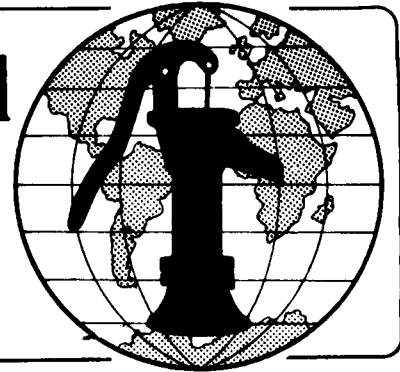


# Water for the World



## Constructing a Disinfection Unit Technical Note No. RWS. 3.C.4

Disinfection units can be constructed for both large and small water supply systems. For most disinfection purposes, chlorine compounds are used as the disinfecting agent. Chlorine is available in most countries and can be obtained in many regions at a relatively low price.

This technical note discusses the construction of simple chlorination units for small water supplies. Each unit can be built using local materials and local labor. Read the entire technical note before beginning construction.

### Useful Definition

**DISINFECTION** - Destruction of harmful microorganisms present in water, through physical (such as boiling) or chemical (such as chlorination) means.

### Materials Needed

Before beginning the construction process, the following items should be available:

1. A list of all materials and tools needed as shown in Table 1. All of these materials should be available when construction begins in order to avoid delays in the project.

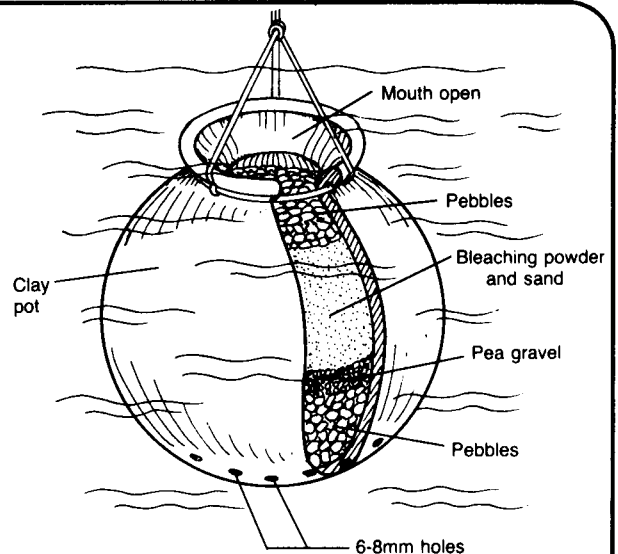
2. A plan of the disinfection unit similar to Figures 1, 2 or 3 which show a pot chlorinator, a drip feed chlorinator, and a floating bowl chlorinator.

Follow the construction steps described below when building a disinfection unit. Refer to the appropriate diagram throughout the construction process.

**Table 1. Materials List for Floating Bowl Chlorinator**

Item	Description	Quantity	Estimated Cost
Labor	Foreman Workers	____ ____	____ ____
Supplies	200-liter steel drum Rubber or cork stopper 3 small tubes 6-9mm and 3mm Flexible hose String Wood or plastic bowl Drain plug Outlet connection Small stones Planks and other wood for platform Paint Latex or rubber base	____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____	____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Tools	Hardware Saw Nails Drill Knife Buckets Paint brush	____ ____ ____ ____ ____ ____ ____	____ ____ ____ ____ ____ ____ ____

Total Estimated Cost = \_\_\_\_



**Figure 1. Pot Chlorinator**

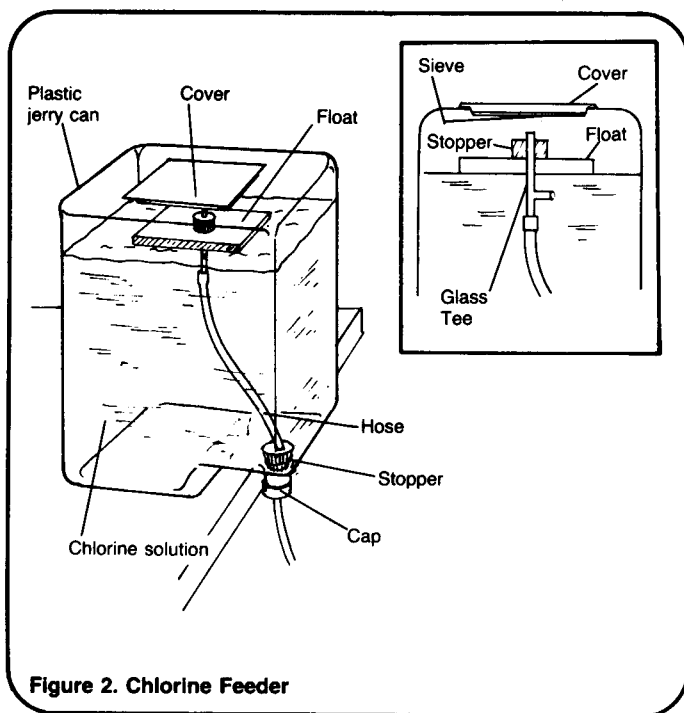


Figure 2. Chlorine Feeder

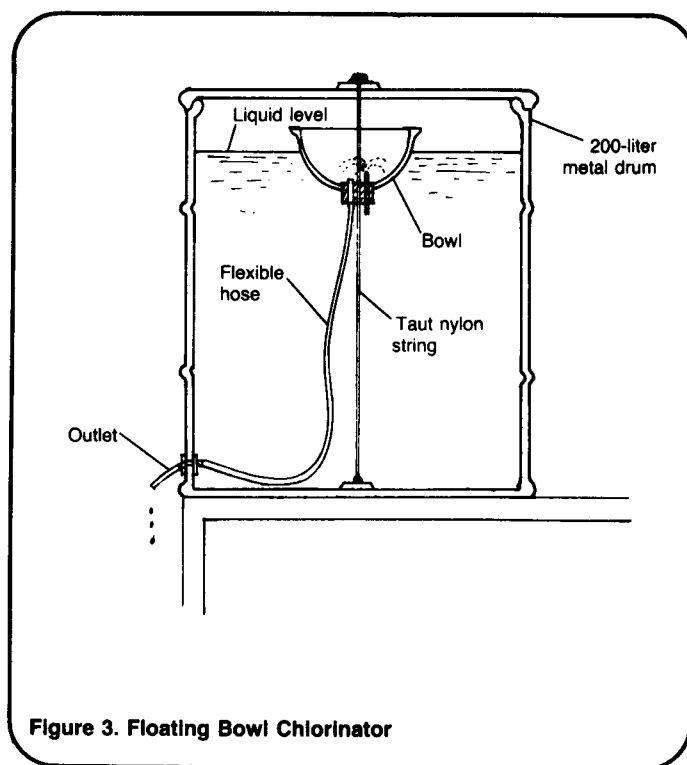


Figure 3. Floating Bowl Chlorinator

## Pot Chlorinators

A pot chlorinator, shown in Figure 1, is effective for disinfecting water in shallow dug wells. To make one, follow the steps below and refer to Figure 1.

1. Use a ceramic, plastic or earthen jar or urn with a capacity of 7-10 liters. The jar does not need a cover.

2. With a sharp object, chisel or hand drill, make seven 6-8mm holes along the bottom of the jar.

3. Fill about half the jar with pebbles and pea gravel 20-40mm in size. The gravel should form a level layer in the pot. Then make a mixture of bleaching powder and sand. Add one part bleaching powder to two parts sand. Usually, 1.5kg of bleaching powder is sufficient for making a pot chlorinator.

4. Add the chlorine and sand mixture to the pot. Then use pebbles to fill the space between the layer of bleaching powder and sand and the neck of the jar.

5. Finally, attach wire or rope to the jar as shown so that the pot can be attached to a rope or hook and lowered into the well. Be sure that the pot is firmly secured to prevent it from being lost in the well.

## Drip Chlorinators

A drip chlorinator can be used to disinfect water in wells, cisterns and other small reservoirs. To make a drip chlorinator, follow the steps listed below and refer to Figure 2.

1. Use a plastic can or bottle to make the drip chlorinator. The spout of the container will act as the outlet for the chlorine solution.

2. Cut open the bottom of the jar to provide a solution inlet and for access to the inside of the can.

3. Prepare the chlorine feed equipment that will fit in the plastic can. Use a piece of plastic, styrofoam, or wood for a float. In the center of the float, place a rubber stopper or cork and pass a piece of hard tubing through it. Glass, copper, brass or rigid

plastic tubing can be used. The tubing should be long enough to extend a little above the rubber stopper but below the float. In the part of the hard tubing below the float, make a small hole. This hole is the inlet for the chlorine solution which will fill the container. Use a tee, as shown in Figure 2, if one is available.

4. Attach a piece of small diameter rubber hose to the tubing. Connect the tubing below the inlet hole as shown.

5. Prepare the outlet for the drip chlorinator in the spout of the bottle. Make a hole in a plastic cap or the cover of the bottle spout so that the hose can pass through it. Pass the hose through a rubber stopper or cork that securely fits in the spout. Place the stopper in the neck of the container as shown, and put a cap or cover on the container spout.

6. Fill the plastic jar with chlorine bleach. Domestic chlorine beach contains 2-5 percent available chlorine. Fill the container until the float reaches the top. Then cover the top of the jar.

7. To control the flow, use a small clamp or make one from two pieces of aluminum and two aluminum nuts and bolts. Place the clamp around the hose and tighten it to cut off all flow during installation. Loosen the clamp to get the rate of flow desired.

8. Install the plastic can over the well or reservoir using wire. The wire can be attached to the well head or lip of the cistern and the container hung inside. The rubber outlet hose should reach into the water.

### Floating Bowl Chlorinators

Floating bowl chlorinators hold a much larger volume of chlorine solution than the drip type used for disinfecting water in wells and small reservoirs. Floating bowl chlorinators are used to add chlorine at a constant rate to water in a tank or in a low pressure pipeline. Floating bowl chlorinators can be constructed with local materials and local labor. Refer to Figure 3 as you read the construction steps.

1. Prepare a 200-liter barrel for storing the chlorine solution. Remove the top cover and clean out the barrel by washing it with a one percent chlorine solution. Let the chlorine stand in the barrel for at least thirty minutes. Empty the barrel and, when it is dry, paint the inside with a latex or rubber base paint. This type of paint is not affected by chlorine.

Once the paint is dry, place a small outlet hole in the side of the barrel as shown in Figure 3. Make the hole 6mm in diameter. Make another hole approximately 10mm in diameter at the bottom of the barrel to serve as the tank's drainage.

2. To feed the chlorine into the water supply, make a floating bowl like that shown in Figures 4 or 5. Use a wooden or plastic bowl or cut the bottom out of a plastic bottle to form a bowl and use it as a float.

3. Using a stopper borer or hand drill, make a hole in the middle of the float to fit a medium-sized rubber or cork stopper. The rubber or cork stopper must be wedged into the opening to fit securely without leaking. Before placing the stopper in the opening, push three short tubes through

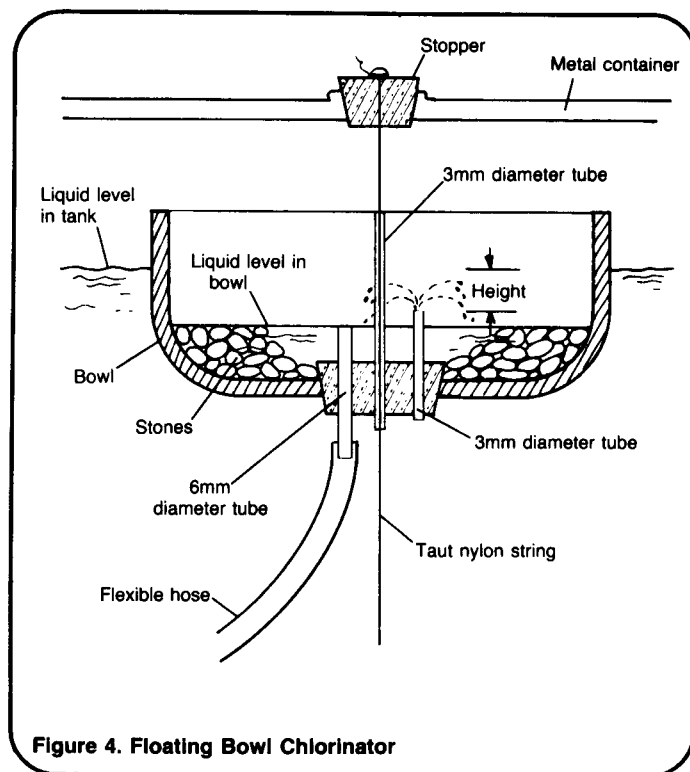


Figure 4. Floating Bowl Chlorinator

the stopper. Use glass, copper, brass or hard plastic tubing. Use two 3mm and one 6-9mm diameter tubes. One 3mm tube should go through the center of the stopper and the other two tubes should be placed to either side of the center. The tube through the center which will carry the guide string shown in Figure 4 should extend to the top of the bowl. The other 3mm tube should reach just below the liquid level in the tank. The 6-9mm diameter tube should reach no higher than the top of the stopper or the layer of small stones used for weights.

4. To install the floating bowl in the tank, first connect one end of the flexible rubber hose to the largest diameter tube. Connect the other end of the hose to a small drip outlet. The drip outlet can be made of plastic or a watertight joint. Or, flow can be controlled by placing a clamp over the flexible tube. Tightening the clamp will slow the flow; loosening it will increase the flow.

5. Secure one end of a nylon string to the bottom of the tank. Take the free end and thread it through the 3mm tube passing through the center of the stopper. Pull the string as tight as possible, and attach it to a wooden cross piece over the top of the barrel. Secure it well so it can be separated from the cover to refill the barrel without disconnecting the bowl. The string serves as a guide for the bowl so that it does not hit the sides of the tank. Figure 5 shows a bowl without a guide string. The chlorinator is easier to make without the guide string, but the bowl may drift to the sides of the barrel. If there are no ridges or plugs in the sides that could keep the bowl from moving downward as the chlorine solution is used, the chlorinator will work.

6. Fill the tank almost to the top with a one percent chlorine solution. To determine the amount of chlorine compound needed to prepare a one percent solution, use the following equation.

Amount of chlorine needed:

$$\frac{\text{Percent strength of solution desired} \times \text{Liters of solution required}}{\text{Percent available in compound}}$$

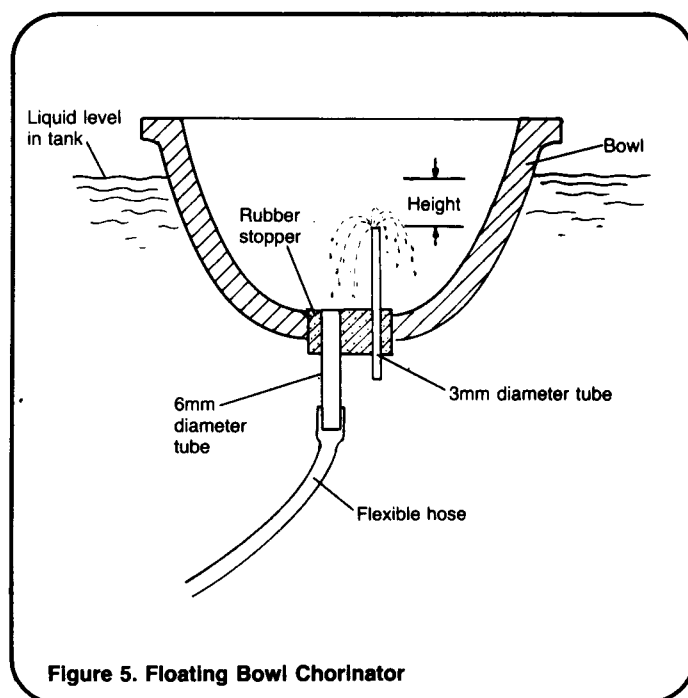


Figure 5. Floating Bowl Chlorinator

To prepare 200 liters of a one percent solution using bleaching powder with 35 percent available chlorine, the amount of bleaching powder which should be used is:

$$Q \text{ chlorine} = \frac{1\% \times 200 \text{ liters}}{35\%}$$

$$Q \text{ chlorine} = \frac{.01 \times 200}{.35}$$

$$Q = 5.5\text{kg.}$$

Approximately 5.5kg of bleaching powder should be added to the water in the tank. Stir gently but well for at least five minutes.

7. To control the flow of the solution from the tank, one of three methods can be used. To reduce the flow, raise the tube that lets water into the bowl to the height near the water level in the tank. Lowering the tube increases the flow. The second method is to reduce the size of the opening to the bowl in the top of the inlet tube. A glass tube can be heated and drawn out. A brass or copper tube can be flattened out. Third, small stones or gravel can be placed in the bowl to increase flow. The stones act as weights and force larger amounts of water to flow into the bowl through the tube. Weights may be added or removed to control the rate of flow.

The tank should be checked often to be sure that the tank always contains chlorine solution. The water being treated should be tested periodically to ensure that there is adequate chlorine residual. A color comparator tester is needed to do this. The addition of a reacting agent called orthotolidine produces a yellow color which increases with chlorine content and indicates the amount of chlorine in the water.

### Summary

Several simple methods are available for chlorinating small supplies of water. The pot chlorinator, the drip

feed chlorinator and the floating bowl chlorinator can all be constructed using locally available supplies and labor. These methods are useful for chlorinating small water supplies but in order to be assured of their effectiveness, water should be tested after chlorination. Where water cannot be tested, make sure that the treated water has a slight chlorine taste and odor. Insufficient chlorination does not provide protection from disease-causing bacteria.