

INTRODUCTION

Swimming pools endure a lot of contamination, especially during the summer months, when swimming is a popular activity. Bathers introduce contaminants like sweat, dirt, oils, and sunscreen into pool water, altering pool chemistry. Other contaminants come from the surrounding environment, such as leaves and insects.

Overall, contaminants fall into three categories: physical, chemical, and biological. Physical contaminants – those you can see – are filtered out by a mechanical system. Chemical contaminants, like the compounds found in sweat and sunscreen – are oxidized by chlorine. Chlorine is also used to destroy biological contaminants: microorganisms living in the pool, such as algae and disease-causing pathogens.

If contaminants are allowed to remain in the pool, then pool water quality suffers. Odor, discoloration, and algae growth may result. Moreover, when pathogens are allowed to survive, bathers may experience infections and irritation. To ensure that pool water stays safe and clean, it is important to maintain adequate chlorine levels and a high functioning filtration system.

MONITORING POOL CHEMISTRY

How do pool operators know if pool chlorine needs to be adjusted? A typical pool chemistry monitoring system uses two parameters: ORP and pH.

Pool Water ORP:

Chlorine sanitizes pool water by reacting with contaminants in oxidation reactions. These reactions produce combined chlorine or chloramines. Combined chlorine is not an effective sanitizer. Therefore, to understand if chlorine concentration is high enough, the critical parameter is free chlorine.

Free chlorine describes the chlorine that is available to sanitize pool water. It exists in two chemical forms: hypochlorous acid (HOCl) and hypochlorite ion (OCl⁻). Hypochlorous acid is the most effective form of free chlorine for removing contaminants.

Some pool operators use DPD test kits to measure chlorine concentration. However, DPD – a chemical that reacts with chlorine to produce a red color – cannot distinguish between free chlorine and combined chlorine. DPD also cannot distinguish between hypochlorous acid and hypochlorite ion.

The easiest way to accurately measure and adjust chlorine for thorough disinfection is by monitoring ORP. ORP (Oxidation Reduction Potential) readings are a measure of the sanitization activity of chlorine. The ORP value is highly sensitive to fluctuations in hypochlorous acid, because HOCl is the form of chlorine that is the most powerful oxidant.

Pool Water pH:

Maintaining proper pool water pH is essential for bather comfort, equipment maintenance, and chlorine functioning. The ideal pH for pool water is between 7.2 and 7.8. A pH value outside this range may cause issues, including:

- Bather discomfort due to skin and eye irritation (pH < 7.2 or 7.8 < pH)
- Decreased longevity of pipes and filters due to corrosion (pH < 7.2)
- Reduced sanitization activity of chlorine (7.8 < pH)

Chlorine Sanitization Activity:

The amount of chlorine needed to keep pool water clean depends on many different factors. When more swimmers are in the pool, the concentration must be higher to adjust for heavier contamination. Intense sunlight can reduce chlorine effectiveness, requiring higher concentrations for sanitation. The pH of pool water impacts chlorine activity by affecting the equilibrium concentration of hypochlorite ion and hypochlorous acid. When pool water pH is too high, hypochlorous acid concentration is reduced. Consequently, chlorine is less effective at oxidizing contaminants, because it is not present in its most active form. The equilibrium reaction below demonstrates this effect:



POOL CHEMISTRY SENSORS & INSTRUMENTATION

A complete pool water monitoring system typically includes a pH sensor, an ORP sensor, and a controller. The controller adjusts the amount of chlorine and other chemicals added to the pool based on inputs from the pH and ORP sensors. This type of set up, illustrated in more detail below, is ideal for automatic adjustments, as factors such as sunlight and bather load fluctuate monthly, daily, and even hourly.

INSTALLATION TIPS

Choosing the Right ORP Sensor:

For the most accurate ORP measurements, Sensorex recommends following industry standards for the type of ORP measuring surface.

- Probes with standard platinum tips are recommended for regular chlorine pools.
- Probes with gold tips are recommended for salt water chlorine pools.

Grounding:

Due to the large amount of plastic piping in typical pool systems, proper grounding is essential to prevent sensor inaccuracy and extend lifetime. Stray electrical current will be attracted to the sensor if the system is not properly grounded.

SPECIAL SENSOR REQUIREMENTS

Portable Measurements:

For pool technicians responsible for multiple sites, a portable monitoring solution is essential. The SAM-1 Smart Aqua Meter enables technicians to monitor pool pH and ORP with an iPhone, iPad, or Android while on the go. Switching between ORP and pH measurement modes takes only seconds. The SAM-1 automatically recognizes the sensor type plugged into the headphone jack and loads appropriate calibration data. Notes and GPS locations can be appended to data, allowing monitoring at several sites in a single day. Data is easily exportable in spreadsheet format and via email for data analysis and record keeping.

Direct Fit Replacements:

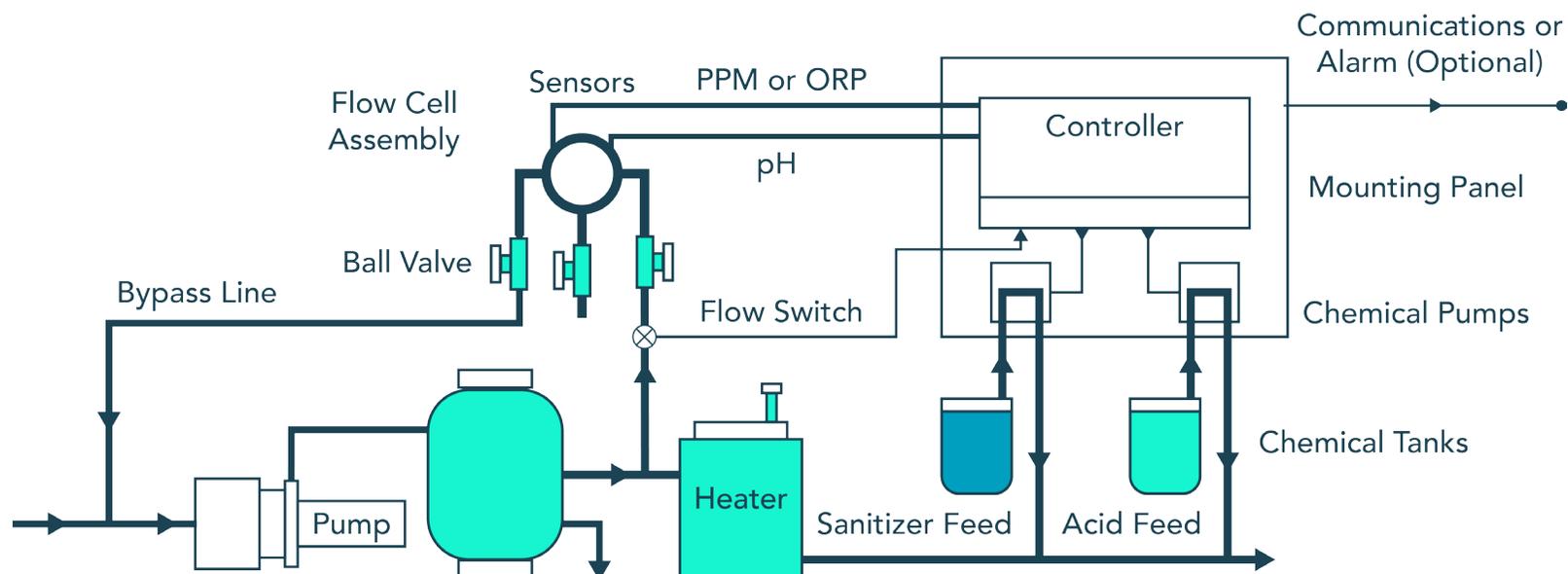
If your pool chemistry monitoring system has already been operating for some time, you may need replacement sensors. Sensorex offers a range of direct fit replacement sensors for pool and spa applications. To find the right sensor to retrofit your system, use our pool sensor manufacturer cross reference guide.

CONCLUSION

Monitoring pH and ORP is critical to maintaining safe, clean pool water chemistry. Key benefits include:

- Ensures bather comfort and water cleanliness
- Verifies sanitization activity of chlorine
- Reduces damage to pipes due to corrosion at low pH
- Automatically controls and adjusts chlorine and other chemicals

SWIMMING POOL MONITORING SYSTEM DIAGRAM:



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