



A Guide To Swimming Pool Water Chemistry

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Maintaining your pool water in a safe balanced state can be a daunting prospect for most pool owners. The aim of this guide is to explain in basic terms how to achieve and maintain the correct water chemistry in your pool & explain the reasons why water chemistry is so important. Your pool water may be crystal clear, but that does not mean it is healthy.

Pool water chemistry can be broken down into two basic categories:

Water Sanitation

Pool water needs to be sanitised to ensure bather safety. Bacteria will rapidly multiply in pool water that remains untreated / unsanitised. The most widely used disinfectant (sanitiser) for domestic pools in the UK is currently Chlorine, we will discuss alternatives to chlorine during this guide. Your pool water should be maintained at the correct chlorine level at all times.

Water Balance

pH is the most important element in swimming pool water chemistry – It affects every other chemical balance in the pool water. pH is a scale for measuring the pools acidity or alkalinity level. Although the pH level is the most important element contributing to water balance there are other factors that also influence water balance, these will be covered later in this guide. We will also discuss the optimum levels and how to achieve and maintain them.

Chemicals normally used to treat swimming pool water:

- Sanitisers / disinfectants – To destroy harmful and objectionable organisms.
- Soda Ash (sodium carbonate) / pH Plus – Used to increase the pH level.
- Sodium bisulphate / pH Minus – Used to decrease the pH level.
- Chlorine Stabiliser – To prevent unnecessary loss of chlorine.
- Algaecide – To kill and prevent the growth of algae.
- Filter Aids / Flocculants / Clarifiers – To help remove foreign debris / material.

pH

The pH level indicates the relative acidity or alkalinity of your pool water. pH is measured on a scale from 0 (strong acid) to 14 (strong alkaline) and pH neutral is 7. In pools a slightly alkaline level between 7.2 & 7.6 is ideal because this range is the most comfortable to the human eye, provides optimum use of free chlorine and provides water that is not corrosive or scale forming.

If pH falls too low (below 7):

- Water becomes acidic.
- Eye & skin irritation occurs.
- Corrosion - Heater element may corrode (unless you have Titanium heating elements) the pump impellor & other metal fittings on the pool will corrode.
- Dissolved metals may leave stains on the walls.
- Rapid loss of alkalinity.
- Wrinkling of liner.

If pH is too high (above 8):

- Chlorine activity is slowed and inefficient.
- Scale formation and discolouration of pool walls.
- Water becomes cloudy.
- Filter is overworked & may become choked.
- Eye & skin irritation may occur.

Before we look at testing & maintaining the correct pH level we will look at two other factors that have a big influence on the pH level & the overall water balance.

Total Alkalinity (TA)

Total Alkalinity is a measure of water's resistance to change in pH – TA is the amount of alkali (not to be confused with alkaline) in the form of bicarbonates, carbonates and hydroxides present in the pool water. TA affects and controls the pH.

The ideal level for TA is between 80 and 140 parts per million (ppm)

If the TA is too high:

- The pH will be difficult to adjust.
- A High pH level often occurs.
- This causes cloudy water, decreased disinfectant effectiveness, scale formation & filter problems.

If the TA is too low:

- The pH will be unstable and difficult to maintain.
- pH changes rapidly when chemicals or impurities enter the water.
- pH may drop rapidly causing etching & corrosion.

How Does TA Affect the pH Level?

In basic terms TA acts like a buffer for your pH level. If you picture a playground seesaw as the pH indicator, and you place 2 people of the same weight on either end - the seesaw balances which relates to pH neutral. The people are representing the TA and if one of these people were to get off of the seesaw this would cause a massive change in the pH level one way or the other. Now picture the same seesaw with 10 equally weighted people on either side, the pH is again balanced but now if one person were to get off of the seesaw the balance would not change as drastically due to the 9 remaining people acting as a counterbalance.

There are a number of products available such as T.A Plus that you can use to increase the pools Total Alkalinity - check the instructions for dosing details.

Water Hardness / Calcium Hardness

Water hardness depends on the amount of dissolved calcium in the pool water. High levels will give rise to scale formation whilst low levels cause corrosion to pool surfaces & equipment.

The water hardness should be maintained at a minimum level of 200ppm. Water hardness can be increased by using a water hardness increaser such as Hardness Plus. Unfortunately the only way to reduce water hardness is to dilute the existing pool water.

Testing Your Pool Water

To ensure that your pool water is a safe and clean environment you will need to spend a short time testing the water chemistry & if required, adding the appropriate water treatment products.

There are several types of testers available:

- Test Strips – (Litmus paper) are the simplest and quickest means of testing your pool water for chlorine & pH.
- Liquid Reagent – Care needs to be taken with this type of test kit to ensure the correct amount of reagent is added.
- Test Tablet – These kits are probably the best means of testing your pool water; they offer simple, accurate analysis at an affordable price.

You should check your pool water daily for both sanitiser and pH. Total alkalinity should be tested on a weekly basis & the water hardness should be tested on a monthly basis.

Your local pool shop will be able to offer this testing service if you do not have the appropriate test kit.

Calculate The Volume Of Water In Your Pool

Now that you have your test results it is necessary to calculate the volume of your pool to determine the quantity of water treatment products your pool needs. It is better to calculate the pool volume in litres rather than gallons, as it is easier to calculate the quantity of product required in metric rather than imperial.

TIP – If you know your pools volume in gallons multiply the amount of gallons by 4.5 to give you an estimate of the volume in litres. I.e. 1,000-gallons is approximately 4,500-litres. 1,000-litres is the metric equivalent of 220-gallons.

If you are unsure consult the manual supplied with the swimming pool.

With the Total Alkalinity & Water hardness now at the correct level you should now test & maintain your pH level.

All dosage rates are per 1000-litres of pool water.

If your pH is too low (below 7.4):

- Use pH Plus (soda ash) 10g per day (per 1000-litres) until the pH has increased to 7.4

If your pH is too high (Above 7.6):

- Use pH Minus (dry acid) 10g per day (per 1000-litres) until the pH has decreased to 7.6

Now that the water balance is correct we now need to look at sanitising the pool water.

Why Do I Need To Sanitise My Pool?

Sanitisation is necessary to disinfect the pool water to prevent the spread of disease organisms from person to person & prevent unwanted growth of bacteria & algae in the pool. Your pool is constantly being polluted by the environment; dirt, leaves, pollen, human perspiration & cosmetics etc are introduced daily.

Which Sanitiser Should I Use For My Pool?

If you look around a pool shop you will see 5 or 6 different types of chemical sanitiser for your pool, there are also some natural non-chemical based sanitisers available – all of which we will cover in this guide. All of the sanitising methods have their good points and all of the chemical treatments also have their drawbacks.

Chlorine

The most commonly used disinfectant currently used for swimming pools in the UK is chlorine. In its element form chlorine is a heavy greenish yellow gas that is so toxic it has been used as a weapon in chemical warfare. Because of the extremely high potential for injury or death from improper use of chlorine gas, a number of chlorine compounds have been formulated to provide chlorine in forms that can be handled and used safely by swimming pool operators. Chlorine is “used” and measured in two ways:

Free Chlorine Residual

Is the amount of chlorine in the pool that has not reacted with foreign substances other than water. It is the chlorine that is still available to disinfect pool water and oxidise organic substances.

Free chlorine residual should be maintained between 1ppm and 3ppm. (2ppm is optimum)

Combined Chlorine

Is basically “used” chlorine, that has reacted with foreign substances other than water and is no longer available in its free state (i.e. to disinfect the water) Chlorine combined with ammonia produces chloramines which cause eye irritation and an objectionable chlorine odour. For this reason combined chlorine residual should be kept to a minimum, preferably below 0.2ppm. A common misconception when chlorine can be smelt around a pool is that there is too much chlorine in the pool; it is in fact that there is too much

“used” chlorine in the pool and in fact more chlorine needs to be added to increase the free chlorine level.

Chloramines can be totally eliminated by using a UV treatment – this will be discussed in detail later in this guide.

The only way to remove chloramines without a UV treatment is to shock treat the pool, this is discussed later in this guide.

Total Chlorine Residual

Is the concentration of free chlorine & combined chlorine. To determine the combined chlorine level you need to test for free chlorine & total chlorine.

$$\text{Combined Chlorine} = \text{Total chlorine} - \text{Free Chlorine}$$

Shock Treatment / Super chlorination

Regular use of the pool will increase the organic matter in the pool water that in turn will lower the efficiency of the sanitiser being used. A shock treatment will burn these organic materials out of the water and therefore allow the sanitiser to do its job properly. It may also become necessary to shock treat a pool if the water turns green due to an algae bloom (this is discussed in detail later in this guide).

When you shock treat a pool you are looking to increase the level of sanitising / oxidising chemical by a minimum of 3 times the normal amount. For information on the best way to shock treat your pool consult your local pool shop

Caution!

Never mix any swimming pool water treatment products together. Each product **must** be added to the water separately. Always add granules to water, **never** add water to granules.

Salt-water Chlorination

Has been used for many years in Europe, Australia and South Africa as it removes the need to add chlorine to a pool. Salt-water chlorination works by having an electrolytic cell break down the salt (Sodium Chloride) dissolved in the water in order to produce chlorine that acts as the sanitiser. Although you will still need to test the chlorine & pH levels the chlorine level will be monitored by the chlorinator and constantly increased or decreased as necessary. The solution produced by the chlorinator does not lose its disinfection force as it can be generated as required and directly dosed into the swimming pool water. Some chlorinators are also available with pH regulators included removing the need to manually adjust the pH level.

Advantages:

- Eliminates irritated & sore eyes and skin.
- Doesn't bleach hair or bathing suits.
- Puts an end to the “traditional” chlorine taste & smell whilst bathing.
- Set & Forget – Just activate the system and set the desired chlorine level.
- Salt in its natural form is a solid and therefore will not leave the pool via evaporation, chlorines natural state is a gas and does leave the pool with evaporation.
- The salt iodine also helps sun tanning.

Algae Control

Algae are microscopic single celled plant life that multiply very quickly. Algae will bloom & grow in swimming pools if nutrients are present and the free chlorine level is too low. Below are descriptions of the three most common algae problems in swimming pools:

- Green Algae – The most common algae in pools, floats in the water and coats pool surfaces. Left unchecked green algae will very quickly turn the pool water pea green.
- Mustard Algae – Settles on the pool walls and causes a slimy yellow film.
- Black algae – Appears in “buds” or clumps attached to steps & other pool surfaces.

Chemical Solutions:

- Green Algae - is very susceptible to chemical treatment. Shock treat the pool with chlorine & keep the filter running, brush the pool walls and floor. Periodically check the chlorine level and maintain above 3ppm until the algae clears. Once cleared you can prevent the future build up by using an appropriate algaecide.
- Mustard Algae – Is much more resistant to chemical treatment and clings more tightly to pool walls than green algae. Shock treat the pool and then thoroughly brush & vacuum the pool. Again when cleared a suitable algaecide can be used to prevent future outbreaks.
- Black Algae – Is very difficult to remove. It can be controlled to some extent by frequent shock treatment and thorough brushing & vacuuming. Black algae can usually be controlled with the use of strong algaecides and maintenance of relatively high free chlorine levels, but complete removal may require draining and cleaning the pool.

Is There An Easier Way To Kill Algae?

Yes – Ultra Violet (UV) Treatment

UV destroys the waterborne organisms including green, single celled algae and bacteria that make the pool water appear murky and unattractive. It will ensure clear pool water even in the absence of chlorine.

Short wave ultraviolet light has a photo oxidisation effect that destroys chloramines & other toxic by-products of chlorine, without adding additional chemical products. Fitting a UV treatment to your pool will also kill all algae instantly when it is passed though the UV treatment plant but will not prevent algae and slime growth on the sides and surfaces of the pool.

Advantages:

- A more pleasant bathing environment with fewer chemicals present.
- Dramatically reduced chemical dosing by up to 78%, and therefore reduced chemical costs.
- Instantaneous disinfection with every pass though the UV.
- Removes all Chloramines (“used” chlorine)
- Less wastewater disposal.
- Less backwashing of filters that can become time-consuming.

- Offers a second disinfection process that gives increased control on the microorganisms difficult to control with chlorine.
- Can be retrofitted to any pool.
- Very simple to operate & install.
- No disinfection by-products created by the UV.
- No danger of over dosing.
- Does not affect the pH level in any way.
- Low initial purchase cost & low running costs.

Filter Aids & Total Dissolved Solids (TDS)

After a pool has been in use for a full season dissolved solids may begin to accumulate. These non-filterable solids include body wastes, suntan lotion, stabiliser, dirt, pollen etc, all of which are too small for your filter to remove by itself. Adding a UV treatment system will reduce the TDS in the pool every time the water is passed through the UV treatment plant. However if you do not currently have a UV system installed then you can use Filter Aids (also known as flocculants or clarifiers). When added to water the filter aids basically "stick" the small non-filterable particles together to increase their size so that they are then large enough to be removed by the filter.