General Troubleshooting Guide

This guide goes over the standard troubleshooting that is performed during periodic check-ups on a system or if it is suspected of not performing properly. The installation of a gauge assembly on the system makes this much easier.

To have the expected amount of ozone oxidizing the water, four basic factors have to be taken into account. If one of these is not working properly it will result in a reduced amount of ozone oxidizing the water, and thus low ORP and ozone ppm readings.

- **The ozone generator** has to produce ozone
- **The air preparation system** has to be functional
  - An air dryer should dry the air
  - An oxygen concentrator should both dry the air and produce 90% oxygen
- **No air leaks** should be present in the airlines, this will insure the gas we're introducing into the water is in fact ozone.
- **The water** itself has to have the correct properties to allow the ozone to oxidize properly

The Ozone Generator

In all of our systems there is a display light of some kind that you typically see during ozone production. If it is illuminated, we can expect ozone is being generated; the cause for any reduction in ozone output will likely be found in the other three sections of this guide.

All of our corona discharge ozone generators are "all-or-nothing" type systems.
There are enough diagnostics built in to most systems that will disable the "ozone" light if there is an issue.
If the output light is not illuminated, the generator is not producing ozone and the ozone generator should be investigated. Consult the ozone generators manual and any support documents.

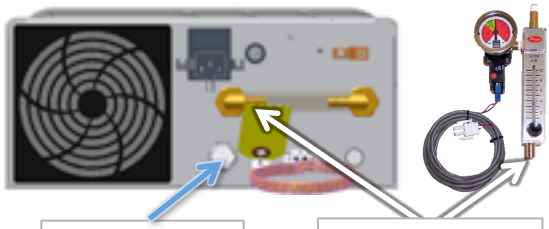
Verify ozone generation by detecting the scent of ozone anywhere in the installation (e.g. the tubing connection on the contact tank's off-gas vent). Due to the ozone generator being "all-or-nothing" if some ozone is detected, we know that the reaction chamber and related circuitry is operational.

If we cannot detect ozone in an easy fashion, we can test the ozone generator directly by blowing air through it:

- Disconnect tubing from the underside of the air inlet of the ozone generator; the intention is to blow air into this fitting.
  - A common location is the underside of the airflow (SCFH) gauge mounted on the underside of the ozone generator.
  - If no gauge is installed, it will be a brass connection on the underside of the ozone generator, in an ozone model number that ends in "/AD" it will be the left-side brass connection we are interested in.
- Disconnect the ozone outlet of the ozone generator.
  - This is a stainless steel fitting, commonly with a grey check valve installed in this port. Remove the check valve, as blowing air through it can be difficult.
- Apply power, enable ozone output and allow it to run for 30 seconds
- Cup your hand around the ozone outlet fitting and flow air into the brass inlet
- Detect the scent of ozone in your hand
  - The smell of ozone is sharp, sweet and can be smelled after a thunderstorm, it is often described as similar to chlorine bleach.
  - If ozone is detected, then the generator is working.
  - If there is no scent of ozone, note down all display lights, gauge readings. Write down the model and serial number of the unit, consult the manual or contact your distributor or ClearWater Tech to continue troubleshooting.

Underside of a CD12/AD

Gauge assembly



Ozone out here

Flow air into one of these two points

Air Preparation

Blue silica gel crystals are installed in each model ozone generator. Some models have a chamber visible through the cover that has mixed blue and white crystals. This is at times referred to as indicating desiccant media.

Ozone generators need to be supplied with dried air or oxygen to produce the expected amount of ozone. Ozone generators with model numbers that end in "/AD" have internal air dryers for this purpose. Other models are commonly paired with oxygen concentrators.

The color of the crystals serves as a status check on the air supplying the ozone generator. There should be no moisture present in the output of an air dryer or oxygen concentrator.
Any moisture passing through the crystals will be absorbed by the silica and produce a color change of blue, to pink and finally to white.

Inline particulate filters and indicating chamber within a unit The original blue and two colors that indicate a nonfunctioning air preparation system

ClearWater Tech, LLC.
Toll Free: 1.800.262.0203 • Ph: 805.549.9724 • Fax: 805.549.0306
850-E Capitolio Way, San Luis Obispo, CA 93401 • email: service@cwtozone.com • www.cwtozone.com 110613

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A color change from blue to pink or white indicates a possible failure of the air dryer or oxygen concentrator and will severely reduce ozone output.

- Ozone generators with model numbers that end in "/AD": Perform the recommended annual maintenance. Replacement of the air dryer media and all indicating media is a part of this maintenance. More information would be available in the unit's manual.
- Systems with oxygen concentrators: Perform the recommended annual maintenance to the ozone generator in addition to inspecting and verifying the health of the associated oxygen concentrator. Information is available in the associated manual.

Air Leaks

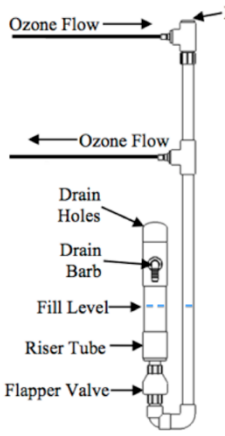
Most installations of our ozone generators involve a venturi injector plumbed into a pressurized water line; this creates a suction that draws the ozone gas into the water.
If there are any breaks in the line, or any component, ambient air enters the line supplanting the ozone, diluting it or if the leak is far enough back, corrupting the dried air from the air prep. Any of these things will result in lowering the ozone output of a system.

Gauge assembly including vacuum switch

Injector manifold with disconnected check valve assembly

If a gauge assembly installed on the ozone generator, insure the needle is kept between -3 to -8"Hg. This is color-coded to a "green" area of the gauge.

- Adjust the black knob at the base of the airflow gauge to move the needle within the green range.
  - If the needle moves freely within the green range, there is no leak. The gas flowing through the ozone generator is getting into the water through the venturi injector.
  - If the needle cannot be brought into the green range, or adjustments to the black knob cause the needle to move to zero (it has to be closed most of the way to bring the needle barely into the green) there may be an air leak.



Vacuum break assembly

Finding an air leak, or no gauge assembly installed, confirm the level of vacuum at the injector is maintained throughout the ozone system.

- Deny power to the ozone generator.
- Disconnect the tubing at the injector and place your thumb over the injector fitting. Use the tactile suction present to give you a baseline level of suction.
- Compare this level of suction to each point of tubing connections after reconnecting the injector.
- Proceed to the end of each tubing connection starting from the injector back to the air preparation system.
  - Specifically check before and after vacuum break, if installed. This is a water trap to keep the ozone generator from getting wet if the check valves fail. In order to remain sealed, there needs to be water on top of the white PVC flapper valve.
  - If vacuum is felt before the ozone generator, but is not detected after it; our leak is obviously within the ozone generator. Insure the power cord is disconnected and remove the cover of the unit. Continue to check within the ozone generator, before and after the reaction chambers is an ideal test.

By now, you've verified there are no leaks or have found an area that is leaking. Consult with your distributor or ClearWater Tech to find out what is involved in resolving the leak (usually maintenance).

Water Chemistry

This area is typically explored when we suspect low ozone output, and the first three sections show to have no issues.

Abnormal pH
7.2 pH is optimal for ozone, the farther you are away from 7.2 you will experience lower ozone oxidation and ppm retention time.

Higher temperature
The hotter the air or water is, the faster ozone will convert back to oxygen. Anything over 85 degrees F will be considered 'hot' by these systems. As temperatures will normally go over this level depending on season or heated pools, all ozone systems are typically oversized to take this into consideration.

Atmospheric breaks
While pressurized in a contact tank or in the pipe, ozone will oxidize the water and build up a small residual ppm level before converting back to oxygen.
If the pressure is suddenly lost due to being introduced to an open (atmospheric) tank or a water feature such as a waterfall, we can expect the ozone to jump out of solution of the water. Oxidation and ppm retention will continue, but at a reduced level in and after this point.

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