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EQUIPMENT In the Zone

Tracking down an ozonator problem can take some special skills, but a checklist of common issues makes the job much easier.

By Ben Thomas | 5.27.2011

Ozone can provide an effective supplementary disinfection system for swimming pools.

This naturally occurring gas, which is composed of three oxygen atoms, is one of the most powerful oxidizers known to man — 25 to 200 times faster at killing algae and bacteria than hypochlorous acid, the strongest form of chlorine.

And because ozone attacks organisms by ripping through their cell walls instead of disrupting their metabolisms from the inside, it's lethal not only to bacteria and algae, but also to viruses, and even microbes such as *cryptosporidium* and *giardia*.

Isolating an ozonator performance issue can involve a bit more detective work than, say, adjusting pH or total alkalinity. Here, we'll examine a variety of possible ozonator issues, and walk through the solution process step by step.



FILE PHOTO

Demand and consumption

At the outset of a service call, it may not be immediately clear whether the sanitation problem lies with the ozonator itself, or elsewhere in the system.

Perhaps the simplest test is a visual inspection of the water's clarity. A properly functioning ozonator does more than just sanitize and oxidize — the ozone it produces reacts with organic and inorganic particles in the water, causing them to flocculate (clump together) for enhanced filtration. Thus, if you notice cloudiness in the water — and the pool's filter is functioning properly — this is likely a sign of ozonator troubles, because it can point to an absence of flocculation.

But even if the water's clear, a test of chlorine residual is a worthwhile starting point for diagnosing a sanitation problem. Ozone's chemical structure breaks down quickly in water — depending on the level of contaminants, it takes anywhere from a few seconds to several minutes. Thus, it's impractical to maintain a long-term ozone residual in the pool.

"You can't build an oxidizer residual with ozone," explains Roy Reed, owner of Memphis Pool in Memphis, Tenn., "so you've got to maintain a little residual [with other chemicals] to keep up with that sanitizer demand." This means a 0.5-1.0 ppm residual of a halogen oxidizer — usually

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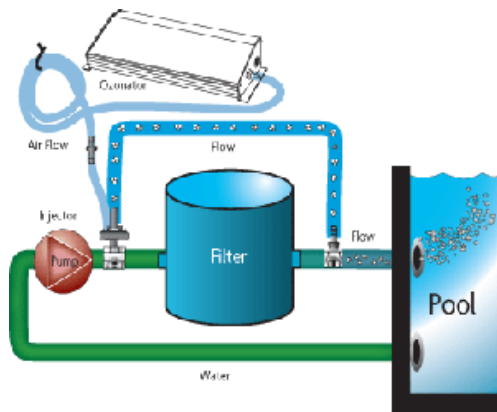
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chlorine — is necessary to ensure that all contaminants in the pool are steadily oxidized.

Test the water's chlorine level, and check for proper sanitizer levels in the pool. Alternatively, if the pool is using a commercial-grade ozone system, it may include a built-in oxidation reduction potential (ORP) meter, which makes it possible to check the water's ability to oxidize contaminants. The ozone system may be experiencing problems if one of three conditions are present: The water's chlorine residual is lower than normal; a higher-than-usual amount of chlorine has been needed to meet the pool's chlorine demand; or the water's ORP reading is lower than normal.

Working backward: **The effectiveness of any ozonation system is impacted by water chemistry, filtration and electrical wiring, so it's crucial to address all these aspects of the system when diagnosing problems with an ozone-disinfected pool.**

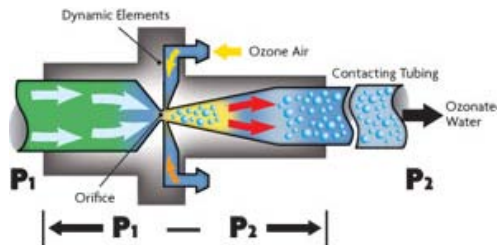
Before proceeding to the ozone generator, it's important to check for some other common reasons the pool's chlorine consumption may have gone up. Check to see if debris such as leaves or dirt has been falling into the pool. If it's rained recently, ask your customer if the pool was left uncovered during the storm. It's also worth finding out if the homeowner threw a pool party recently, or knows of any other conditions — such as landscaping or water-loving pets — that might have contributed to a spike in chlorine demand.

Addressing conditions like these is crucial, because even if the ozone generator is working properly, the pool's chlorine demand may still need to be recalculated, and the oxidizer output adjusted accordingly.

"Having an ozonator doesn't negate the necessity of maintaining a proper chemical balance in the water," Reed says.

Pipes and valves

Once the nature of the sanitizer issue has been determined, the next step is to begin tracing the trouble to its source. If a problem with the ozonator is suspected, it's helpful to start by inspecting the ozone generation system for any obvious signs of damage, like a frayed power cord or broken electrical connection. If any major degradation is present, it may be necessary to replace that portion of the system's electrical wiring.



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Next, inspect all check valves within the ozone system for water leaks or blockages. If any are damaged, they'll need to be replaced right away — a broken valve not only prevents proper ozone circulation, but it may also allow water to flow into the ozone generator, causing additional long-term damage.

Some professionals recommend using multiple "layers" of check valves to ensure a minimum likelihood of leakage.

"Create redundancy with your check valves, so you don't have to constantly watch them," says Steve Stubbs, principal of Riviera Pools and Spas in Los Angeles. "Make sure that there are at least two check valves in line before the [ozone] generator pack, and always carry some extras in your truck. From a mechanical standpoint, those valves are the places that are most likely to fail first."

Another potential trouble spot is insufficient suction of ozone gas, often caused by an improper pressure differential across the ozone generator's injector (sometimes called a venturi). The pressure on the inlet side of the injector must be higher than the pressure on the outlet side to ensure sufficient suction and proper gas flow.

"Make sure there is a presence of vacuum at all times — even when servicing the system," Stubbs says, "so that you've always got something pulling the gas through the line."

Some generators include pressure gauges on both sides of the injector, while for others, you'll need to check the performance of the injector by using an air flow meter at the injector's gas

Under pressure: **A lack of suction across the ozonator's injector (also known as a venturi) can lead to insufficient availability of gas (air or pure oxygen, depending on the system) within the ozone generation chamber. Thus, checking the pressure differential with a pressure gauge or air flow meter is an important step in a diagnosis.**

inlet port. Regardless of which method is used to check air flow, any necessary changes can be made by adjusting the injector bypass valve.

Manufacturers typically provide a pressure differential recommendation for optimum suction performance on each model they make. If someone's noted operating parameters such as this on a previous visit, it pays to check that the current settings are in line with the values observed when the system was last working properly — and to note any settings changed on this visit. "That way," Stubbs says, "the next time you see something awry, you have a starting point for ascertaining what's gone wrong."

Into the system

No matter what is determined about the pool's chlorine demand and the generator's plumbing conditions, it's generally worthwhile to run a few checks on the ozonator itself. Many ozone systems include an indicator light that reflects proper operation. If the light is on, the problem likely lies somewhere in the plumbing, or with the water's chemistry. Conversely, if the light is off, or showing a different color than usual, the ozone generator is probably experiencing a problem.

The next step is to determine whether the system is an ultraviolet (UV) or corona discharge (CD) ozone generator, because each type entails its own unique setup, and its own problem-solving methodology. Both types of ozonators are popular in residential applications, and meet the supplementary sanitizer demands of a small pool.

Within a UV ozonator, the only part that's necessary to inspect is the UV lamp. If the lamp isn't lit, try replacing the bulb or checking the electrical wiring. If the lamp is lit, the next step is to determine whether it's producing ozone. This can be done with an ozone test kit, which is available from a variety of ozone and test kit manufacturers.

CD ozone systems are available in residential and commercial sizes, but many residential pools also use commercial-grade CD ozone generators. "I usually put commercial ozonators on my residential applications," says Steve Kenney, owner of SRK Pools in East Hampton, N.Y. "I've found that residential units just don't meet the oxidizer demand we see up here in the Northeast."

Commercial-grade CD systems involve more complexity than UV or residential CD ozone generators, but any issues can typically be isolated to one of a few key areas.

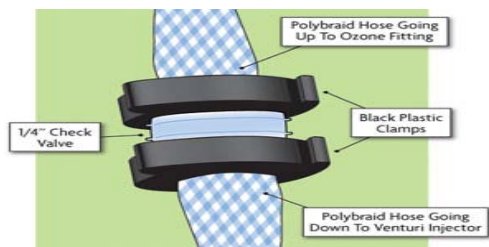
If the CD system uses an air dryer, check the moisture level around it using a dew point monitor. Even a small amount of moisture accumulation can foul the dryer and interfere with ozone production.

The process of corona discharge causes some chemical reactions with other molecules in natural air — most notably hydrogen (H) and nitrogen (N), which react with the free oxygen atoms (O) to form nitric acid (HNO₃). Thus, if the system isn't using an oxygen concentrator, it's important to check for nitric acid buildup in the ozone cell or downstream plumbing. If the buildup is severe enough to create a blockage or otherwise inhibit the ozonator's normal operation, it'll be necessary to determine whether the part in question can be cleaned, or if it needs to be replaced.

However, most commercial CD ozone generators — including many installed on residential pools — use an oxygen concentrator to draw pure oxygen from the air, allowing for a much purer and more concentrated ozone output. If the system includes an oxygen concentrator, check to make sure there's a clean air filter in the concentrator's compressor, and check with an oxygen meter to determine the concentrator's exact oxygen output. If the compressor hasn't been serviced within the past year, or if you notice any abnormal air flow or unusually high oxygen pressure, the air filter — or perhaps the entire compressor — will need to be replaced.

Determining the pool's sanitizer demand, checking the mechanics of the ozonator's plumbing, and verifying its ozone production are all significant factors in any informed decision about the system's needs.

"All of these elements contribute to the synergy required to maintain the level of sanitation required by a specific body of water," Reed says. "At the end of the day, the effectiveness of the ozone process depends on an operator's trained eye, and careful monitoring of all aspects of the operation."



PROZONE/ILLUSTRATION BY NICK ORABOVIC

Checking valves: **The system's check valves may be prone to blockage or leaks, which can lead to more serious problems within the ozonator as a whole. Keeping these valves intact and clear is a critical aspect of ozonator maintenance.**

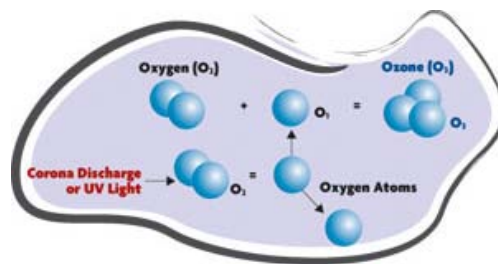


ILLUSTRATION BY NICK ORABOVIC

Breaking down: **Ozone is formed when oxygen molecules (O₂) are split into individual atoms (O), which then recombine into molecules of ozone (O₃).**