

ACE™ Salt Water Sanitizing System Frequently Asked Questions

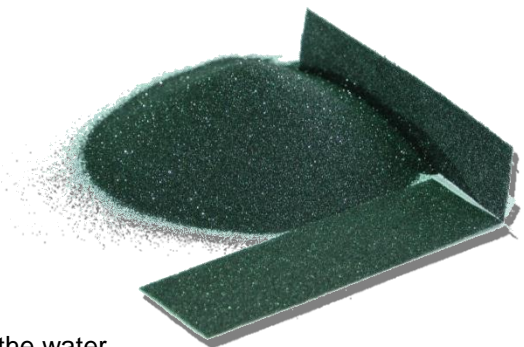


ACE System Technology

- The ACE salt water sanitizing system utilizes the same salt water technology that many pool owners have come to love. The salt water-based chlorinating technology has been on the market for over 30 years.
- The ACE system overcomes challenges that have prevented traditional salt systems from working in the hot tub environment through **the use of exclusive, patented, diamond technology**.
- Like pool salt water systems, the ACE system makes hot tub water care more hands-free.
 - Traditional chlorine water care requires hot tub owners to manually add chlorine daily.
 - Ozone systems used with silver ions, like the EverFresh® system and similar systems on the market, require hot tub owners to manually add MPS non-chlorine shock daily or after each use, and chlorine weekly.
 - All hot tub water care programs require the use of EPA approved sanitizers – chlorine, bromine, or biguanide.
 - **The ACE system generates chlorine automatically, eliminating the need for daily and/or weekly addition of sanitizer.**
- When using the ACE system **the water feels softer on the skin and is more enjoyable**.
 - Bottled chlorine products are stabilized with an acid that can build up in hot tub water over time, causing drying and irritation to the skin and eyes. The ACE system generates chlorine from salt and water, eliminating the unwanted side effects of bottled chlorine.
 - The addition of salt to water makes the **water feel silkier** on the skin, and the lower levels of hardness recommended for the ACE system means **water is actually softer**.
 - A side-by-side comparison is a great way to confirm the difference in water treated using the ACE system, and water that is treated with traditional chlorine water care.
- **Hot Spring Spas has been testing salt technology for over 12 years and the diamond technology specifically for over 4 years.**

The Diamond Electrode

- The patented diamond electrode is **formed completely of industrial diamond crystals**, as pictured here. It makes the ACE system work more effectively than any other salt water system.
- As energy is sent through the electrodes, the unique structure of the diamond crystals allows the ACE system to transfer significantly more energy into the water than other salt water systems – **four times more energy** than systems using titanium electrodes alone.



Diamond Electrodes

- The ACE system has the ability to transfer a higher level of energy into the water, which provides it with a number of advantages over other salt water systems, such as:
 - **The ability to maintain spa water using a very small amount of salt.**
 - **The ability to create Active Oxygen which breaks down contaminants completely.**
 - **The ability to generate ozone, hydrogen peroxide, and MPS, in addition to chlorine.**

Salt Levels

- The ACE system uses salt to create the chlorine sanitizer required by the EPA.
- **The ACE system requires very little salt.** It is estimated that humans can taste salt in water at approximately 3 - 4,000 ppm. The target salt level when using the ACE system is only 1,000 ppm. Take a look at how the salt level of water treated with the ACE system compares to the average salt level of other liquids.

Liquid	Average Salt Level
Sea water	35,000 ppm
Tears	6,000 ppm
Pool water with a salt system	3,000 - 5,000 ppm
Hot tub water with the ACE system	1,000 ppm
Tap water	500 ppm



The largest Hot Spring spas require **only 6 cups** of salt at start-up – less than a single 5 lb. bottle.

- The ACE system will continually generate chlorine from the salt initially added to the water. The hot tub owner only needs to add more salt when they drain and refill the hot tub, or after topping off the water significantly.

Active Oxygen

- **Active Oxygen is a term used to describe a powerful oxidizer (-OH) derived from water (H₂O), and is different from oxygen (O₂) derived Ozone (O₃).**
- Active Oxygen is created when energy transferred into the water breaks apart water molecules. Without the diamond electrode there is not enough energy to split apart water and create Active Oxygen – **no other salt water chlorine system can create this oxidizer.**
- This process, called advanced oxidation, **is used to treat water in a variety of other industries.** It's also used to purify ground water and waste water, as well as to treat water used in food manufacturing facilities and in breweries, to name just a few other applications.
- The benefit of Active Oxygen is that it **breaks down waste and contaminants completely** with oxygen, leaving behind carbon dioxide and water. It does not leave behind chloramines or other byproducts that can cause hot tub water to be irritating to the skin and eyes, or to cause a strong odor.
- The ACE system cleans hot tub water by first generating Active Oxygen. The Active Oxygen reacts with the added sodium chloride salt to create chlorine, an EPA approved sanitizer that removes any additional contaminants introduced into the water.



- **The Active Oxygen also pairs with other elements in the water to create a variety of oxidizers** commonly used to maintain hot tub water.
 - Active Oxygen ($\cdot\text{OH}$) combines with water (H_2O) resulting in **hydrogen peroxide** (H_2O_2)
 - Active Oxygen ($\cdot\text{OH}$) combines with oxygen (O_2) resulting in **ozone** (O_3)
 - Active Oxygen ($\cdot\text{OH}$) combines with pH down (NaHSO_4), which is typically added during the balancing process, resulting in **MPS** ($\text{HO}\cdot\text{SO}_4$) – a common non-chlorine shock

Vanishing Act™ Calcium Remover

- Adjusting the calcium hardness level of hot tub water is a normal part of the water balancing process.
- The Vanishing Act calcium remover is a revolutionary new product (patent-pending) that **physically removes calcium** from the water, making it easy to achieve reduced calcium hardness levels **that meet the latest guidelines**. (In some regions the Vanishing Act calcium remover may not be necessary.)
- The accumulation of scale caused by high levels of calcium hardness can be detrimental to hot tub components like the jet pumps and heater, as well as the electrodes within the ACE system. **All hot tub owners can benefit from the Vanishing Act calcium remover** which helps to protect hot tub components, and to make hot tub water feel softer.
- The Vanishing Act calcium remover is the best option to achieve the ACE system's recommended calcium hardness level (50ppm) for improved operation and minimized cell cleaning.
- Removing calcium from the water **reduces the need for additional chemicals**, like stain and scale, which only temporarily treat calcium in the water. This means there is one less bottle to pour, and also **helps to extend the life of the hot tub water**.
- The Vanishing Act calcium remover can be used at start-up or anytime the hardness level tests above the recommended range (25 – 75 ppm for ACE owners). It takes 3 – 24 hours to remove excess calcium from the water depending on the hot tub model. It is perfectly safe to use the hot tub while the Vanishing Act calcium remover is at work; **there is no need to wait**.
- If scale does accumulate on the ACE system electrodes, it can easily be removed by **soaking the ACE cell in a simple solution of pH down and spa water for 10 minutes**. An empty bottle with cell cleaning instructions on the label is included with the ACE kit for convenience. The cell should be cleaned this way once every three months as preventative maintenance.



Start-Up and Operation

- **The hot tub owner must balance their hot tub water at start-up** and after each drain and refill. It is important that the pH and alkalinity are in the OK range, and that any metals or hardness are addressed appropriately. **This is true for every water care program**, including the ACE system, traditional chlorine, bromine, ozone and silver ions, etc.
- In order to balance spa water and get started with the ACE system, a **hot tub owner will need pH up and pH down, test strips, and a small bottle of granular chlorine**. A Vanishing Act calcium remover and a bottle of salt are included with the system. Water composition can vary by region, so

in some cases the Clean Screen™ pre-filter may be needed to control metals, and also to address organic contaminants and tannins.

- When using the ACE system, the hot tub owner will need to add a small amount of salt to their hot tub water.



- **All hot tubs and all water care systems, including the ACE system, require shocking** with bottled granular chlorine at start-up to help address any contaminants in the initial fill water and the spa's plumbing. This step will enable the ACE system to generate a measurable level of chlorine in less time, and ensures that the water is safely sanitized and ready to soak in right away.

- **The spa's intuitive control panel makes it easy to enter use level and spa size information at start-up.** These settings take seconds to input, and tell the ACE system how much chlorine and oxidizers are needed.



- The ACE system begins to work as soon as the hot tub is powered. It may take up to 24 hours for the system to register an accurate salt level reading and to generate a measurable amount of chlorine. Hot tub owners with the ACE system can **start enjoying their hot tub as soon as the water is balanced and shocked.**



- **Every hot tub owner should test the water with a test strip weekly**, regardless of the water care program. ACE system owners should ensure that the pH level is in the OK range (pH increase is a natural result of the chlorine generation process), and confirm that the system is set at an appropriate use level. After about a month the pH and use levels should stabilize.

- For most ACE system owners, **testing the water becomes the only regular weekly maintenance requirement.** Easy-to-read system status messages on the Hot Spring control panel and the illuminated water care icon on the Limelight control panel **let the owner know the ACE system is working**, and provide a 30-day reminder to re-test the water to ensure it is balanced and make any adjustments if needed.

- If use patterns change because of the season, a vacation, or any other reason, the owner can simply adjust the use level setting accordingly, or turn the system off for extended periods of inactivity – just like a home thermostat. The system cannot independently measure the chlorine levels in the water, but the **use level can be adjusted quickly and easily** by the owner.

- For events when the hot tub is expected to be used more than normal, a **convenient Boost function** allows the owner to increase the chlorine level without having to adjust the everyday use level.

- The number of water changes needed per year varies by owner. Using the ACE system helps reduce the amount of bottle products that are added to the water and break down waste and contaminants completely. In doing so the system helps minimize the level of total dissolved solids in the water, **helping hot tub water to last longer**.
- The cell is designed to last for 14,000 hours of operation. **The ACE cell does not operate 24 hours a day**. The amount of time the cell is working each day is determined by the size of the spa and how often it's used, so the life of the cell will vary. **On average, the cell will last about 3 years**.
- Over time, the **cost of water care using the ACE system is comparable** to the cost of using a system that includes an ozone unit, silver ion cartridge, and MPS non-chlorine shock. The ownership experiences provided by these two water care options are very different, because the ACE system eliminates the need to manually dose the hot tub water with MPS with each use and granular chlorine weekly.

Compatibility

- The ACE salt water sanitizing system is compatible with August 2009-and-newer Hot Spring Spas, and August 2010-and-newer Limelight Hot Tubs.
- The ACE system is compatible with granular chlorine, bromine, and MPS non-chlorine shock. It is not compatible with biguanides.
- While ozone and the ACE system are compatible, **installing both an ozone system and the ACE system is not necessary, nor is it recommended**. In most cases, the ozone produced by an ozone system will oxidize the chlorine generated by the ACE system, making it difficult to maintain a chlorine level of 3 ppm. Only in rare cases, in which the hot tub is used so frequently that the ACE system cannot generate enough chlorine to keep up, should the ozone unit be added to augment the cleaning power of the ACE system.