Water Chemistry Guide

water test

The water chemistry information provided in this guide will help you keep your pool water crystal clear, safe for swimmers, and friendly to its plaster surface.

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the clear choice in pool care

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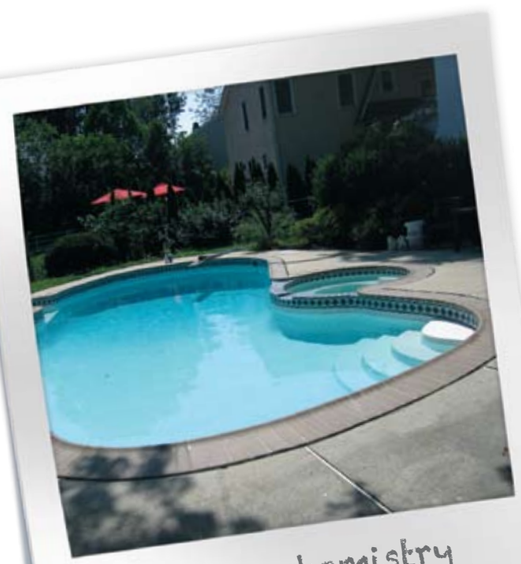
Introduction

The purpose of this brief Pool Water Chemistry Guide is to provide you with the basic information on water chemistry so that your pool water is not only crystal clear and but also safe to the swimmer as well as friendly to its surface: water chemistry has a serious bearing on the health condition of both.

Water chemistry includes 2 primary categories: balanced water and sanitized water. Balanced water relates to the chemical and mineral elements of the pool water. Sanitized water relates to the cleanliness and sanitary condition of the pool water. Detailed information on these matters and more are presented in the sections which follow.

Please be sure to first read the brief sections of "Water Chemistry Importance", "Nature of Water" and "Nature of Plaster" before proceeding to "Water Chemistry Basics" as it's important to understand the components of water chemistry including the nature of these elements. Also, additional information on water chemistry and plaster-care can be found at our web site: *www.aquathority.com.*



water chemistry

Water Chemistry Importance

Water chemistry incorporates "balanced" and "sanitized" pool water. And the primary reasons why balanced pool water and sanitized pool water are so important lies in the destructive effects if they are not. Unbalanced water will corrode, etch, scale and even stain pool equipment and surfaces. Unsanitary water could have ill-effects upon swimmers, water quality and pool surface.

The 5 key chemical elements which affect the sanitization and the balance of water are pH, total alkalinity, calcium hardness, cyanuric acid and sanitizer of choice. By consistently monitoring and adjusting these chemical elements you can keep your water balanced, your pool equipment and surface healthy, and your water clean.

There are many different types of sanitizers: chlorine, bromine and chlorine generators being the most common (NOTE: never combine sanitizers and always follow product label instructions). The common purpose of these various sanitizing chemicals is to disinfect and sanitize the pool water by preventing algae and destroying bacteria.

Chlorine, the most common sanitizer, is most effective at lower water temperatures (65 to 85 degrees) whereas bromine is most effective at elevated temperatures (85 to 104 degrees).

Nature of Water

Water has an appetite which is affected by its temperature among other variables. If water is fed the proper types and amounts of food (balancing products) it will become full and satisfied (stable). Conversely, if the water is deprived or starved, it will become hungry and aggressively destructive as it leeches its food from the plaster.

It's essential to understand that pool water which is unbalanced and unstable will destroy a pool's plaster finish whereas pool water which is balanced and stable will preserve a plaster's finish.

Nature of Plaster

Because plastered pools and spas are, and need to be, constantly submerged in water they are affected by the chemistry of the water more than any other factor or variable. This constant interactive relationship between the mineral content of the plaster surface and the mineral content of the pool water produces a reaction.

Over time, this reaction will have an impact on the condition and life of the plaster surface: in some cases these reactions cause minor cosmetic changes in the plaster, however, in many cases these reactions can have a more corrosive effect, even causing plaster to deteriorate.

balanced water

water appetite

plaster & water

Determining Pool Water Volume

When it comes to actually balancing your pool water by adding chemicals it's important to know your pool's volume of water. Here are a few simple formulas for determining your pool's number of gallons.

Average depth formula:

- shallow-end depth + deep-end depth divided-by 2 = average depth
- example: 3.5' + 8.5' = 12' 12'/2 = 6' average depth

Water volume for a rectangular or square pool:

- length x width x average depth x 7.5 = water volume in gallons
- example: 40 x 20 = 800 800 x 6 = 4,800 4,800 x 7.5 = 36,000 gallons

Water volume for a round or oval pool:

- length x width x average depth x 5.9 = water volume in gallons
- example: 40 x 20 = 800 800 x 6 = 4,800 4,800 x 5.9 = 28,320 gallons

Must-Have Chemicals

Make sure that you have the following testers and chemicals on-hand at all times:

Test kit (liquid reagents or strips which test for)

- alkalinity
- pH
- calcium hardness (or total hardness)
- sanitizer (chlorine, bromine, salt or sanitizer of choice)
- cyanuric acid

pH buffer

NOTE: total alkalinity level affects the stability of the pH level

- alkalinity rise (sodium bicarbonate)
- alkalinity lower (muriatic acid)

pH chemicals

NOTE: pH represents the acid or basic-content of water

- pH plus (sodium carbonate)
- pH minus (muriatic acid or sodium bicarbonate)

Calcium chemicals

NOTE: the calcium hardness level affects the plaster surface

- calcium increase (calcium chloride) or hardness increaser

Sanitizer chemicals

NOTE: sanitizer chemicals prevent algae and destroy bacteria, and also oxidizes dissolved matter

- chlorine (tablets or sticks), if your pool is set-up for chlorine
- bromine (tablets), if your pool is set-up for bromine
- salt, if your pool has a salt generator

Shock chemicals

NOTE: shock destroys algae and bacteria

- liquid chlorine

NOTE: granular chlorine shock products can cause plaster to discolor where the granular rests if not mixed according to label instructions

Diatomaceous earth (D.E.)

NOTE: for D.E. filters

- always replenish D.E filters with diatomaceous earth after backwashing

Algaecides

NOTE: helps to prevent and remove algae

- available by the quart

Clarifiers

NOTE: helps to keep water clear and discourages bacteria

- available by the quart

Stain and scale preventer

NOTE: helps to neutralize metallic impurities and prevent stain and scale

- available by the quart

Water Chemistry Basics

The first step in water chemistry is to be in the habit of testing your pool water at least 3 times a week and, on occasion, taking a sample of your pool water to an authorized pool dealer for an in-store test. The second step is to have on-hand a fresh test kit as well as the "Must-Have Chemicals" as itemized in the previous section.

NOTE: most test kits have a shelf-life of no longer than 12 months.

#1: Alkalinity level

Test and adjust total alkalinity

- total alkalinity is a measurement of dissolved minerals
- proper alkalinity level helps stabilize pH, so, get total alkalinity in-range prior to adjusting pH
- test alkalinity and adjust to 80 to 120 ppm (parts per million) for plaster and concrete pools
- test alkalinity and adjust to 125 to 150 ppm (parts per million) for vinyl liner and/or fiberglass pools

Low alkalinity will cause volatility with your pH level

- add alkalinity rise (sodium bicarbonate) to increase alkalinity

High alkalinity (rare) will cause your pH level to be rigidly fixed and may cause scale and cloudiness

- add muriatic acid or sodium bisulfate to decrease alkalinity, or drain and replace some of pool water

#2: pH level

Test and adjust pH

- pH represents the acid or basic-content of water
- test pH and adjust level to 7.2 to 7.6

Low pH means that your water is too acidic and will cause damage to plaster and especially equipment

- add pH plus (sodium carbonate) to increase pH level

High pH means that your water has too much alkalinity and needs to be lowered

- add muriatic acid (Hydrochloric acid) or pH decreaser (sodium bisulfate) to decrease pH level

NOTE: granular pH decreasers are not to be used on colored plaster other than white

#3: Calcium hardness (total hardness)

Test and adjust calcium hardness:

- once alkalinity and pH are in-range, calcium hardness needs to be adjusted
- the calcium hardness level affects the plaster surface

#3: Calcium hardness (total hardness) cont.

- test calcium hardness and adjust to 275 to 400 ppm (parts per million)

Water with low calcium levels will pull calcium from the plaster and cause etching and roughness

- add calcium chloride to increase calcium hardness

Water with high calcium (rare) may cause scale formation and cloudy water

- drain and replace some of the pool water to decrease calcium hardness

#4: Chlorine level

Test and adjust chlorine:

- chlorine sanitizes and disinfects water by preventing algae and destroying bacteria, it also oxidizes dissolved matter
- add chlorine (in tablet or liquid form) to a achieve an ideal level of 1.5 to 2.0 ppm (parts per million)

NOTE: granular chlorine shock products can cause plaster to discolor where the granular rests

#5: Cyanuric acid level

Test and adjust cyanuric acid:

- cyanuric acid, a chlorine stabilizer, should ideally be 50 ppm (parts per million)

Low cyanuric acid will cause the chlorine to be consumed by the sun's ultraviolet rays

- add cyanuric acid to increase cyanuric acid level; cyanuric acid to be added slowly only at the skimmer(s)

High cyanuric acid can bind the chlorine and render it ineffective

- drain and replace some of the pool water to decrease cyanuric acid level

#6: Shock (super-chlorination)

Swimmers bring elements – perspiration, deodorant, saliva, urine, mucous, suntan lotion, hair products, etc. – into the pool water which combine with chlorine to form "chloramines". These chloramines reduce the efficiency of the chlorine and, subsequently, can cause swimmer irritation.

Shocking a pool with liquid chlorine or granular shock will remove the chloramines and also destroy accumulation of algae and bacteria. Weekly shocking is universally recommended (depending upon usage).

#7: Algaecides

While there are many different types of algae they all are microscopic plants which are introduced to the pool by swimmers, rain and wind. Sunlight and nitrogenous materials stimulate their growth so that algae can take-over a pool quickly and, thereafter, be expensive and burdensome to treat, e.g. green algae, yellow (aka mustard) algae, pink algae, and black algae.

It's important to understand that algae and bacteria feed each other naturally. Algae takes-in carbon dioxide and gives-off oxygen, and bacteria takes-in oxygen and gives-off carbon dioxide. The key is to prevent it in the first-place by adding algaecides on a regular basis in addition to proper chlorination and weekly shocking.

#8: Clarifiers

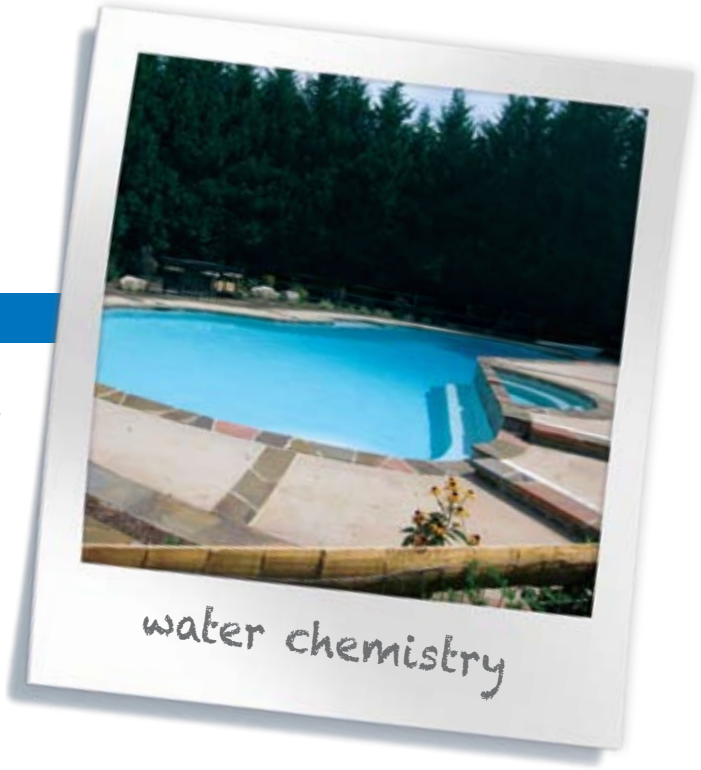
Water clarity has an impact on the appearance of the water, prevention of disease, and swimmer welfare. Because cloudy water can harbor bacteria and viruses which in-turn can cause human symptoms such as earaches, pinkeye, rashes, etc., cloudy or discolored water is a condition which makes swimming less desirable as well as unhealthy.

Water clarity is achieved through the filtration system which removes large particulate matter like dirt, skin flakes, algae spores, bacteria, fertilizers and other debris. However, the smaller particulate matter, such as oils and lotions, will pass-through the filter and return to the pool. Clarifiers essentially coagulate these oils, lotions and smaller particulate matter into a larger mass which the filter then effectively removes. Adding a clarifier on regular basis will help ensure clear and clean pool water.

#9: Stain and scale preventer

Surface stains are typically caused by metals in the pool water and other metallic impurities introduced to the pool by groundwater (via garden-hose), rainwater, toys, swimmers and the like. Iron, copper and manganese are the most common metals found in municipal water, well water and rainwater.

The other source for metallic impurities is corroded pool equipment such as heaters, ladders and pool lights. Low pH or total alkalinity can cause corrosion of these metal-based components and in-turn produce copper and iron metal particulates. Adding a stain and scale preventer on a regular basis will help prevent metallic stains as well as scale.



#10: Phosphate remover

Mostly a concern for chlorine generator pools (employing salt), high levels of phosphate can retard or stop the generator's production of chlorine. Phosphates can be introduced to the pool water via swimmer, dirt, fertilizers, hair products and, even, pool chemicals (containing tri-sodium phosphate or polyphosphates). Signs of high phosphate include cloudy water and lack of chlorine residual.

Measured in ppb (parts per billion), the ideal phosphate ppb range should be 200 to 500 ppb. For chlorine generator pools, monitoring the phosphate level on a regular basis is recommended as is adding a phosphate remover as needed.

Additional Informative Guides

Please reference these additional informative AquaThority guides at www.aquathority.com or request a hardcopy from our office.

- New Plaster Guide
- Pool Plaster Guide
- Pool Renovation Guide
- Pool Safety Guide

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