

Water Missions International
Erosion Chlorinator
Assembly and Operating Manual
October 2009



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1. Introduction

The vast majority of health problems related to unsafe water in developing countries are the result of microbiological contamination of the water. According to the WHO, “infectious diseases caused by pathogenic bacteria, viruses and parasites (e.g., protozoa and helminths) are the most common and widespread health risk associated with drinking-water”¹. This microbiological contamination of the water is usually the result of animal or human feces. Water that appears clear may still be contaminated with microbiological pathogens. To make water safe to drink, it must be disinfected. Chlorination is the most commonly used disinfection technique for drinking water. Several disinfection techniques, including chlorination, are very effective against pathogens. Chlorine has the added benefit of having a residual disinfection capability. Chlorine will remain in the water and maintain a disinfection capacity as the water is moved from the disinfection point to the point of use. This makes chlorine ideal for use in developing countries where the water is often transported, stored, and even used with dirty containers.

When a source of clear water (turbidity less than 1 NTU) is available, chlorination may be used to disinfect the water without pre-filtration. Drilled wells or natural springs are examples of water sources in developing countries that may have clear water and thus be appropriate locations for installation of a chlorinator. The WMI chlorinator is ideally suited for this type of application. It can be used with a flow range of 5- 20 GPM.

The Water Missions Erosion Chlorinator will provide effective chlorination of drinking water when it is properly installed and operated. This manual serves as the guide for the proper installation and operation.

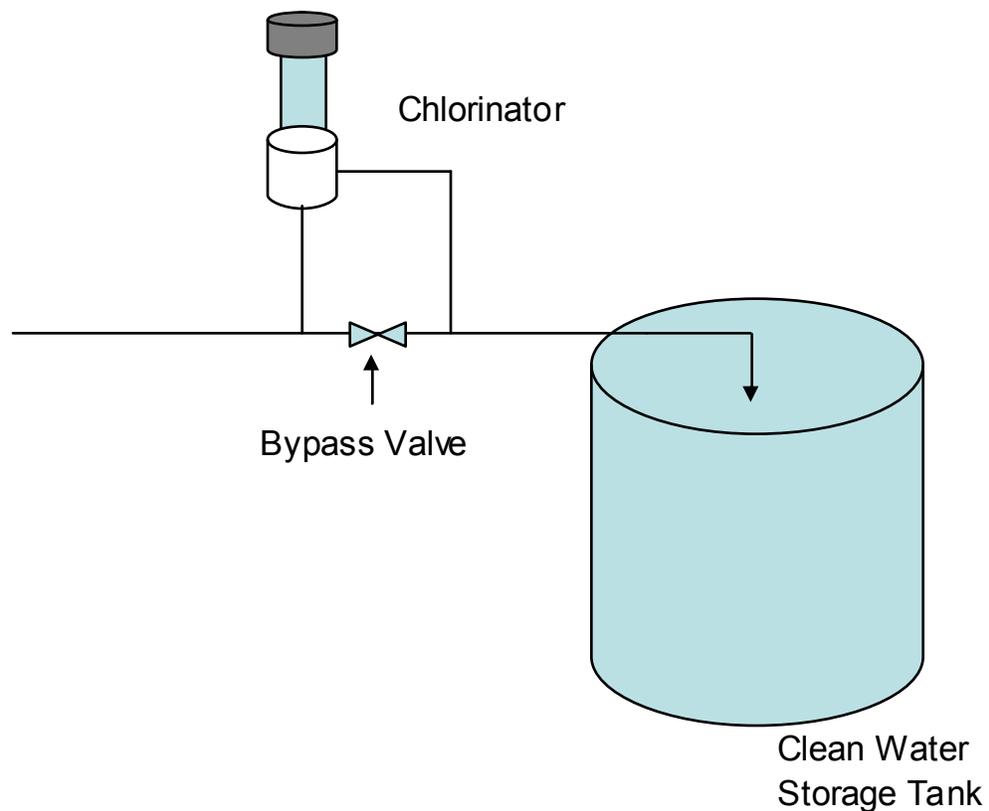
1. WHO Guidelines for Drinking Water Quality, 2004, pg 121.

2. Where to Install a Chlorinator

The location of the chlorinator is the most important aspect in planning the installation. The water can be pumped to the chlorinator, but once it goes through the chlorinator, it should flow without restriction to the water storage tank or other desired location.

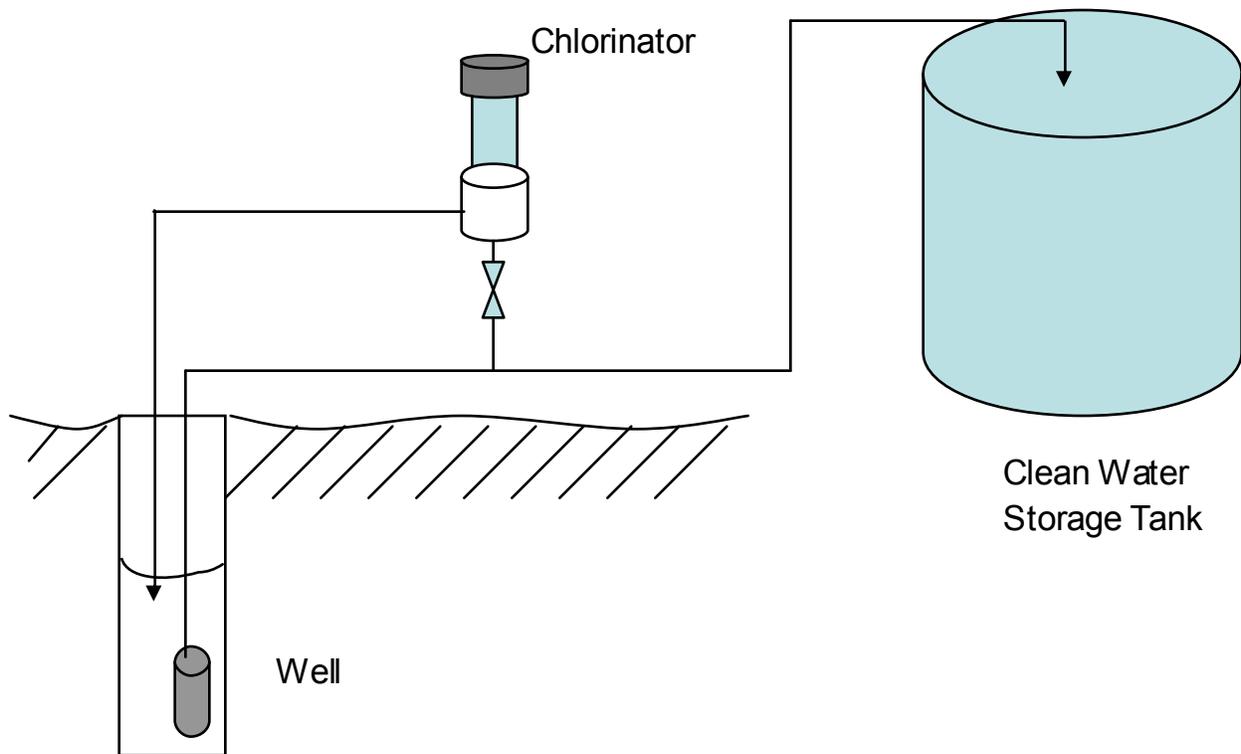
To reduce the likelihood of corrosion, the chlorinator should be installed away from electrical wiring, metal piping or other components that may corrode upon exposure to chlorine. It is advisable to mount the chlorinator in a separate room from the pump controls or other electrical devices.

The WMI chlorinator is commonly installed on the inlet line to a water storage tank. When it is installed on a pressurized line leading to a storage tank, the chlorinator should be installed with a bypass line as explained in this manual. All piping in the vicinity of the chlorinator should be non-metallic. This type of installation is shown in Schematic 1 below.



Schematic 1: Installation on supply line to water storage tank

Alternately, the chlorinator may be installed directly on the discharge line from a well and be used to chlorinate the water in the well. In this application, the chlorinator is installed on a tee. The chlorinated water is returned directly to the well. The chlorinated water should be discharged into the well below the water level in the well. All chlorinator piping should be non-metallic. A valve is installed between the tee and the chlorinator to control flow through the chlorinator as shown in Schematic 2 below.



Schematic 2: Installation on discharge from well

Note: Bypass around chlorinator not required



Picture of a chlorinator installed on well discharge line

Figure 2. Piping and other parts.

Parts Defined

1. One (1) erosion chlorinator
2. One (1) erosion chlorinator bracket
3. Two (2) 6" hose clamps
4. Four (4) 2-1/2" hose clamps
5. Two (2) 3/8" x 3" stainless steel bolts
6. Four (4) #8 x 2-1/2" stainless steel wood screws
7. One (1) Pipe assembly #1 (see provided figure for reference)
8. One (1) Pipe assembly #2 (see provided figure for reference)
9. One (1) two-way ball valve
10. Three (3) 4" diameter O Rings
11. Two (2) 1" diameter O Rings
12. Two (2) 1" barbed slip-fit insert male adapter
13. Two (2) 1" barbed threaded insert male adapter
14. One (1) 4" length threaded ends PVC pipe
15. One (1) 1" female coupling (slip x thread)
16. One (1) roll of Teflon tape
17. One (1) 8 ounce canister of PVC purple primer
18. One (1) 8 ounce canister of PVC cement
19. One (1) bag of chlorine testing kits

Tools Needed

For the assembly you will need

1. A flathead screwdriver
2. A 9/16" wrench (or any other wrench to turn a 9/16" bolt)

Finding a location

Find a sturdy vertical surface or pole that will allow for attachment of the chlorinator bracket. An exterior wall of a building or a telephone pole are good examples of chlorinator locations.

Assembly

Note: it may be easier to attach the bracket to the mounting surface and assemble the rest of the chlorinator separately. If this is true, follow the instructions as normal, but move step 3 to the end.

Step 1. Bracket Mounting

Attach the chlorinator bracket to the selected surface. Use the wood screws and/or bolts to attach the bracket as needed.



Figure 3. Chlorinator mounting bracket

Step 2. Bracket Preparation

Slide one of the 6" hose clamps through the top two slots in the bracket and put the other hose clamp through the bottom slots. See figure 4.



Figure 4. Bracket with 6" hose clamps

Step 3. Chlorinator Attachment

With the black screw-on top pointing up, attach the erosion chlorinator to the bracket. Mount the chlorinator such that the clear part is in the slot of the bracket, this will ensure that it stays vertical. Wrap the 6" hose clamps around the chlorinator and tighten them with the screwdriver. See figure 5.



Figure 5. Mounted Chlorinator

Step 4. Piping Assembly #2

Wrap the threaded male part of pipe assembly #2 with one or two layers of Teflon tape. Screw pipe assembly #2 into the side hole on the bottom part of the chlorinator. After screwing the assembly in, make sure that loose collar of the assembly is facing the bottom hole of the assembly; this action ensures that the rest of the assembly will fit together.

Step 5. Piping Assembly #1

Wrap the threaded male part of pipe assembly #1 with one or two layers of Teflon tape. Screw assembly #1 into the bottom hole on the bottom part of the chlorinator. After screwing the assembly in, make sure that loose collar of the assembly is facing the loose collar from pipe assembly #2.



Figure 6. Pipe assemblies #1 and #2 properly aligned

Step 6. Ball Valve

Place the ball valve between the two assembly collars and tighten the collars onto the ball valve. Make sure to position the valve such that the valve handle is facing in an easily-accessible direction: downward or away from the bracket are best.



Figure 7. Chlorinator assembly

Step 7. Connection to Water Source

There are several plumbing options to be considered for the erosion chlorinator. Choose the best option for the supplies and set-up at the installation location. The following are descriptions on how to install the fittings onto the system and how to connect the inlet and outlet flow pipes to the system.

1. 1" barbed threaded insert male adapter
Use this attachment for a connection that has a threaded female end and needs a hose attached. Add Teflon tape to the threaded male part and screw it in until tight.
2. 1" barbed slip-fit insert male adapter
This adaptation should be used in the situation where the inlet and/or outlet flows are provided via 1" hoses. To attach to the rest of the system, clean the male and female slip fits where the connection is to be made as instructed on the PVC cement canister. Add the PVC primer and cement as instructed on the canisters to attach the two pieces.
3. 4" length threaded ends PVC pipe
This piece should be used if the water lines have female threaded connections. To use this attachment, cut the piece in half. At this point, clean the pipe and add PVC cement as instructed for the barbed slip-fit adapter.
4. 1" female coupling (slip x thread)
This part should be used when a slip fit male part needs to be converted to a threaded female part, or a threaded male part should be converted to a slip-fit female part. Add the PVC cement to the slip-fit as instructed above, and add Teflon tape to the threaded male part as needed.

2. Operation

Adding Chlorine

The WMI chlorinator is designed to operate with 3-inch diameter chlorine tablets such as the OxyChem ACL 90 Trichlor tablets or an equivalent (See Appendix 1 for detailed specifications).

To add chlorine to the system, unscrew the top of the chlorinator and place chlorine tablets into it until the chlorinator is full. **Always wear gloves or otherwise protect your hands from direct contact with the chlorine.** Load the tablets into the chlorinator as far as possible one at a time to ensure that they lay flat on top of each other. Do not drop the tablets, as this will cause them to break. Screw the top of the chlorinator securely back on before continuing.

NOTE: When finished, wash hands thoroughly as prolonged chlorine contact can cause mild burns.

NOTE: Chlorine is a very powerful disinfectant and must be handled carefully. When removing the chlorinator top or opening the container storing the chlorine source, concentrated chlorine fumes may be present. Ensure the area is well ventilated and to not inhale the concentrated fumes.

Startup

The inlet of the chlorinator is the open pipe for pipe assembly #2 and the outlet for the system is the open end from pipe assembly #1. Making sure that the inlet and outlet hoses have been properly attached, and the rest of the chlorinator is properly set-up, turn on the supply water and let water begin flowing through the system. Be sure the ball valve is open (the valve handle will be parallel with the pipe connected with the valve). See figures 8-10 for ball valve operation.

Testing water

The WMI chlorinator is supplied with SenSafe free chlorine test strips manufactured by Industrial Test Systems (see Appendix 2 for detailed specifications). These strips can measure chlorine concentration from 0 – 6 ppm. These test strips provide a simple and accurate method for testing the free chlorine concentration in the water. Following the instructions on the SenSafe bottle, test the chlorine level of the water in the collection tank. The target chlorine concentration is 2.0 ppm.

Controlling chlorine concentration

The ball valve is the key to controlling the concentration of the chlorine. See figures 8-10 for ball valve operation.



Figure 8. Open



Figure 9. Half Closed



Figure 10. Closed

Opening the ball valve will slowly decrease the concentration by allowing more non-chlorinated water into the storage tank; closing the valve will increase the chlorine concentration. If the collected water does not have a chlorine concentration of 2.0 ppm, take the following steps:

1. For a chlorine level above 2.0 ppm, open the ball valve and let water flow into the storage tank. Periodically test the chlorine until the desired level is reached. When this has been done, adjust the ball valve so that the chlorine concentration stays near the 2.0 ppm level.
2. For a chlorine level below 2.0 ppm, close the ball valve and let water flow into the storage tank. Periodically test the chlorine until the desired level is reached. When this has been done, adjust the ball valve so that the chlorine concentration stays near the 2.0 ppm level.

In figures 11 and 12 on the following page, you can see a general overview of how the concentration of chlorine changes with the position of the valve.

When to add more chlorine tablets to the chlorinator

When the chlorine tablet level is about half of the original chlorine level, add tablets as instructed above.



Figure 11. Valve position references for Figure 12

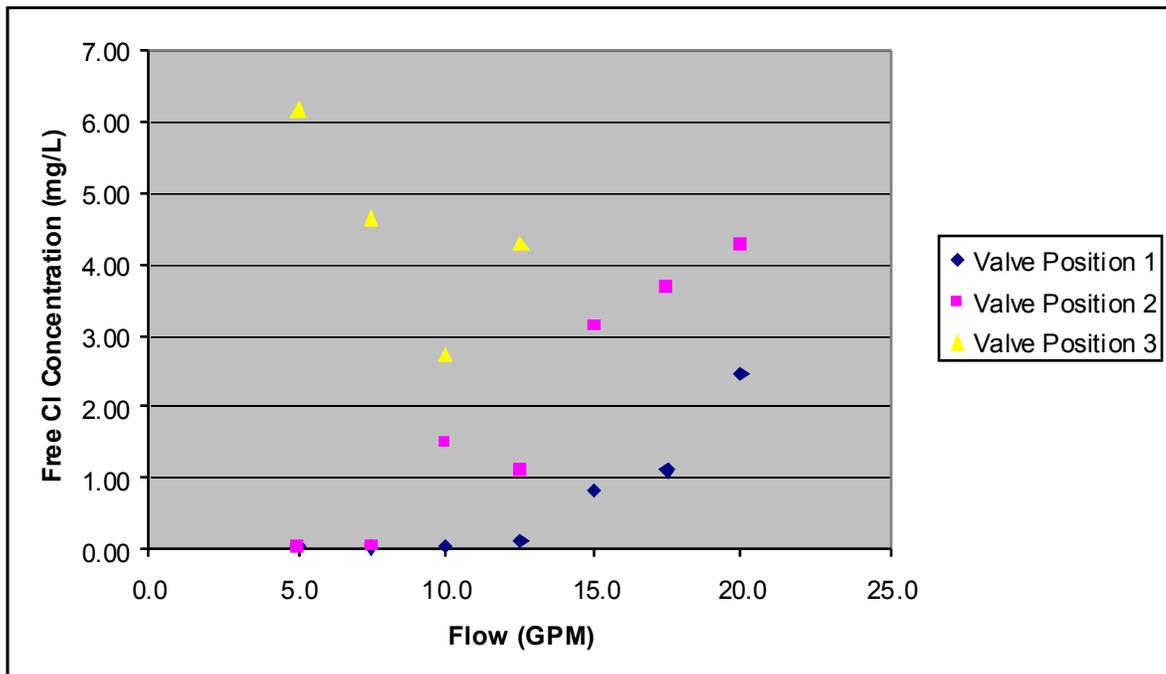


Figure 12. Approximate chlorine concentrations based on flow rate through chlorinator and bypass valve position.

3. Troubleshooting

Fixing a leak

If there is a leak in the system, first find the source of the leak. Then turn off the system and fix the leak by taking the following measures:

If the leak is at a joint of the inlet or outlet hoses and the pipe assemblies, strengthen the connection by either tightening the hose clamp or by screwing in the water lines. If the leak is at a joint that has been glued together, dry the pipe connection and add some PVC cement to the rim. Allow this cement to dry and turn the water back on to see if the leak has been fixed. If not, replace the leaking PVC fittings.

If the leak is at a connection with the chlorinator, disassemble the entire chlorinator. For the pipe component that is the source of the leak, wrap a little more Teflon tape around the threaded male part, and tighten the pipe connection.

If the leak is at the ball valve, first try tightening the collar at the leak. If the leak persists, remove the ball valve from the assembly and check the 1" O-Rings. Replace the O-Ring at the leak with one of the spares given in the kit.

High Water Level in the Chlorinator

In normal operation the water level in the chlorinator should be below the lowest part of the clear plastic tube. When there is significant backpressure on the chlorinator, the water level may be visible in the chlorinator. However the water level in the chlorinator should be stable.

If the water level is rising or if it reaches the top of the clear tube, there is a leak at the top of the chlorinator. The most likely cause is that the top piece of the chlorinator is not attached tightly enough to form a seal. To correct this problem, stop the flow of water through the chlorinator and relieve the pressure in the chlorinator. Then remove the top and inspect the O-ring seal and the mating surface. If the O-ring is damaged, replace the O-ring. If the mating surface is uneven, either repair the mating surface or replace the top of the chlorinator. Then place the top back on the chlorinator and tighten, being careful to insure proper alignment of the top on the chlorinator body.

Appendix 1

Chlorine Tablets



ACL® Chlorinated Isocyanurates

ACL® 90T Tablets

ACL 90 is an OxyChem trade name for trichloro-s-triazinetrione. OxyChem markets tablets in a variety of sizes and weights.

Property Specification

Available Chlorine, % 90 Minimum

Three-Inch Tablets (Wrapped, Unwrapped)

Appearance White 3 inch (76.2 mm) diameter tablets with smooth surfaces and well defined edges.

Tablet Weight, grams 199 - 202

Chlorinated Isocyanurates Division

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Occidental Tower
5005 LBJ Freeway
Dallas, Texas 75244
Toll-free: (800) 578-8880
Tel: (972) 404-3800
Fax: (972) 404-4815

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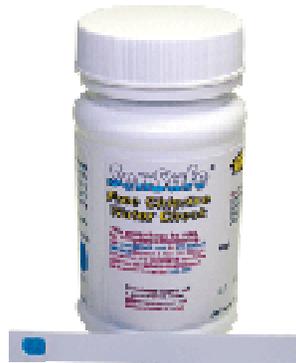
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ACL PW-0702

Appendix 2

Chlorine Test Strips

USEPA Approved SenSafe™ Free Chlorine Water Check



SenSafe™ Free Chlorine Water Check (USEPA Approved)

Part Number: 481026

Detection Range: 0, 0.05, 0.1, 0.2, 0.4, 0.6, 0.8, 1.2, 1.5, 2, 2.6, 4, 6 ppm (mg/L)

Total Test Time: 40 Seconds

Number of Tests: Bottle of 50

Industrial Test Systems, Inc.

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