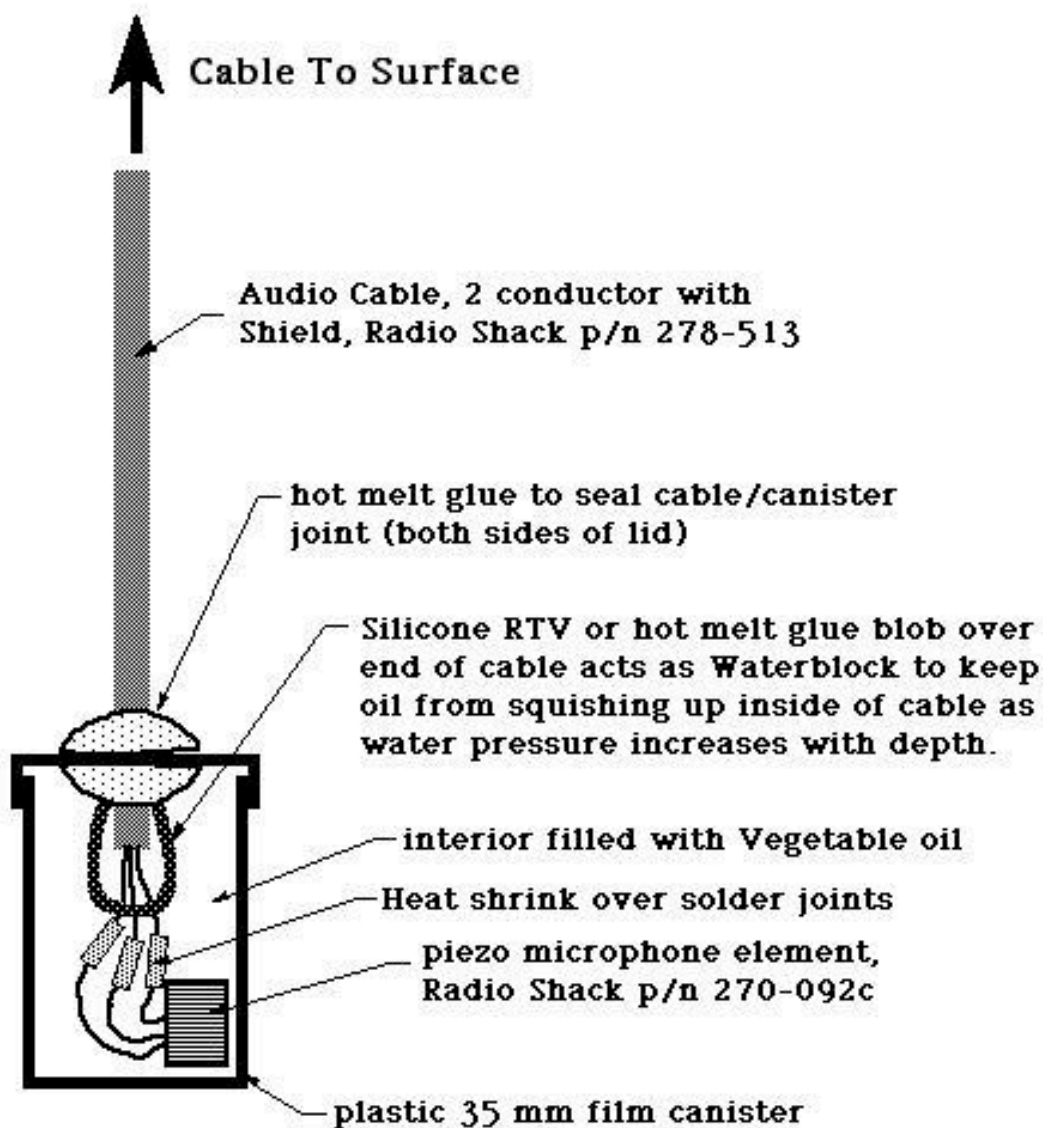
Watlington, F., 1979. How to Build & Use Low Cost Hydrophones. TAB Books, Blue Ridge Summit, PA (currently out of print)

Acoustics and Sonar Information Resources

<http://www.atcourses.com/acoustics.htm>

Acoustic Thermometry of Ocean Climate, Scripps Institution of Oceanography/UCSD

<http://atocdb.ucsd.edu/>



**BUILD A HYDROPHONE**  
**HYDROPHONE MECHANICAL SCHEMATIC**  
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