AquaChek® Select®

FAST • EASY • ACCURATE®

The Complete Guide to Pool and Spa Care

15-Second Test!

- 24-page Care and Treatment Guide
- Easy-to-use Pool and Spa Test Strips
- Test Log for recording your results
- Refill available

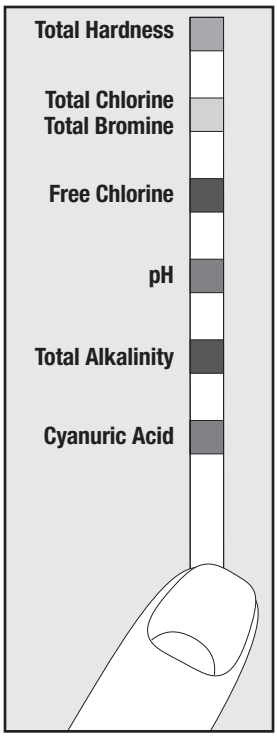
I'll tell you about...

Hello, I'm Dr. H.Tueau, world famous poolologist, and AquaChek® spokesperson. Allow me to commend you for choosing the fast and reliable way to test your pool or spa–AquaChek Select® Test Strips. AquaChek Select is the premiere test kit; one strip performs seven important tests. In just a few seconds you'll know your water's total hardness, total chlorine (or total bromine), free chlorine, pH, total alkalinity and cyanuric acid levels.

Allow me to guide you through testing your pool with an AquaChek Select Test Strip, and then using the results for treating your pool.

Testing is easy with AquaChek! You already know it is important to test your pool or spa often to keep the water fresh and sparkling clean. Test your pool a minimum of twice a week if the pool is not being used. As the swimmer load increases, you should test more often to be sure the water is balanced and proper sanitizer levels are being maintained. Always test your spa before and after each use since imbalances can rapidly occur. For example, two people in a 400-gallon (1.5 kL) spa will use 1 ppm (part per million, which is the same as mg/L) of free chlorine in the first 15 minutes of use!

If you detect any imbalances after testing, this booklet has treatment recommendation charts to help you correct the problem. All of the chemicals listed are described by their common names. These chemicals are available at your local retailer who carries pool and spa products. Although normally packaged under a brand name, the common chemical name will also be listed on the label usually as the "active ingredient." **See the "Warnings for Handling Chemicals" section in this booklet before treating your pool or spa.** Also, you may wish to consult your local pool and spa professional for treatment suggestions.



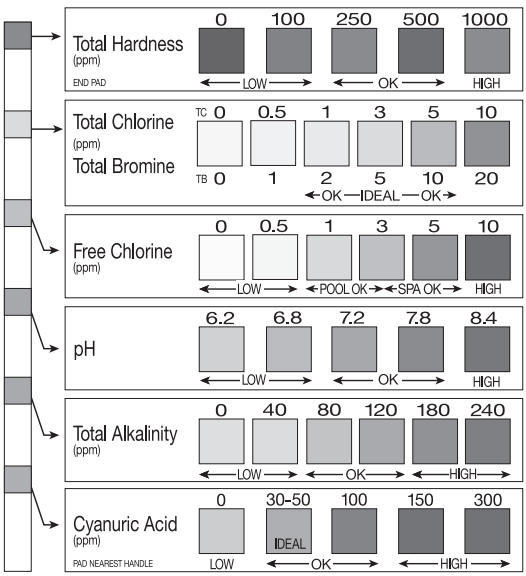
Let's take a close look at an AquaChek Select test strip.

AquaChek Select is a test that checks total hardness, total chlorine (or total bromine), free chlorine, pH, total alkalinity and cyanuric acid. There are six pads on each test strip. Each pad checks a different condition of the water. The test pads work by changing color to indicate the conditions of the pool or spa water.

Note: Remember to dry your hands before removing test strips from the bottle. Also, close the lid on your AquaChek bottle securely after removing a strip. This will help to keep them fresh. Store the strips in a cool dry place, and leave the packet of drying agent in the bottle — it will help keep the test strips at their best.

Now let's examine the color comparator.

AquaChek Select has a reusable plastic color comparator. There are six rows of color blocks on the comparator, which correspond to the six test pads on the AquaChek Select test strips. It's easy ... after you've dipped a test strip, compare the color pads to the color chart on the comparator!



The color comparator is reusable, and should last several seasons. Once you've used all the test strips, you need only buy an AquaChek Select Refill Kit. The Refill Kit comes complete with a bottle of 50 AquaChek Test Strips, and a fresh color chart insert for the reusable plastic color comparator.

How to Calculate Total Volume of Your Pool

To use the treatment charts in this booklet, you will need to know the volume of your pool. This can be easily calculated. Follow the formulas below, or log onto www.AquaChek.com and use our online calculator.

Let's use my pool as an example throughout this booklet; it is 27 feet (8.23 m) long, 15 feet (4.6 m) wide, 8 feet (2.4 m) deep at the deep end and 2 feet (0.6 m) deep at the shallow end.

First calculate the average depth by adding the deep end and shallow end depth measurements and dividing the result by 2.

The average depth of my pool is 5 feet (1.5 m):
8 feet + 2 feet = 10 feet; 10 feet ÷ 2 = 5 feet
(2.4 m + 0.6 m = 3.0 m); 3.0 m ÷ 2 = 1.5 m.

If your pool is rectangular or square, calculate the total water volume in gallons by multiplying the length times the width times the average depth in feet times 7.5. For metric volume, multiply length times width times average depth.

My pool has a total volume of 15,188 gallons (56.8 kL):
27 feet x 15 feet x 5 feet x 7.5 = 15,188 gallons
(8.23 m x 4.6 m x 1.5 m = 56.8 kL).

Round your calculation to the nearest 1,000 gallons or nearest kL to use the treatment charts in this booklet.

For example, my 15,188 gallon (56.8 kL) calculation rounds to 15,000 gallons (57 kL).

If your pool is round or oval, multiply the diameter (one direction) times diameter (other direction) times average depth and then multiply by 5.9 to give the water volume in gallons or multiply by 0.785 for metric volume.

If a round pool measures 20 feet (6.0 m) in one direction and 20 feet (6.0 m) in the other direction and has an average depth of 5 feet (1.5 m), calculate the volume as follows:
20 x 20 x 5 x 5.9 = 11,800 gallons
(6.0 x 6.0 x 1.5 x 0.785 = 42.66 kL).

Round your calculation to the nearest 1,000 gallons or kL:
11,800 (42.66 kL) rounds to 12,000 gallons (43 kL).

Basic Pool and Spa Water Chemistry

Total Hardness

Total hardness refers to the amount of calcium and magnesium in your pool or spa water. When total hardness is too high, scale can form causing pool filters or plumbing to clog and water to appear cloudy. If water is too soft (too low in total hardness), it will slowly dissolve plaster walls and corrode metal fixtures. Swimming pools and spas should have a total hardness range of 250 to 500 ppm (mg/L).

Chlorine

The purpose of a pool or spa disinfectant is to sanitize (kill all living organisms), disinfect (kill all disease-causing organisms), and oxidize (destroy ammonia, nitrogen-containing contaminants and swimmer waste). A disinfectant must be continually active in the water so that it may react instantaneously with bacteria, algae and other organic matter as they are introduced into the water. Providing this measurable "sanitizer residual" to the water is a very important job of any disinfectant. Without it, all protection for the swimmers is lost.

The most popular type of disinfectant is chlorine. The amount of chlorine that your pool or spa requires to eliminate contaminating materials from the water is called chlorine demand. The chlorine that is active and able to sanitize and oxidize contaminants in the water is referred to as free chlorine residual. Chlorine that has already used up its ability to sanitize by reacting with contaminants is called combined chlorine. Total chlorine is the sum of both free chlorine residual and combined chlorine. Periodically, you will need to add more chlorine to your pool or spa to maintain an optimum level to sanitize/oxidize new contaminants. The free chlorine residual in your pool should be between 1 and 3 ppm (mg/L), and between 3 and 5 ppm for spas.

When the free chlorine residual has used up its sanitizing ability, it becomes combined chlorine. An over-abundance of combined chlorine causes eye irritation and strong, sometimes offensive, chlorine odors. Most people think that there is too much chlorine in the water when they smell this strong odor. However, just the opposite is true — all the free chlorine has combined with swimmer waste and has created those foul-smelling combined chlorine products.

If your total chlorine test strip reading is higher than your free chlorine test strip reading, you need to superchlorinate or shock treat your pool. Superchlorination or shock treatments are required more frequently when pool water temperatures

are high or heavy swimmer loads occur. Superchlorinating, or shock treating, your pool means adding enough chlorine to raise the free chlorine residual to 10 ppm for at least 4 hours. Alternatively, shock treating can be carried out with potassium monopersulfate (non-chlorine shock treatments). **Non-chlorine shock treatments will consume the organic contaminants, but will not sanitize.** Consult your pool dealer if potassium monopersulfate is to be used.

Total Bromine

Bromine is another popular type of disinfectant, primarily used in spas. Bromine is more effective in high temperatures and higher pH ranges associated with spas. Additionally, combined bromine does not produce the offensive odor that combined chlorine does. However, bromine is not ideal for outdoor pools and spas because bromine is not stable in sunlight (UV). Bromine is very quickly degraded by strong sunlight until no disinfectant remains, creating an unsafe swimming environment. Therefore, bromine is only used in indoor pools and hot tubs (or in hot tubs that remain covered when not in use).

Unlike chlorine, the combined form of bromine is still an effective sanitizer. Whereas combined chlorine is chlorine that has used up its sanitizing ability, combined bromine is still capable of sanitizing and disinfecting. Therefore, **Total Bromine** is measured to indicate the sanitizer residual. An appropriate level of bromine in the water will help to ensure the water remains clean and clear. You should maintain the bromine level In the range of 3 to 5 ppm for swimming pools and 4 to 6 ppm for spas.

Total Alkalinity and pH

Total alkalinity measures the amount of alkaline substances (primarily, bicarbonates and carbonates) in your water. Alkaline substances buffer your water against sudden changes in pH. It is important to prevent pH changes that can cause scaling or corrosion of metal fixtures. The total alkalinity is in the right range at 100 to 120 ppm (parts per million) if sodium dichlor, trichlor or bromine is being used as the sanitizer. Total alkalinity levels of 80 to 100 ppm are considered to be in the right range if calcium, sodium, or lithium hypochlorite is being used as a sanitizer.

pH refers to the intensity of acid or alkaline materials in your water. pH intensity is measured on the pH scale, a numerical scale extending from 1 (extremely acidic) to 14 (extremely basic). A pH of 7.0 is considered neutral. The right pH range for pool and spa water is 7.2 to 7.8, with an ideal range of 7.4 to 7.6. pH levels greater than 7.8 can cause swimmer discomfort (skin and eyes), produce

scale on the pool and equipment, and reduce the sanitizing action of chlorine. pH levels less than 7.2 can also cause swimmer discomfort and cause corrosion of pool fixtures and equipment.

Cyanuric Acid

Cyanuric acid, also called “stabilizer” or “conditioner,” makes chlorine more stable when exposed to the sun’s ultraviolet rays. It is like sunblock for your sanitizer, preventing it from degrading as quickly as it would otherwise. Without cyanuric acid, your chlorine level can drop from the ideal range to zero in less than two hours. On the other hand, if cyanuric acid is too high, it can cause a high level of total dissolved solids (TDS), and cause chlorine to be inefficient.

Two types of chlorine compounds, dichlor and trichlor, already contain some cyanuric acid. The level of cyanuric acid will build up with the continued use of either of these sanitizers. If using any other form of chlorine, you will need to add cyanuric acid separately in order to stabilize the chlorine. The acceptable level of cyanuric acid is 30 to 150 ppm (except where 100 ppm maximum is regulated by the health department), with an ideal level of 30 to 50 ppm (mg/L).

Follow These Easy, Single Dip Instructions:

Remove an AquaChek test strip from the bottle, and replace the cap. Dip the test strip into your pool or spa and remove immediately.

Hold the strip level, pad side up, for 15 seconds. Do not shake the excess water from the test strip. Immediately make color comparisons, as follows:

Total Hardness *(end pad)*

Total Chlorine (or Total Bromine)

Free Chlorine

pH

Total Alkalinity

Cyanuric Acid *(pad nearest handle)*

Estimate the result if color on test pad falls between two color blocks.

Note: **For best results on the cyanuric acid test, pH should be between 7.0 - 8.4, and total alkalinity should be at or below 240 ppm.**

Test Log Results

Write down the results of the tests in the Test Log at the end of this booklet. Now consult the Treatment Recommendation Charts on the following pages to determine how to obtain proper pool or spa water balance.

Analyzing Test Results and Adjusting Pool Water

In the preceding section we discussed testing water. But testing the water is only half the job. Knowing what to do with the results is the other half. This section will tell you how to interpret test results and how to achieve water balance.

Maintaining pool and spa water quality is like walking a tightrope. It is a balancing act that is affected by several factors, all working together to produce a positive result — a safe, healthful aquatic environment.

Water Balance

As water falls from the sky in the form of rain, it runs over the earth's surface, forming lakes, rivers, streams, ponds, creeks and reservoirs.

All along the way, the water dissolves tiny amounts of whatever it comes in contact with. Because a large portion of the earth's surface is limestone, the water picks up calcium on its way to our homes. In those areas where there is not much limestone, the water picks up very little calcium and other minerals.

When it eventually is used to fill a pool or spa, the water may possess one of three major characteristics:

- It may be under-saturated: such water may also be described as hungry, aggressive or corrosive.
- It may be saturated: such water may also be described as being at equilibrium, balanced, or neutral.
- It may be over-saturated: such water may also be described as scale-forming.

If the water is under-saturated (corrosive), it may cause etching and pitting of concrete and plaster lined pools and may also lead to staining, skin and eye irritation, and vinyl liner wrinkling.

If the water is saturated (neutral), it has satisfied its craving for minerals on its way to the pool and will not have any effect on the pool or equipment.

If the water is over-saturated (scale-forming), it will deposit its excess mineral content on the pool and equipment in the form of scale.

Of all the minerals found in and around a concrete pool, calcium is the most abundant and the one most likely to be dissolved by corrosive water. At the same time, calcium is the most likely mineral to be deposited onto the pool and equipment in the form of scale from over-saturated water.

Wouldn't it be nice if there were a way to determine if the water in a pool or spa is corrosive, neutral or scale-forming?

Back in 1936, a man named Wilfred F. Langelier devised an index for predicting that very thing.

Through experimentation, Langelier discovered that five factors influence calcium-carbonate precipitation. They are pH, temperature, alkalinity, calcium hardness and total dissolved solids (TDS).

He assigned a value to each of these factors and then developed a handy little formula that could be used to determine the scale-forming properties of the water. Even though he set out only to find a way to predict whether water would form scale, he also found that his method could predict the water's ability to corrode. Other predictive indices have also been developed.

A detailed discussion of Langelier's approach and other similar indices is beyond the scope of this booklet. Some of the test procedures required for Langelier's calculations are best performed by a pool professional. A homeowner can usually keep his pool in adequate balance by using the simpler approach described below. For extreme cases, where the pool is far out of balance, a visit to your local pool professional, or by your service person may be required.

Water Adjustments

In establishing its standards for public and residential pools and spas, The International Aquatic Foundation (IAF) and National Spa & Pool Institute (NSPI) have developed a set of guidelines for chemical maintenance of water quality. These "Chemical Operation Parameters" were designed specifically for the pool

and spa industry as a method for maintaining water quality without relying on any of the established indices, such as Langelier's.

It is interesting to note that if you follow the NSPI chemical guidelines and calculate the values using one of the established indices, you will discover that the water will be in balance according to the calculated index value.

We have reprinted the IAF/NSPI chemical standards for your reference.

IAF/NSPI Standards For Swimming Pools

(1999 Operational Parameters)

	Minimum	Ideal	Maximum
Free Chlorine, ppm	1.0	1.0 - 3.0	3.0
Combined Chlorine, ppm	None	None	0.2
pH	7.2	7.4 - 7.6	7.8
Total Alkalinity, ppm	60	80 - 100* 100 - 120**	180
TDS, ppm	300	1000 - 2000	3000
Calcium Hardness, ppm	150	200 - 400	500 - 1000+
Cyanuric Acid, ppm	10	30 - 50	150†

*(for Liquid Chlorine, Calcium Hypochlorite and Lithium Hypochlorite)

**(Dichlor and Trichlor Compounds)

†(except where limited by Health Dept. requirements often to 100 ppm)

Adjusting the Water

The only real way to make a water adjustment is to first make a test which tells you what the water is like. Then compare it to your set of guidelines, and then you will know what needs to be adjusted and by how much.

It should be clear from the charts used here and with the discussion about the Langelier Index that several different things can be changed to bring water into balance.

Total Dissolved Solids (TDS) can be changed easily by draining water and refilling, but altering TDS probably has the smallest impact of any of the five major water-balancing factors.

Temperature has a fairly large impact, but pools are kept in a fairly constant temperature range.

Calcium hardness can have a large influence on water balance, but it is the most difficult to change if it needs to be lowered or if the source water is high in calcium.

So three of the five items in the Langelier Index can be regarded as fixed. The only parameters you usually get to change regularly are pH and alkalinity — they have a large impact on water balance, and they are easy to change. Therefore, they are the most common adjustments made.

Before you attempt to balance pool or spa water, you need to establish a minimum level of calcium hardness. Although experts vary on the specific amount, it is generally agreed that the minimum amount of calcium hardness ought to be between 150 and 175 ppm. If your source water is low in calcium, the level can be increased by adding calcium chloride ($CaCl_2$). As a rule of thumb, 1 pound (454 g) calcium chloride added to 10,000 gallons (38 kL) of water will increase calcium hardness by 8 ppm (parts per million).

We have included a chart to help you determine how much calcium chloride must be added to pools of various sizes to attain a desired increase in hardness. For example, to raise the hardness 20 ppm in a 15,000-gallon (57 kL) pool, look down the left column to 20 ppm, then across that row to 15,000. You will need to add 3 ¾ pounds (1.7 kg) of calcium chloride.

Raising Hardness With Calcium Chloride

See warnings for handling chemicals on page 22

Increase In Hardness in ppm	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
10	2 oz. / 56.7 g	10 oz. / 283 g	1 1/4 lbs. / 568 g	1 3/4 lbs. / 795 g	2 1/2 lbs. / 1.1 kg	3 1/4 lbs. / 1.5 kg	6 1/4 lbs. / 2.8 kg
20	4 oz. / 113 g	1 1/4 lbs. / 568 g	2 1/2 lbs. / 1.1 kg	3 3/4 lbs. / 1.7 kg	5 lbs. / 2.3 kg	6 1/4 lbs. / 2.8 kg	12 1/2 lbs. / 5.7 kg
30	6 oz. / 170 g	1 3/4 lbs. / 796 g	3 3/4 lbs. / 1.7 kg	5 1/2 lbs. / 2.5 kg	7 1/2 lbs. / 3.4 kg	9 1/2 lbs. / 4.3 kg	18 3/4 lbs. / 8.5 kg
40	8 oz. / 223 g	2 1/2 lbs. / 1.1 kg	5 lbs. / 2.3 kg	7 1/2 lbs. / 3.4 kg	10 lbs. / 4.5 kg	12 1/2 lbs. / 5.7 kg	25 lbs. / 11.4 kg
50	10 oz. / 283 g	3 lbs. / 1.4 kg	6 1/4 lbs. / 2.8 kg	9 1/2 lbs. / 4.3 kg	12 1/2 lbs. / 5.7 kg	15 3/4 lbs. / 7.2 kg	31 1/4 lbs. / 14 kg
60	12 oz. / 340 g	3 3/4 lbs. / 1.7 kg	7 1/2 lbs. / 3.4 kg	11 1/4 lbs. / 5 kg	15 lbs. / 6.8 kg	18 3/4 lbs. / 8.5 kg	37 1/2 lbs. / 17 kg
70	14 oz. / 397 g	4 1/4 lbs. / 1.9 kg	8 3/4 lbs. / 4 kg	13 lbs. / 6 kg	17 1/2 lbs. / 8 kg	22 lbs. / 10 kg	43 3/4 lbs. / 20 kg
80	1 lb. / 454 g	5 lbs. / 2.3 kg	10 lbs. / 4.5 kg	15 lbs. / 6.8 kg	20 lbs. / 9 kg	25 lbs. / 11.4 kg	50 lbs. / 23 kg
90	1 lb. / 454 g	5 1/2 lbs. / 2.5 kg	11 1/4 lbs. / 5 kg	17 lbs. / 7.7 kg	22 1/2 lbs. / 10.2 kg	28 lbs. / 12.7 kg	56 1/4 lbs. / 26 kg
100	1 1/4 lbs. / 568 g	6 1/4 lbs. / 2.8 kg	12 1/2 lbs. / 5.7 kg	18 3/4 lbs. / 8.5 kg	25 lbs. / 11.4 kg	31 1/4 lbs. / 14 kg	62 1/2 lbs. / 28.4 kg

Total Alkalinity

The next pool water condition to be adjusted should be total alkalinity. The amount of chemicals required to bring alkalinity into the proper range can be determined by using the accompanying charts and simply following the NSPI guidelines.

If your total alkalinity is less than 80 ppm, sodium bicarbonate can be used to raise the total alkalinity. Sodium carbonate can also be used, but this also substantially increases pH. Determine the total alkalinity with a test strip, then note in the chart below, *Raising Alkalinity with Sodium Bicarbonate*, how much it must be raised in parts per million (ppm) to bring it into balance. The balance level depends on the sanitizer being used (please see NSPI Standard-Swimming Pool Table for ideal ranges for various sanitizers). For example, on a test of my pool, the test strip indicates a color mid-way between the 0 and the 80 ppm color blocks, or about 40 ppm. Dichlor is being used as the sanitizer and therefore, a mid-range total alkalinity of 100 ppm is desired (see Total Alkalinity and pH section on page 5). Thus, I need to raise the total alkalinity 60 ppm for my 15,000-gallon (57 kL) pool. Referring to the chart, look down the left column to 60 ppm, then across that row to the column headed 15,000 (57 kL). I will need to add 13 ½ pounds (6 kg) of sodium bicarbonate.

Raising Alkalinity With Sodium Bicarbonate

See warnings for handling chemicals on page 22

Increase In Total Alkalinity in ppm	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
10	2 1/2 oz. / 62 g	12 oz. / 340 g	1 1/2 lbs. / 681 g	2 1/4 lbs. / 1 kg	3 lbs. / 1.4 kg	3 3/4 lbs. / 1.7 kg	7 1/2 lbs. / 3.4 kg
20	4 3/4 oz. / 135 g	1 1/2 lbs. / 681 g	3 lbs. / 1.4 kg	4 1/2 lbs. / 2 kg	6 lbs. / 2.7 kg	7 1/2 lbs. / 3.4 kg	15 lbs. / 6.8 kg
30	7 1/4 oz. / 205 g	2 1/4 lbs. / 1 kg	4 1/2 lbs. / 2 kg	6 3/4 lbs. / 3 kg	9 lbs. / 4 kg	11 1/4 lbs. / 5 kg	22 1/2 lbs. / 10.2 kg
40	9 1/2 oz. / 269 g	3 lbs. / 1.4 kg	6 lbs. / 2.7 kg	9 lbs. / 4 kg	12 lbs. / 5.5 kg	15 lbs. / 6.8 kg	30 lbs. / 13.6 kg
50	12 oz. / 340 g	3 3/4 lbs. / 1.7 kg	7 1/2 lbs. / 3.4 kg	11 1/4 lbs. / 5 kg	15 lbs. / 6.8 kg	18 3/4 lbs. / 8.5 kg	37 1/2 lbs. / 17 kg
60	14 1/2 oz. / 411 g	4 1/2 lbs. / 2 kg	9 lbs. / 4 kg	13 1/2 lbs. / 6 kg	18 lbs. / 8 kg	22 1/2 lbs. / 10.2 kg	45 lbs. / 20.4 kg
70	1 lb. / 454 g	5 1/4 lbs. / 2.4 kg	10 1/2 lbs. / 4.8 kg	15 3/4 lbs. / 7.2 kg	21 lbs. / 9.5 kg	26 1/4 lbs. / 12 kg	52 1/2 lbs. / 23.8 kg
80	1 1/4 lbs. / 568 g	6 lbs. / 2.7 kg	12 lbs. / 5.5 kg	18 lbs. / 8 kg	24 lbs. / 10.9 kg	30 lbs. / 13.6 kg	60 lbs. / 27.2 kg
90	1 1/2 lbs. / 681 g	6 3/4 lbs. / 3 kg	13 1/2 lbs. / 6 kg	20 1/4 lbs. / 9 kg	27 lbs. / 12.3 kg	33 3/4 lbs. / 15.3 kg	67 1/2 lbs. / 30.6 kg
100	1 1/2 lbs. / 681 g	7 1/2 lbs. / 3.4 kg	15 lbs. / 6.8 kg	22 1/2 lbs. / 10.2 kg	30 lbs. / 13.6 kg	37 1/2 lbs. / 17 kg	75 lbs. / 34 kg

If the total alkalinity is more than 120 ppm, it is most commonly lowered using dry acid (sodium bisulfate). For example, let's say the test strip reading for total alkalinity is 180 ppm. If the pool volume is 15,000 gallons (57 kL), and you are using dichlor as the sanitizer (so the ideal level is between 100 and 120 ppm) refer to the chart, *Lowering Alkalinity with Dry Acid*. To decrease total alkalinity by 80 ppm, 19 ¼ pounds (8.7 kg) of dry acid (sodium bisulfate) would be required for a 15,000-gallon (57 kL) pool. This amount of acid will probably require 5 or 6 separate additions, spread over two days.

Retesting should be carried out after the total amount of liquid or dry acid has been added and the water has been allowed to circulate for at least two hours.

Lowering Alkalinity With Dry Acid (Sodium Bisulfate)

See warnings for handling chemicals on page 22

Decrease In Total Alkalinity in ppm	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
10	2 1/2 oz. / 70.8 g	12 3/4 oz. / 361 g	1 1/2 lbs. / 681 g	2 1/2 lbs. / 1.1 kg	3 1/4 lbs. / 1.5 kg	4 lbs. / 1.8 kg	8 lbs. / 3.6 kg
20	5 oz. / 142 g	1 1/2 lbs. / 681 g	3 1/4 lbs. / 1.5 kg	4 3/4 lbs. / 2.2 kg	6 1/2 lbs. / 3.0 kg	8 lbs. / 3.6 kg	16 lbs. / 7.3 kg
30	8 oz. / 227 g	2 1/2 lbs. / 1.1 kg	4 3/4 lbs. / 2.2 kg	7 1/4 lbs. / 3.3 kg	9 1/2 lbs. / 4.3 kg	12 lbs. / 5.4 kg	24 lbs. / 10.9 kg
40	10 1/4 oz. / 290 g	3 1/4 lbs. / 1.5 kg	6 1/2 lbs. / 3.0 kg	9 1/2 lbs. / 4.3 kg	13 lbs. / 6.0 kg	16 lbs. / 7.3 kg	32 lbs. / 14.5 kg
50	12 3/4 oz. / 361 g	4 lbs. / 1.8 kg	8 lbs. / 3.6 kg	12 lbs. / 5.4 kg	16 lbs. / 7.3 kg	20 3/4 lbs. / 9.4 kg	40 1/2 lbs. / 18.4 kg
60	1 lb. / 454 g	4 3/4 lbs. / 2.2 kg	9 1/2 lbs. / 4.3 kg	14 1/2 lbs. / 6.7 kg	19 1/4 lbs. / 8.7 kg	24 lbs. / 10.9 kg	48 lbs. / 21.8 kg
70	1 lb. / 454 g	5 1/2 lbs. / 2.5 kg	11 1/4 lbs. / 5.1 kg	16 3/4 lbs. / 7.6 kg	22 1/2 lbs. / 10.2 kg	28 1/4 lbs. / 12.8 kg	56 1/2 lbs. / 25.7 kg
80	1 1/4 lbs. / 567 g	6 1/2 lbs. / 3.0 kg	12 3/4 lbs. / 5.8 kg	19 1/4 lbs. / 8.7 kg	25 1/2 lbs. / 11.6 kg	32 lbs. / 14.5 kg	64 lbs. / 29 kg
90	1 1/2 lbs. / 681 g	7 1/4 lbs. / 3.3 kg	14 1/2 lbs. / 6.7 kg	21 1/2 lbs. / 9.8 kg	28 3/4 lbs. / 13 kg	36 lbs. / 16.3 kg	72 lbs. / 32.7 kg
100	1 1/2 lbs. / 681 g	8 lbs. / 3.6 kg	16 lbs. / 7.3 kg	24 lbs. / 10.9 kg	32 lbs. / 14.5 kg	40 lbs. / 18.2 kg	80 lbs. / 36.3 kg

pH

The next pool water parameter to be adjusted is pH. Like alkalinity, the amount of acid or base required to bring pH into the proper range can be determined by knowing the direction (higher or lower) and the amount of change you want by using the following charts. For example, on a test of my 15,000-gallon (57 kL) pool, the color of the pH pad on the test strip is between the 7.8 and 8.4 color blocks. I estimate the pH is 8.0, which is in the high range. Referring to the chart, *Lowering pH with Dry Acid*, I look down the left column to 7.8 to 8.0, then across that row to the column 15,000 (57 kL). I need to add 0.9 lbs of dry acid. Retesting should be done after the dry acid has been added and the water circulated for at least two hours. To raise the pH, refer to the chart, *Raising pH with Soda Ash*.

Lowering pH With Dry Acid (Sodium Bisulfate)

(When pH is over 7.8, add the amount of acid indicated below, then retest)

See warnings for handling chemicals on page 22

pH Level	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
7.8 - 8.0	1 1/2 oz. / 42.5 g	4 oz. / 113 g	8 oz. / 227 g	1 lb. / 454 g	1 1/4 lbs. / 568 g	1 1/2 lbs. / 681 g	3 lbs / 1.4 kg
8.0 - 8.4	4 oz. / 113 g	8 oz. / 227 g	1 lb. / 454 g	1 1/2 lbs. / 681 g	2 lbs. / 905 g	2 1/2 lbs. / 1.1 kg	5 lbs. / 2.3 kg
Over 8.4	8 oz. / 227 g	1 lb. / 454 g	1 1/2 lbs. / 681 g	2 1/2 lbs. / 1.1 kg	3 lbs / 1.4 kg	4 lbs. / 1.8 kg	7 1/2 lbs. / 3.4 kg

Raising pH With Soda Ash (Sodium Carbonate)

(When pH is under 7.2, add the amount of soda ash indicated below, then retest)

See warnings for handling chemicals on page 22

pH Level	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
7.0 - 7.2	3/4 oz. / 21.3 g	4 oz. / 113 g	8 oz. / 227 g	12 oz. / 340 g	1 lb. / 454 g	1 1/4 lbs. / 568 g	2 1/2 lbs. / 1.1 kg
6.7 - 7.0	1 1/4 oz. / 35.4 g	6 oz. / 170 g	12 oz. / 340 g	1 lb. / 454 g	1 1/2 lbs. / 681 g	2 lbs. / 908 g	4 lbs. / 1.8 kg
Under 6.7	1 1/2 oz. / 42.5 g	8 oz. / 227 g	1 lb. / 454 g	1 1/2 lbs. / 681 g	2 lbs. / 908 g	2 1/2 lbs. / 1.1 kg	5 lbs. / 2.3 kg

Free Chlorine Residual

Swimmer protection is of primary concern, and that depends on maintaining an adequate free chlorine residual to control the growth of bacteria and algae and to rid the water of organic contaminants.

Years of research have shown that swimmer protection can be achieved by maintaining a free available chlorine residual of 1 to 3 parts per million (ppm) in a swimming pool and 3 to 5 ppm in a spa. So an important step in providing swimmer and bather protection is to measure the free chlorine residual. The results of your test can fall into one of three categories:

- Water with no measurable free chlorine residual.
- Water with a measurable free chlorine residual.
- A disgusting swamp from which no sanitizer measurement can be made because no one wants to get close enough to draw a water sample.

For water with no measurable free chlorine residual (either newly filled or existing) or a “swamp,” the water should be superchlorinated or “shocked” to be sure that all living things have been killed.

To superchlorinate water with no measurable free chlorine residual, bring the free available chlorine level up to 10 ppm and hold that level for 4 hours.

Superchlorination Chart - Pools

Amount Needed to Introduce 10 ppm (mg/L)

See warnings for handling chemicals on page 22

Type of Chlorine	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
Sodium Hypochlorite	10 oz. / 296 mL	1 3/4 qts. / 1.7 L	3 1/4 qts. / 3.0 L	1 1/4 gal. / 4.7 L	1 2/3 gal. / 6.3 L	2 gal. / 7.6 L	4 gal. / 15.2 L
Lithium Hypochlorite	4 oz. / 113.4 g	1 1/4 lbs. / 568 g	2 1/3 lbs. / 1.1 kg	3 1/2 lbs. / 1.6 kg	4 3/4 lbs. / 2.2 kg	6 lbs. / 2.7 kg	12 lbs. / 5.4 kg
Dichlor	2 1/4 oz. / 63.7 g	11 oz. / 311 g	1 1/3 lbs. / 605 g	2 lbs. / 908 g	2 2/3 lbs. / 1.2 kg	3 1/3 lbs. / 1.5 kg	6 3/4 lbs. / 3.1 kg
Calcium Hypochlorite	2 oz. / 56.7 g	10 oz. / 284 g	1 1/4 lbs. / 568 g	2 lbs. / 908 g	2 1/2 lbs. / 1.1 kg	3 1/4 lbs. / 1.5 kg	6 1/2 lbs. / 2.9 kg

The accompanying *Superchlorination Chart* tells you how much of various types of chlorine you must add to pools of different sizes to obtain a residual of approximately 10 ppm.

We must point out that this chart — and all of the other charts that appear here — will only provide a guideline for water adjustment. It should be obvious that adding a given amount of chlorine to a pool full of clean, clear water will not produce the same result as adding the same amount of chlorine to a swamp.

The only sure way to know that you have added enough chlorine is to make the addition according to the chart, allow enough time for the chlorine to mix thoroughly (10-15 minutes for a spa and 2 to 4 hours for a pool), and retest the water.

For example, if you are using sodium hypochlorite to superchlorinate a 10,000-gallon (38 kL) pool, you need to add 3 ¼ quarts (3.0 L). Retest the water in 2 hours to make sure the free chlorine residual has reached 10 ppm. If you are using calcium hypochlorite, you need to add 1 ¼ pounds (568 g) to achieve the same result in a 10,000-gallon (38 kL) pool.

If you have been regularly caring for a pool, another general guideline for superchlorination is to add 3 to 6 times the amount of chlorine you normally add to maintain the pool. For example, if you add ½ a gallon (1.9 L) of sodium hypochlorite for normal chlorination, you would add 1 ½ to 3 gallons (5.7 to 11.4 L) for superchlorination.

Superchlorination will establish a measurable free chlorine residual in your pool in most cases. Superchlorination of “swamp” water may <u>not</u> produce a free chlorine residual and, therefore, will need to be repeated.

Chlorination Chart - Pools

Amount Needed to Introduce 1 ppm (mg/L)

See warnings for handling chemicals on page 22

Type of Chlorine	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
Sodium Hypochlorite	1 oz. / 29.6 mL	5 1/2 oz. / 163 mL	10 1/2 oz. / 310 mL	1/2 qt. / 473 mL	2/3 qt. / 631 mL	3/4 qt. / 710 mL	1 2/3 qts. / 1.6 L
Lithium Hypochlorite	1/2 oz. / 14.2 g	2 oz. / 56.7 g	4 oz. / 114 g	6 oz. / 170 g	1/2 lb. / 227 g	10 oz. / 283 g	1 1/4 lbs. / 568 g
Dichlor	1/4 oz. / 7.1 g	1 oz. / 28.3 g	2 1/4 oz. / 63.8 g	3 1/4 oz. / 92.1 g	4 1/4 oz. / 120 g	5 1/2 oz. / 149 g	11 oz. / 312 g
Calcium Hypochlorite	1/4 oz. / 7.1 g	1 oz. / 28.3 g	2 oz. / 56.7 g	3 oz. / 85 g	4 oz. / 113 g	5 oz. / 142 g	10 1/4 oz. / 290 g
Trichlor	1/8 oz. / 3.5 g	3/4 oz. / 21.2 g	1 1/2 oz. / 42.5 g	2 1/4 oz. / 63.8 g	3 oz. / 85 g	3 3/4 oz. / 106 g	7 1/2 oz. / 213 g

Once a free chlorine residual has been established, determine if that value falls in the 1 to 3 ppm ideal range. Swimming in pool water with a free chlorine residual up to 5 ppm is okay. If your test strip reading shows less than 1 ppm, refer to the accompanying *Chlorination Chart* to find how much of the various sanitizers you must add to pools of different sizes to obtain a free chlorine residual of about 1 ppm.

For example, if you are using calcium hypochlorite in a 10,000-gallon (38 kL) pool, you will need to add 2 ounces (56.7 g) to increase the free chlorine residual by 1 ppm or 4 ounces (114 g) to increase the residual by 2 ppm. If you are using sodium hypochlorite, you will need to add 10 ½ liquid ounces (310 mL) for each 1 ppm of increase.

Total Bromine Residual

If you are using bromine as your primary sanitizer, maintaining a total bromine residual is still of primary concern to control the growth of bacteria and algae and to rid the water of organic contaminants. (If you use chlorine as your primary sanitizer, you can disregard this section.)

Remember that with bromine, free and combined bromine are both effective sanitizers and therefore you should measure total bromine. In the case of bromine, you need not be concerned about the difference in free and combined bromine. Swimmer protection can be achieved by maintaining an ideal total bromine residual of 3 to 5 parts per million (ppm) in a swimming pool and 4 to 6 ppm in a spa. Because there are only two commonly used bromine forms, we will simply refer to them as tablets and granular bromine.

Just as with chlorine, it is also important to recognize when there is no total bromine present in the water. Whether you are sure you have no total bromine

because of your test results or because your pool or spa looks more like a pond complete with frogs and lily pads, a shock treatment is required. Typically a non-chlorine shock called monopersulfate is used to shock bromine pools or spas. However, the monopersulfate shock does not increase the level of bromine, so the dosage is not calculated the same way. Just follow the guidelines in the *Non-Chlorine Shock Chart* to determine how much monopersulfate to add.

For example, if you have a 15,000-gallon pool (57kL) with no measurable bromine, you will need to add 1 ½ lbs. of monopersulfate to the water. Keep in mind that shocking with monopersulfate does not increase the bromine level. Therefore, you will need more bromine in order to bring the level up after you have finished shocking.

Bromine Treatment Chart

Amount Needed to Introduce 1 ppm (mg/L)

See warnings for handling chemicals on page 22

Type of Bromine	Pool Volume					
	500 gal. / 1.9 kL	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	25,000 gal. / 95 kL
Bromine Tablets*	0.05 oz. / 1.6 g	0.1 oz. / 3 g	0.5 oz. / 16 g	1 oz. / 32 g	1.5 oz. / 48 g	2.5 oz. / 80 g
Granular Bromine	0.15 oz. / 5 g	0.3 oz. / 10 g	1.5 oz. / 48 g	3 oz. / 96 g	4.5 oz. / 144 g	7.5 oz. / 240 g

* One bromine tablet is approximately 0.5 oz. in weight.

Non-Chlorine Shock Chart (Monopersulfate)

Amount Needed to Introduce Approximately 12 ppm (mg/L)

See warnings for handling chemicals on page 22

	Pool Volume					
	500 gal. / 1.9 kL	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	25,000 gal. / 95 kL
Powder Monopersulfate	0.8 oz. / 23 g	1.6 oz. / 46 g	8 oz. / 227 g	1 lb. / 454 g	1 1/2 lbs. / 681 g	2 1/2 lbs. / 1.1 kg

Cyanuric Acid

Cyanuric acid (conditioner, stabilizer), as I discussed earlier, is the chemical that protects chlorine from the degrading effects of the sun's ultraviolet (UV) rays. If your chlorine source is dichlor or trichlor, you will not need to add extra cyanuric acid since it is already a part of these sanitizers.

The IAF/NSPI standard for cyanuric acid concentration in pool water recommends a minimum of 10 ppm, an ideal range of 30-50 ppm and a maximum of 150 ppm, although health authorities often set a maximum of 100 ppm for public pools and spas.

Establishing or Increasing Cyanuric Acid Level

See warnings for handling chemicals on page 22

Increase in Cyanuric Acid in ppm	Pool Volume						
	1,000 gal. / 3.8 kL	5,000 gal. / 19 kL	10,000 gal. / 38 kL	15,000 gal. / 57 kL	20,000 gal. / 76 kL	25,000 gal. / 95 kL	50,000 gal. / 189 kL
10	1 1/4 oz. / 35.4 g	6 1/2 oz. / 184 g	12 3/4 oz. / 361 g	1 1/4 lbs. / 568 g	1 2/3 lbs. / 756 g	2 lbs. / 908 g	4 lbs. / 1.8 kg
20	2 1/2 oz. / 62 g	12 3/4 oz. / 361 g	1 3/4 lbs. / 796 g	2 1/2 lbs. / 1.1 kg	3 1/3 lbs. / 1.5 kg	4 lbs. / 1.8 kg	8 1/3 lbs. / 3.8 kg
30	4 oz. / 113 g	1 1/4 lbs. / 568 g	2 1/2 lbs. / 1.1 kg	3 3/4 lbs. / 1.7 kg	5 lbs. / 2.3 kg	6 1/4 lbs. / 2.8 kg	12 1/2 lbs. / 5.6 kg
40	5 1/4 oz. / 149 g	1 2/3 lbs. / 758 g	3 1/3 lbs. / 1.5 kg	5 lbs. / 2.3 kg	6 2/3 lbs. / 3.0 kg	8 1/3 lbs. / 3.8 kg	16 2/3 lbs. / 7.5 kg
50	6 1/2 oz. / 184 g	2 lbs. / 908 g	4 1/4 lbs. / 1.9 kg	6 1/4 lbs. / 2.8 kg	8 1/3 lbs. / 3.8 kg	10 1/2 lbs. / 4.8 kg	21 lbs. / 9.5 kg

Refer to the accompanying chart, *Establishing or Increasing Cyanuric Acid Level*, to find out how much cyanuric acid you must add to pools of various sizes to increase the concentration by 10-50 ppm. For example, if you want to add 30 ppm of cyanuric acid to a newly filled 15,000-gallon (57 kL) pool, you will have to add 3 ¾ pounds (1.7 kg) of cyanuric acid.

Because health authorities are usually more concerned with the cyanuric acid level being too high, you should also know how to reduce the concentration. The most common way is to drain part or all of the water and refill. Draining and replacing half the water will result in a 50% reduction of the cyanuric acid concentration.

Conclusion to Pool Water Balancing

We realize that no set of water testing and adjustment guidelines can possibly cover every situation that can arise. But they can certainly start you off in the right direction.

In this booklet, we have attempted to provide you with a basic understanding of the various chemical tests used in the pool and spa industry, what they mean and how to interpret and act on the results.

Knowing how to test and adjust water can make your pool maintenance job easier. When you establish a routine for maintaining water balance, you practice prevention instead of crisis management. The result is improved water quality in your pool.

Analyzing Test Results and Adjusting Spa Water

Introduction

Much of what has been said in the previous chapter on testing and adjusting pool water applies to spa water. The major differences are in the water temperature and ideal ranges. As with pools, NSPI guidelines for spas will be followed. These guidelines are provided in the accompanying chart.

Water Adjustments

As with pools, the level of calcium hardness must be established prior to balancing spa water. The NSPI spa recommendations and the adjustment procedures outlined in the chapter on pools should be followed to adjust calcium hardness. For spas under 1,000 gallons (3.8 kL), decrease the amounts given in the hardness table in proportion to the volume of the spa. Likewise, the tables for adjusting alkalinity and pH given in the pool chapter can be followed to adjust the pH and alkalinity of a spa. Please keep in mind that the ideal values for spas should be taken from the NSPI guidelines for spas. Again, for spas under 1,000 gallons (3.8 kL), decrease the amounts of chemicals recommended in the appropriate tables in proportion to the volume of the spa. **Note: Concentrated muriatic acid (liquid) is not recommended for use in spas because it is so highly concentrated and so little is needed. Do not add more than 1 ounce (28.3 g) of dry acid (sodium bisulfate) per 500 gallons (1.9 kL) at any one time.** Additional acid may be added to the spa after circulating water with the aerator (air blower) on, and the pump turned off for 30 minutes. Then retest.

IAF/NSPI Standards For Spas

(1999 Operational Parameters)

	Minimum	Ideal	Maximum
Free Chlorine, ppm	2.0	3.0 - 5.0	10.0
Combined Chlorine, ppm	None	None	0.2
pH	7.2	7.4 - 7.6	7.8
Total Alkalinity, ppm	60	80 - 100* 100 - 120**	180
TDS, ppm	300	1000 - 2000	3000
Calcium Hardness, ppm	150	200 - 400	500 - 1000+
Cyanuric Acid, ppm	10	30 - 50	150†

*(for Liquid Chlorine, Calcium Hypochlorite and Lithium Hypochlorite)
**(Dichlor and Trichlor Compounds)
†(except where limited by Health Dept. requirements often to 100 ppm)

Spa Volume Determination

Use the spa volume number provided by the spa manufacturer to calculate the correct amounts of chemical components necessary to balance the water in your spa. If that number is not available, contact the manufacturer and provide him with the serial number attached to the spa. The actual volume of your spa can then be traced and provided to you. Contact your spa dealer with the length, width and depth measurements to quickly estimate the volume of your spa.

Draining Your Spa

The general recommendation from the NSPI Chemical Treatment and Process Committee for residential and commercial spas is that draining should be carried out every 2 to 3 months, depending on the number of bathers using the spa on a daily basis.

For example, divide your spa volume by 3. (If you know your spa's volume in liters, divide the volume by 11.4 instead of 3). Then divide this result by the number of bathers using the spa per day. The result is the number of days that the spa can be used before draining is necessary.

For example:

$$\frac{\text{450 gal. spa}}{3} = \frac{150}{\text{2 people/day}} = \text{75 days}$$

More frequent draining will be necessary with commercial spas. For example:

$$\frac{\text{900 gal. spa}}{3} = \frac{300}{\text{50 bathers/day}} = \text{6 days}$$

Free Chlorine Residual

Your spa's free chlorine level should be kept at 3 to 5 ppm (parts per million). The chart, *Chlorine Treatment – Spas*, gives the recommendations to raise the free chlorine level by 4 ppm. For example, if your spa holds 500 gallons (1.9 kL) and you use dichlor, add ½ oz. (14.2 g) to increase the free chlorine by 4 ppm. If your spa has a smaller or larger water capacity, adjust the amounts proportionately.

Chlorine Treatment – Spas

To Introduce 4 ppm (mg/L)

See warnings for handling chemicals on page 22

Type of Chlorine	100 gal. / 379 L	250 gal. / 948 L	500 gal. / 1.9 kL
Dichlor	1/10 oz. / 2.8 g	1/4 oz. / 7.0 g	1/2 oz. / 14.2 g
Sodium Hypochlorite	2/5 oz. / 11.8 mL	1 oz. / 29.6 mL	2 oz. / 59.1 mL
Lithium Hypochlorite	1/5 oz. / 5.7 g	1/2 oz. / 14.2 g	1 oz. / 28.3 g

For example, let's assume you have a 750-gallon spa which already contains 1 ppm free chlorine and you are using dichlor as the sanitizer. Now, calculate how much dichlor you will need to add to raise the chlorine level to 4 ppm.

A. Desired Free chlorine level = 4 ppm
B. Test strip reading for free chlorine = 1 ppm
C. Subtract B from A to find the increase needed = 3 ppm

D. Choose any convenient column in the Chlorine Treatment- Spas Chart and find the amount needed for a 4 ppm increase. For this example the 500-gallon column was chosen. One half ounce of dichlor is required per 500 gallons. = $^1/_2$ oz.
E. Gallons from column heading used in D above = 500 Gallons
F. Volume of your spa = 750 Gallons
G. Divide F by E = $\frac{750}{500} = 1\frac{1}{2}$

H. Amount of dichlor required:
= D times C divided by A times G

$= D \times \frac{C}{A} \times G$

$= \frac{1}{2} \times \frac{3}{4} \times 1\frac{1}{2}$

$= \frac{9}{16}$ oz.

If your total chlorine test strip reading is higher than your free chlorine test strip reading, you will need to superchlorinate or shock treat your spa. (Consult your spa dealer if potassium monopersulfate is used to shock your spa.) After doing a test on my spa with an AquaChek test strip, I find the total chlorine pad is a shade of green between the 3 ppm and 5 ppm color blocks. So, I estimate the total chlorine to be 4 ppm. According to the test strip, the free chlorine is 3 ppm. Because the total chlorine is greater than the free chlorine, I need to superchlorinate my spa. See the *Superchlorination Chart - Spas.*

Superchlorination Chart – Spas

To Introduce 10 ppm (mg/L)

See warnings for handling chemicals on page 22

Type of Chlorine	100 gal. / 379 L	250 gal. / 948 L	500 gal. / 1.9 kL
Dichlor	1/4 oz. / 7.0 g	2/3 oz. / 18.9 g	1 1/4 oz. / 35.1 g
Sodium Hypochlorite	1 oz. / 29.6 mL	2 1/2 oz. / 74 mL	5 oz. / 148 mL
Lithium Hypochlorite	2/5 oz. / 11.3 g	1 oz. / 28.3 g	2 oz. / 56.7 g

For outdoor spas which use chlorine as a sanitizer, cyanuric acid can be used as a stabilizer as in pools. If you use dichlor or trichlor as the chlorine source, you will not need to add extra cyanuric acid since it is already a part of either of these sanitizers. Again, the cyanuric acid adjustment tables given in the pool chapter can be used to adjust cyanuric acid levels in spas if the amounts are proportionately decreased with volume for spas under 1,000 gallons (3.8 kL).

Total Bromine Residual

If using bromine, your spa's total bromine level should be kept at 4 to 6 ppm (mg/L). The chart, *Bromine Treatment – Spas*, gives the recommendations to raise the total bromine level by 5 ppm. For example, if your spa holds 500 gallons (1.9 kL) and you use bromine tablets, add ¼ oz. (8 g) to increase the total bromine by 1 ppm. If your spa has a smaller or larger water capacity, adjust the amounts proportionately.

Bromine Treatment Chart – Spas

Amount Needed to Introduce 1 ppm (mg/L)

See warning for handling chemicals on page 22

Type of Bromine	Spa Volume		
	100 gal. / 379 L	250 gal. / 948 L	500 gal. / 1.9 kL
Bromine Tablets*	0.01 oz. / 0.4 g	0.025 oz. / 1 g	0.05 oz. / 2 g
Granular Bromine	0.03 oz. / 1 g	0.08 oz. / 2.5 g	0.15 oz. / 5 g

* One bromine tablet is approximately 0.5 oz. in weight.

Non-Chlorine Shock Chart – Spas

Amount Needed to Introduce Approximately 12 ppm (mg/L)

See warning for handling chemicals on page 22

	Spa Volume		
	100 gal. / 379 L	250 gal. / 248 L	500 gal. / 1.9 kL
Powder Monopersulfate	0.2 oz. / 4.6 g	0.4 oz. / 12 g	0.8 oz. / 23 g

Helpful Hints

The amounts of liquid chemicals referred to in making water adjustments are given in ounces and quarts. The following conversion tables are provided for your convenience.

1 tablespoon = 3 teaspoons = 14.8 mL

2 tablespoons = 1 liquid ounce = 29.6 mL

1 liquid ounce = 6 teaspoons

16 tablespoons = 1 cup

1 cup = 8 liquid ounces = 237 mL

1 pint = 16 liquid ounces = 473 mL

1 quart = 32 liquid ounces = 946 mL

WARNINGS FOR HANDLING CHEMICALS

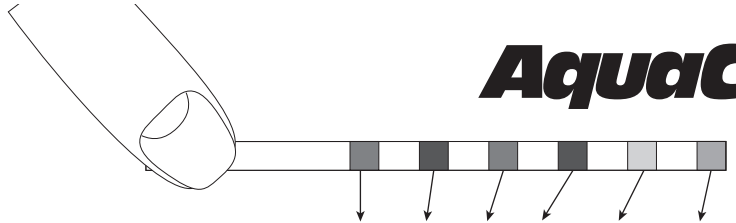
- **Do not add chemicals when swimmers are in the water!**
- Always follow chemical manufacturer's directions.
- Never mix chemicals together, particularly cal-hypo (calcium hypochlorite) with trichlor tablets (trichloro-s-triazinetrione) in erosion/feeder-type canisters. A fire and/or explosion could result.
- **Always add acid to water; never add water to acid.**
- Carefully add liquid or dry acid into various areas at the deep end of the pool away from ladders, skimmers, and metal parts. Alternatively, for vinyl liner, fiberglass, smaller pools, and spas, the prescribed quantity of dry acid (sodium bisulfate) should be dissolved in a 2-5 gallon plastic pail of water before adding to the pool or spa. Circulate water for at least 2 hours and retest. Several incremental additions over a 2-day period will be required for larger quantities of acid. As a general rule for pools, do not add more than 1 quart (946 mL) muriatic acid or 2.5 pounds (1.1 kg) dry acid per 10,000 gallons (38 kL) of pool water per day.
- **For spas,** the pump should be turned off, and the pre-dissolved acid should then be added and mixed vigorously by turning on the aeration pump (air blower). The purpose of this approach is to prevent a surge of acidic (corrosive) spa water from entering the pump and heater which could result in metal corrosion. Concentrated muriatic acid (liquid) is not recommended for use in spas because it is so highly concentrated and so little is needed. For spas, do not add more than 1 ounce (28.3 g) of dry acid per 500 gallons (1.9 kL) at any one time. After 30 minutes, retest. Additional acid may then be added to the spa.
- Muriatic acid liquid (about 30%) is concentrated and very corrosive. Dry acid (sodium bisulfate) is also very corrosive. Handle acid very carefully. Rinse plastic dispensing containers with water after use. Wear protective eyewear. Wash away spills thoroughly with water. Keep material away from children. Do not get on skin, in eyes, or on clothing. In case of contact, immediately flush eyes or skin with large amounts of water for 15 minutes. Call a physician.
- Calcium hypochlorite (granular or tablets), 10% sodium hypochlorite (liquid), and lithium hypochlorite (granular) are all very alkaline materials and the same handling precautions outlined for acids should be followed.

- Never store acids and chlorine compounds next to each other.
- All chemicals used for any purpose in or around the pool should be handled very carefully and precautions noted by the manufacturer followed.

Test Log

Keeping a log of your test results will help you understand how the chemical balance of your pool or spa changes. You'll be able to identify any recurring problems. Also, if you do encounter chemical imbalance difficulties that you can't seem to solve on your own, your log is an excellent reference to show to your local pool and spa dealer for professional advice on treating your pool or spa.

AquaChek® Test Log



Filter Type:

Stabilizer Used:

24

	DATE	TIME OF DAY	FILTER RUN TIME HRS / DAY	LAST BACKWASH CYCLE	CHLORINE TYPE USED	CYANURIC ACID	TOTAL ALKALINITY	pH	FREE CHLORINE	TOTAL CHLORINE TOTAL BROMINE	TOTAL HARDNESS	TREATMENT
1												
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3												
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#1

Dip and remove strip

#2

Wait 15 seconds

#3

Compare pads to color chart on bottle

One AquaChek Select Test Strip gives you reliable results for 7 important tests!

Total Hardness. A proper Hardness level keeps water from causing corrosion or scaling.

Total Chlorine. Knowing your Total Chlorine level will help you determine when to shock (when compared to the Free Chlorine level).

Total Bromine. Keep Total Bromine levels in the ideal range to ensure clean water.

Free Chlorine. An ideal level of Free Chlorine keeps water sparkling clean.

pH. A proper pH level keeps water from causing corrosion or scaling.

Total Alkalinity. A correct level of Total Alkalinity prevents sudden pH changes.

Cyanuric Acid (Stabilizer). An ideal level of Cyanuric Acid protects against chlorine loss caused by sunlight.

The reusable color comparator offers the easiest and most convenient way to make your test strip comparisons. Inside this booklet you will find step-by-step instructions that will guide you through pool and spa testing. You'll also find detailed treatment recommendations with precise guidelines on balancing your water. There's even a handy test log so you can keep track of your pool or spa test results.

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