

Bubbler Construction for Water Garden Winter Protection

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Introduction: Water gardens vary in size from a 50-gallon barrel on the deck to very large ponds holding thousands of gallons of water. A common feature that most people enjoy in their water gardens is: fish. Unfortunately for fish to live in winter in water gardens in our northern latitudes requires that a hole be provided in the ice to allow gases such as ammonia and carbon dioxide to escape. Also it is helpful to keep levels of oxygen in the pond at levels in excess of 6 mg/L to minimize stress on the fish. Ammonia may accumulate under an ice cover of the pond as a result of the decay of organic matter from leaves and from the fish. Several methods are available to keep a hole open each with its advantages and disadvantages (see Table I below).

Table I: Comparison of methods for keeping a hole through the ice

Method	Purchase Cost ¹	Monthly Operating Cost ¹	Advantages	Disadvantages
Stock heater (1000 - 1500 watts)	\$35 to \$80	\$75 to \$150	Will reopen a hole after power failure	Operating costs May melt hole in pond if it touches the pond side or bottom
Light bulb in inverted pot	\$20 to \$50	\$5 to \$9 using 75 watt bulb	Simple, will reopen hole after power failure Gives visual confirmation that it is operating	Does not aerate or actively promote oxygen transfer. Hole is set by size of pot bottom.
Suspended bubbler	\$35 to \$55	\$0.25 to \$0.50	Active transfer of gases (oxygen in and ammonia out) large area for gas transfer No electrical cords in or over the pond	May need to defrost airline after power failure pond size \$ 800 gallons

¹ Costs are approximate based on 2002 dollars and assuming electricity at \$0.12 per kwh and for the light bulb or suspended heater assume self-assembly/construction.

For in-ground ponds that are larger than approximately 800 gallons the suspended bubbler represents a least-cost method of maintaining high oxygen levels in the pond as well as keeping a hole open for active removal of toxic gas such as ammonia. It is also possible to use a small water pump to achieve the same effect but it will not help put oxygen in the water to the same extent and the operating and purchase costs will be similar to the light bulb method (the light bulb is built into a plastic pot that is inverted over a floating, tubular platform). One additional cost for the bubbler system is approximately \$5 per year for replacement parts. The bubbler is suspended in the pond rather than placed on the bottom for several reasons: a.) suspending the bubbler reduces the possibility of stirring up debris on the bottom of the pond which might encourage algae blooms and excess oxygen consumption; b.) in ponds where the depth may be as deep as three to four feet (or deeper) the depth may severely limit the amount of air that can be pumped and reduce the effectiveness of the system. The rationale for placing the float with bubbler in the middle of the pond is based on trying to get the maximum amount of water flowing upwards. The teepee or float assembly helps provide a little bit of sunlight/protection to keep the hole open. Do not be surprised to see ice form inside the float - as long as the bubbler is bubbling it is still doing its job of stripping out unwanted gases and adding oxygen.

The following are used in the construction:

- 1 sheet of solid insulation - usually polyurethane - blue, pink or gray typical dimensions are 2 feet wide, 2 inches thick by 10 feet long. Available at any lumber yard, Home Depot, etc. Approximate cost \$8-\$12.
- ½ doz. Stainless steel sheet rock screws (Do not use galvanized or copper or regular steel screws) approx. 2" long. These are used to help hold the joints together while the hot glue or other adhesive sets up.
- 1 10" airstone - available at your local aquarium store. Approximate cost is \$4-\$8. Don't use bubble bars since they tend to float!
- 3 ft. Aluminum or other non-rusting wire (not copper!). I use "aluminum ground wire" - it is approximately 1/8" thick, easy to bend by hand. It is usually available in 50 foot rolls. I use the excess to attach to lily pots to lower them into the pond. You can also use nylon cord if you are using the airstone since it will sink.
- 10-20 ft. Silicone tubing to attach to the bubble bar. Use the silicone tubing-not the vinyl since the silicone (bit more expensive) is flexible at cold temperatures. Use a connector to attach additional lengths together. Tubing and connectors will also be available at your aquarium store. Approximate cost \$5-\$10.
- 1 Air pump for aquariums. I purchased the largest one I could find at my local aquarium store. Check the number of watts or power it will draw. I use something in the range of 4 to 4.5 watts (more power, more air but you don't need a lot). Approximate cost is \$30-\$40. May be cheaper units on the 'Net or Ebay. The air pump will not be rated for use outside but that is okay since you will be housing it in an insulated box.

Miscellaneous:

Duct tape, nylon cord (three pieces approx. 15 feet long or longer), clear plastic bag from dry-cleaner, ½ dozen or so of small, stainless steel sheet metal screws, hot glue for Styrofoam (and the glue gun - borrow one from someone if you can).

Assembly (approximately 1½ hours - refer to figure below): Take the insulation board and cut a ring at one end that is 24 inches in diameter (as wide as the board) and with approximately 2" width (Inner diameter of roughly 20") - don't cut this circle out of the middle of the board but rather do it at one end. To do this just tie or tape a magic marker onto a ruler at 12" and a nail at the other end and scribe a circle. Move the magic marker to 10" and scribe the second circle using the same center. To cut through the board you can use a long, thin knife or a keyhole saw or a jig saw. The inner section you can save to use as the base for the air pump housing. Cut four support members approximately 3 feet long 2" thick (thickness of the insulation) by 2" wide. Length is not critical since you will be cutting them to fit. Cut the ends so that one end of each support will be flat on the ring (see sketch) while at the same time at a 45 to 60 degree angle (you are going to be forming a teepee with all four members meeting in the middle). Note that you can overlap the ends on two of the members and then butt the other two against them. Using a hot glue gun (this seems to work the best) put hot glue on two of the members wherever they will be touching each other and on the ends where they will be touching the ring. I usually insert one of the long stainless steel screws through each joint to help support the members while the glue sets (use an electric screwdriver or drill to drive the screws in flush). After you have glued and set up all four support members on the ring set it aside.

Constructing the Pump Housing: It is necessary to put the pump outside so that it draws in air from outside. If you place the pump inside where it is warm then the warm, moist air will go out into the tubing with the result that the moisture will condense, freeze and plug the line. The unit will work fine outside in the insulated box that you are about to make. Cut two pieces of the remaining insulation board approximately 7" wide by 12" long. Cut an additional two pieces of the remaining insulation board approximately 7" wide by 6" long. These will be the four sides of the pump housing. Cut a top from the remaining board that will fit with an approximate 1 inch overhang over the box. Mount the four walls to the top with hot glue (but **do NOT** assemble them to the base - that round part you had set aside!). In other words, the four sides are glued to the top but not to the bottom. When the glue has set up you should be able to place the pump inside and cover it with this assembly. Cut a notch in the bottom edge of one of the sides of the box. This will be used to place the end of the electrical cord inside (out of the elements). Also make a hole in the side of the box with a nail or drill slightly larger than the tubing but at the height where it exits the pump. The pump box is done.

Take two pieces of aluminum wire and mount them on opposite sides of the ring (I've also used string which works fine as long as aeration bar is heavy enough to sink - some types - bubble bars - are very light). To do this just wrap one end around the ring and let the other hang down approximately 15"-18" (allow another 2" inches to wrap around the ends of the bubble bar). Wrap duct tape at third points (three equally spaced points around the ring). These will be the points where you tie the string to moor the ring in your pond. Cover the upper part of the teepee with the clear, plastic dry-cleaning bag wrapping it around and under the base ring. Use the small stainless steel screws as "thumbtacks" to hold the plastic bag in place by just pushing them through the plastic

into the top surface of the ring. In this fashion you will have covered the ring with the plastic . Poke a hole through the plastic where the duct tape is located and attach one end of each of the nylon cords at each third point. Mount the bubble bar on the aluminum wires or strings hanging down from the bottom of the ring so that it will be horizontal when the ring is floating in the water. Attach the silicone tubing to the bubble bar and pass it up through one of the holes where a cord is attached and wind the tubing around the support cord.

Float the ring assembly with the bubble bar in your pond. Position it over the deepest spot and using the three cords stake it in position. These cords do not need to be very tight - just take up the slack so that it doesn't move around too much. The tubing should be wound a few turns around one cord all the way to land. Push the tubing through the hole in the pump housing and attach it to the outlet of the air pump. Plug your extension cord into the pump plug and place the extension cord end and pump plug inside the pump housing and put the pump housing over the pump. Although your pump is protected from the elements it is strongly recommended that you plug it into a ground-fault-interrupt protected circuit (GFI). Place a rock (2-5 pounds) on the top of the housing to hold it so the wind can't blow the housing off. Put the whole pump and housing where it will be convenient to find it in the winter. Plug it in! You're DONE! Once a year check the diaphragms of the pump for cracks or take it to an aquarium shop for replacement of the diaphragms.

Word of caution. As the bubbles rise they bring a great deal of water to the surface. If you have the capability in the pump you can regulate the air flow if you wish. I leave mine on at fairly full blast. You should be able to see the water actually moving out from under the teepee. This winter you will be tempted to go out and check that everything is working. Just be careful since the water movement will keep the ice quite thin for a ways out from the teepee! (This is based on first hand, personal experience!!!---- The water is COLD!!!)

