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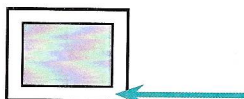
NOTICE

The pool must remain full of water at all times. Pool may be damaged if water level is allowed to drop substantially below the inlets. When appreciable drawdown is noticed or if it becomes necessary to drain the pool, the manufacturer/pool dealer should be contacted for instructions.

Latham International
787 Watervliet-Shaker Rd • Latham, NY 12110
518-951-1000

CAUTION

If you have someone else close your pool, or if you decide to close your pool, please let whoever closes your pool know not to drain the pool below the skimmer square:



Ground water in this area is constantly being shifted and diverted. If you lift the weight off the liner, it will float and cause wrinkles. One gallon of water weighs eight pounds.

REMINDERS

Go to www.haywardnet.com to register your Hayward products: filter head and body, pump, salt machine, salt cell, auto chlorinator.

In the big envelope you will find your liner warranty card. Please fill it out and send it in.

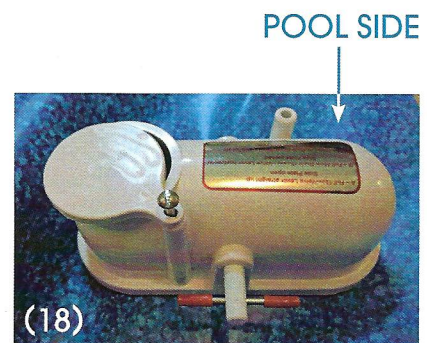
CALL YOUR COUNTY FOR FINAL INSPECTION. You have to call for final inspection. You must be home for this inspection. The county must go inside home to inspect the electrical box. They also inspect the fence and junction box. They must have access to these places. You have a half-year from the permit date to schedule the final inspection. If you have any questions, please call your county. This is a free service. It was included with the permit cost. Please look on your permit to find the number for your county. That should be your only inspection left on the permit.

Make sure all doors leading to pool without fence have alarms on them, including windows less than 4' from the ground.

The fence gate has to be a **self-latching child safety latch**, opening outward.

VACUUM INSTRUCTIONS

1. **When pool is on** and running in filter position, empty skimmer basket(s).
2. **Switch diverter valve** to "vac position" in skimmer (diverter flap fully open and diverter handle straight up and down). Close flap in the other skimmer if you have one.
3. **Hook** triangular vac head to pole, hook hose to vac head, hook skim vac (round white lid with hole on it) to other end of hose. Leave skimmer basket in skimmer so it will catch the big stuff.
4. **Submerge** vac hose and vac head into water (filling hose up with water by pushing hose into the water).
5. **Place** the skim vac over basket in skimmer.
6. **Vacuum pool** until pressure on gauge raises 5-10 psi above clean pressure or until vac loses suction.
7. **Lay hose** to the side of pool still in water and go to pump and filter.
8. **Turn pool off.**
9. **Roll out** blue backwash hose.
10. **Turn** multi-port valve to backwash position.
11. **Turn pool on.**
12. **Backwash** until water is clear in sight-glass.
13. **Turn pool off.**
14. **Turn** multi-port valve to rinse.
15. **Turn pool on.**
16. **Rinse** for 10-20 seconds
17. **Turn pool off.**
18. **Turn** multi-port valve back to filter position
19. **Empty the skimmer basket** under the skim vac. Place the skim vac back over the clean basket and turn pool back on.
20. **Continue vacuuming** if needed.
21. **Repeat** above steps if necessary.



Remember: If you have two skimmers, always shut the flap in the skimmer you are not working off of.

22. **After vacuuming**, switch diverter valve to "daily operation."

ALWAYS TURN POOL OFF WHEN MOVING MULTI-PORT VALVE HANDLE.



Pool Chemistry

FOR ELECTRONIC CHLORINE GENERATORS



It is important to maintain salt and stabilizer levels in order to prevent scaling and to ensure maximum enjoyment of the pool. Test the water periodically and use standard pool industry procedures to adjust levels.

Salt 2700 to 3400 ppm

Check monthly (using the digital salt display). The higher end of the salt level range lets the electronic chlorine generator produce more chlorine and also helps extend the life of the cell. The electronic chlorine generator will indicate when the salt drops below 2700 ppm and the electronic chlorine generator will stop operating if the salt drops below 2500ppm. On most pools, the salt level tends to slowly drift downward as fresh water is added to the pool (rain or makeup water for splash-out, back-washing etc.). A good procedure is to add enough salt to be near the top of the range. Usually add stabilizer (see below) at the same time.

Stabilizer 60 to 80 ppm

Check monthly. Stabilizer is also known as conditioner, cyanuric acid, or isocyanuric acid. Refer to local codes regarding its use. Stabilizer helps maintain the chlorine residual in the pool by protecting it from the UV rays from the sun. Without stabilizer, the electronic chlorine generator would have to produce much more chlorine in order to keep the desired residual level in the pool. Add enough stabilizer to be near the top end of the range at the same time you add salt.

Chlorine

Ideally, all of the chlorine in the pool should be "free chlorine" and there should be zero "combined chlorine." "Free chlorine" means that it is not attached to any contaminants in the pool and is ready to attack any algae or bacteria that it comes in contact with. Note that test kits using the OTO method (yellow color) only test total chlorine and can not differentiate between "free" and "combined". DPD test kits (red color) do allow for the testing of both total chlorine and "free chlorine".

pH determines Chlorine effectiveness

The recommended pH range is 7.2 to 7.8. If the pool's pH rises above the top end of the range, the sanitizing effectiveness of the chlorine can be greatly reduced. For example: The chlorine in a pool with the pH at 7.2 is approximately ten times more effective than the same amount of chlorine in a pool with the pH at 8.2.

Why is water chemistry important?

Continuous filtration, cleaning and sanitization are not enough — balancing pH (potential hydrogen) is vital. Chlorination should keep germs and algae at bay but when pH is unbalanced, it can't do its job. Let the pH drop too low and the water becomes acidic and attacks anything it touches. When pH drifts up, the water becomes alkaline and creates an environment where mineral deposits (scale) can form. Furthermore, when pH is high, chlorine becomes less effective at its primary task — killing bacteria and algae.

ORP (oxidation reduction potential) measures the oxidizing capacity in water. It is a proven measurement and maintenance technology mandated for commercial pool sanitization. Unlike most home-test processes, ORP is not fooled by the effects of pH, TDS (total dissolved solids) and other factors. Most home-test kits and strips only report free chlorine and other less effective forms of chlorine. Only ORP can deliver further detailed analysis of the more important free chlorine. It differentiates free chlorine's components HOCl (hypochlorous acid) and OCl- (hypochlorite ion). OCl- is a slow-acting sanitizer, and HOCl is up to 300 times more effective. ORP targets HOCl, a more fine-tuned measurement of the effectiveness of chlorine and water quality.

Studies have reported on the relationship between ORP and chlorine's activity with germs and bacteria. They've concluded that ORP significantly predicts water bacterial quality better than other methods. As a result, in most states, the highly regulated commercial pool industry requires ORP testing.

What is balanced water?

Water balance is composed of several key factors — pH, total alkalinity, calcium hardness and TDS. All of these factors are important, but none more so than pH. pH is a measurement of the concentration of hydrogen ions in water. It is measured using a logarithmic scale from 0 to 14, with pH 7 being neutral.

For pool water to be in balance, all factors must be in their proper range. That range may vary slightly depending on the finish of the pool and the average temperature of the pool water. The one value that never changes is pH. It must be maintained between 7.2 and 7.8 for a pool to be considered "balanced."

WATER QUALITY PARAMETER	IDEAL LEVELS
Salt	2700 to 3400 ppm
Free Chlorine	1.0 to 3.0 ppm
pH	7.2 to 7.8
Cyanuric Acid (Stabilizer)	60 to 80 ppm (80 ppm best)
Total Alkalinity	80 to 120 ppm
Calcium Hardness	200 to 400 ppm
Metals	0 ppm
Saturation Index	-2 to 2 (0 basil)

FOR ELECTRONIC CHLORINE GENERATORS



GOLDLINE
CONTROLS®
A HAYWARD COMPANY

Hayward and Goldline Controls-brand electronic chlorine generation systems all generate their own chlorine from a low concentration of salt dissolved into the pool water to create 100% of the pool's sanitizing needs.

Will the pool water taste salty?

No. The concentration of salt in the pool water is approximately 1/10 of the level in the ocean and is below the level of taste for most people. This level of salt is equivalent to 1 teaspoon of salt in a gallon of water. Encourage anybody who is concerned to do a "taste test".

Types of salt

Electronic chlorine generators use ordinary food grade, solar salt or water softener salt. Regardless of which type of salt you chose ensure that it is at least 99% pure salt (NaCl). Never use rock salt (ice melt) or salts that have more than 1% of "anti-caking agents", "yellow prussiate of soda", or "sodium ferrocyanide" added as these compounds may cause staining of the pool. Salt is available from most distributors in 40–80 pound bags.

Amount of salt to add to the pool

Hayward and Goldline Controls-brand electronic chlorine generation systems require salt levels between 2700 and 3400 ppm. This amount of salt is below the level of taste for most people and is the equivalent of 1 teaspoon of salt per gallon. **Since all chlorine added to a pool eventually reverts to salt, it is very important to measure the salt level in existing pools before adding any salt.**

How to add salt

After determining the amount of salt to add from the table above, hold 1 or 2 bags in reserve. Dump the remaining bags directly into the pool and brush the salt around to speed up the dissolving process. Do not allow the salt to sit in a pile at the bottom of the pool. Salt water is heavier than fresh water so the salt water will tend to accumulate at the deepest part of the pool. Run the filter system with the suction coming from the main drain for 24 hours to evenly distribute the salt throughout the pool. Note: For new plaster pools, consult with the applicator for the recommended cure time before adding salt.

Salt Display

The salt display responds slowly to rapid changes in salt level. It takes up to 24 hours of circulation for the salt to be evenly distributed in the pool. Be patient and do not over-react by adding too much salt. If the salt level is still low after 24-48 hours, add the reserve bags (see "How to add salt" above) to the pool.

[illegible]



CHEMISTRY QUICK START GUIDE

OVERVIEW

Before attempting to operate your new chlorine generator, salt must be added to your pool and your pool's water chemistry must be properly balanced. Properly balanced pool water is not only necessary for chlorine generation, but also to protect your pool equipment and users of the pool.

BECAUSE SOME CHEMICALS INFLUENCE MORE THAN ONE CHEMISTRY PARAMETER, IT IS IMPORTANT THAT YOU FOLLOW THE STEPS IN THE ORDER PRESENTED.

The following steps require the use of a reliable pool chemical test kit(s).

STEP 1: Calculate Pool Volume

Determine the total number of gallons of water in your pool using the formulas below. This calculation will be used frequently when adjusting pool chemical levels so take care when measuring. For non-standard shaped pools, it may be easier to break the pool up into "sections" to make the calculations. When done, add all the "sections" to determine the total volume of your pool.

	GALLONS (pool size in feet)	LITERS (pool size in meters)
Rectangular	Length x Width x Average Depth x 7.5	Length x Width x Average Depth x 1000
Round	Diameter x Diameter x Average Depth x 5.9	Diameter x Diameter x Average Depth x 785
Oval	Length x Width x Average Depth x 6.7	Length x Width x Average Depth x 893

STEP 2: Adjust Salt Level

IDEAL RANGE: Before adding salt, test your pool water for the current level of salt.

RECOMMENDED LEVEL: 2700 - 3400 ppm (3200 ppm ideal)

After testing salt, refer to Table 1 to determine how much salt must be added to achieve a level of 3200 parts per million (ppm).

Salt should be added directly to the pool with the pool pump on. Brush the salt around to speed up the dissolving process - do not allow the salt to pile up on the bottom of the pool. For new plaster pools, wait 10-14 days before adding salt to allow the plaster to cure. Run the filter pump for 24 hours with the suction coming from the main drain (use pool vac if there is no main drain) to allow the salt to evenly disperse throughout the pool.

Use common food quality salt usually available in 40-80 lb. bags labeled "Pool Salt" or "Coarse Solar Salt". Do not use rock salt, salt with yellow prussiate of soda, salt with anti-caking additives, or iodized salt.

STEP 3: Adjust Cyanuric Acid

Cyanuric Acid (Stabilizer) is very important to the performance of your chlorine generation system. It's a mild acid that helps prevent the breakdown of chlorine due to the sun's ultraviolet rays.

**IDEAL LEVEL: 60 - 80 ppm outdoor pools
20 - 40 ppm covered pools
0 ppm indoor pools**

Test your pool's Cyanuric Acid level using a pool test kit or bring a water sample to your local pool store.

Refer to Table 2 to determine the amount of Cyanuric Acid needed to raise the Cyanuric Acid to the desired level.

STEP 4: Adjust Total Alkalinity

Total Alkalinity (TA) is a measure of the total alkaline substances found in the pool water. The results of improper TA levels range from corrosion of metal pool parts, staining of the pool, burning eyes, cloudy water and reduced chlorine efficiency.

IDEAL LEVEL: 80 - 120 ppm

Test your pool's TA.

Refer to Table 3 to increase the pool's TA using Baking Soda (Sodium Bicarbonate 100%).

Refer to Table 4 to decrease the pool's TA using Muriatic Acid (Hydrochloric Acid 31.45%).

STEP 5: Adjust Total Hardness

Total Hardness is the measurement of the total amount of minerals that are found in your pool's water. Too much calcium hardness will cause scaling in your pool and too little will cause the pool water to become corrosive.

IDEAL LEVEL: 200 - 400 ppm

Test your pool's Total Hardness.

If low, add Calcium Chloride (77%) according to Table 5.

If Total Hardness is high, dilute or replace the pool water.

STEP 6: Adjust pH

pH is the measure of how acid/alkaline the pool water is. If pH is too low, the water can be corrosive to pool equipment. If pH is too high, then the chlorine becomes much less effective for sanitization.

IDEAL LEVEL: 7.2 - 7.8

Test your pool's pH.

To increase the pool's pH, add Soda Ash according to Table 6.

To decrease pool pH, add Muriatic Acid according to Table 7.



HAYWARD®

CHEMISTRY QUICK START GUIDE

Table 1

POUNDS and (Kg) OF SALT NEEDED FOR 3200 PPM

Current salt level (ppm)	12,000 (45,000)	14,000 (52,500)	16,000 (60,000)	18,000 (67,500)	20,000 (75,000)	22,000 (82,500)	24,000 (90,000)
0	320 (145)	373 (170)	427 (194)	480 (218)	533 (242)	587 (267)	640 (291)
200	300 (136)	350 (159)	400 (182)	450 (205)	500 (227)	550 (250)	600 (273)
400	280 (127)	327 (148)	373 (170)	420 (191)	467 (212)	513 (235)	560 (256)
600	260 (118)	303 (138)	347 (158)	390 (177)	433 (197)	477 (217)	520 (236)
800	240 (109)	280 (127)	320 (145)	360 (164)	400 (182)	440 (200)	480 (218)
1000	220 (100)	257 (117)	293 (133)	330 (150)	367 (167)	403 (183)	440 (200)
1200	200 (91)	233 (106)	267 (121)	300 (136)	333 (152)	367 (167)	400 (182)
1400	180 (82)	210 (95)	240 (109)	270 (123)	300 (138)	330 (150)	360 (164)
1600	160 (73)	187 (85)	213 (97)	240 (109)	267 (121)	293 (133)	320 (145)
1800	140 (64)	163 (74)	187 (85)	210 (95)	233 (106)	257 (117)	280 (127)
2000	120 (55)	140 (64)	160 (73)	180 (82)	200 (91)	220 (100)	240 (109)
2200	100 (45)	117 (53)	133 (61)	150 (68)	167 (76)	183 (83)	200 (91)
2400	80 (36)	93 (42)	107 (48)	120 (55)	133 (61)	147 (67)	160 (73)
2600	60 (27)	70 (32)	80 (36)	90 (41)	100 (45)	110 (50)	120 (55)
2800	40 (18)	47 (21)	53 (24)	60 (27)	67 (30)	73 (33)	80 (36)
3000	20 (9)	23 (11)	27 (12)	30 (14)	33 (15)	37 (17)	40 (18)
3200	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal
Above 3400	Dilute	Dilute	Dilute	Dilute	Dilute	Dilute	Dilute

Table 2

POUNDS and (Kg) OF STABILIZER (CYANURIC ACID) NEEDED FOR 80 PPM

Current Stabilizer level (ppm)	8,000 (30,000)	10,000 (37,500)	12,000 (45,000)	14,000 (52,500)	16,000 (60,000)	18,000 (67,500)	20,000 (75,000)	22,000 (82,500)	24,000 (90,000)
0 ppm	5.3 (2.4)	6.7 (3.1)	8.0 (3.6)	9.4 (4.3)	10.7 (4.9)	12.0 (5.4)	13.4 (6.1)	14.7 (6.7)	16.0 (7.3)
10 ppm	4.7 (2.1)	5.8 (2.7)	7.0 (3.2)	8.2 (3.7)	9.4 (4.3)	10.5 (4.8)	11.7 (5.3)	12.9 (5.9)	14.0 (6.4)
20 ppm	4.0 (1.8)	5.0 (2.3)	6.0 (2.7)	7.0 (3.2)	8.0 (3.6)	9.0 (4.1)	10.0 (4.5)	11.0 (5.0)	12.0 (5.5)
30 ppm	3.3 (1.5)	4.2 (1.9)	5.0 (2.3)	5.9 (2.7)	6.7 (3.0)	7.5 (3.4)	8.4 (3.8)	9.2 (4.2)	10.0 (4.5)
40 ppm	2.7 (1.2)	3.3 (1.5)	4.0 (1.8)	4.7 (2.1)	5.4 (2.4)	6.0 (2.7)	6.7 (3.0)	7.4 (3.3)	8.0 (3.6)
50 ppm	2.0 (0.9)	2.5 (1.1)	3.0 (1.3)	3.5 (1.6)	4.0 (1.8)	4.5 (2.0)	5.0 (2.3)	5.5 (2.5)	6.0 (2.7)
60 ppm	1.3 (0.6)	1.7 (0.8)	2.0 (0.9)	2.3 (1.0)	2.7 (1.2)	3.0 (1.4)	3.3 (1.5)	3.7 (1.7)	4.0 (1.8)
70 ppm	0.7 (0.3)	0.8 (0.4)	1.0 (0.5)	1.2 (0.5)	1.4 (0.6)	1.5 (0.7)	1.7 (0.8)	1.8 (0.8)	2.0 (0.9)
80 ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3

POUNDS and (Kg) OF BAKING SODA (SODIUM BICARBONATE 100%) NEEDED TO INCREASE TOTAL ALKALINITY TO THE RECOMMENDED RANGE

Desired Increase (ppm)	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	0.1 (0)	0.1 (0)	0.7 (0.3)	1.4 (0.6)	2.1 (1)	2.8 (1.3)	3.5 (1.6)
20 ppm	0.1 (0)	0.3 (0.1)	1.4 (0.6)	2.8 (1.3)	4.2 (1.9)	5.6 (2.5)	7 (3.2)
30 ppm	0.2 (0)	0.2 (0)	2.1 (1)	4.2 (1.9)	6.3 (2.9)	8.4 (3.8)	10.5 (4.8)
40 ppm	0.2 (0)	0.6 (0.3)	2.8 (1.3)	5.6 (2.5)	8.4 (3.8)	11.2 (5.1)	14 (6.4)
50 ppm	0.3 (0)	0.7 (0.3)	3.5 (1.6)	7.0 (3.2)	10.5 (4.8)	14.0 (6.4)	17.5 (7.9)
60 ppm	0.3 (0)	0.8 (0.4)	4.2 (1.9)	8.4 (3.8)	12.6 (5.7)	16.8 (7.6)	21 (9.5)
70 ppm	0.4 (0)	1 (0.4)	4.9 (2.2)	9.8 (4.4)	14.7 (6.7)	19.6 (8.9)	24.5 (11.1)
80 ppm	0.4 (0)	1.1 (0.5)	5.6 (2.5)	11.2 (5.1)	16.8 (7.6)	22.4 (10.2)	28 (12.7)
90 ppm	0.5 (0)	1.3 (0.6)	6.3 (2.9)	12.6 (5.7)	18.9 (8.6)	25.2 (11.4)	31.5 (14.3)
100 ppm	0.6 (0)	1.4 (0.6)	7.0 (3.2)	14 (6.4)	21 (9.5)	28 (12.7)	35 (15.9)

Table 4

OUNCES and (L) OF MURIATIC ACID NEEDED TO DECREASE TOTAL ALKALINITY TO THE RECOMMENDED RANGE

Desired Decrease (ppm)	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	1 (0)	2.5 (0.08)	13 (0.41)	26 (0.81)	39 (1.2)	52 (1.6)	65 (2)
20 ppm	2 (0)	5 (0.16)	26 (0.81)	52 (1.6)	78 (2.4)	105 (3.3)	131 (4)
30 ppm	3.2 (0)	8 (0.24)	39 (1.2)	78 (2.4)	105 (3.3)	131 (4)	166 (5)
40 ppm	4.2 (0)	10.5 (0.33)	52 (1.6)	105 (3.3)	157 (4.9)	208 (6.5)	260 (8)
50 ppm	5.2 (0)	13 (0.41)	65 (2)	131 (4)	196 (6)	260 (8)	323 (10)
60 ppm	6.2 (0)	15.5 (0.49)	78 (2.4)	157 (4.9)	225 (6.9)	314 (9.5)	390 (12)
70 ppm	7.2 (0)	18 (0.57)	91 (2.9)	183 (5.7)	275 (8.5)	366 (11.4)	457 (14)
80 ppm	8.4 (0)	21 (0.66)	105 (3.3)	208 (6.5)	312 (9.5)	416 (12.7)	520 (16)
90 ppm	9.4 (0)	23.5 (0.73)	118 (3.6)	235 (7.3)	353 (11)	470 (14.6)	588 (17.9)
100 ppm	10.4 (0)	26 (0.81)	131 (4.1)	260 (8.1)	390 (12.2)	520 (16.2)	651 (20.9)

Table 5

POUNDS and (Kg) OF CALCIUM CHLORIDE (77%) NEEDED TO INCREASE CALCIUM HARDNESS TO THE RECOMMENDED RANGE

Desired Increase (ppm)	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	0 (0)	0.1 (0)	0.6 (0.3)	1.2 (0.5)	1.8 (0.8)	2.4 (1.1)	3 (1.4)
20 ppm	0.1 (0)	0.2 (0)	1.2 (0.5)	2.4 (1.1)	3.6 (1.6)	4.8 (2.2)	6 (2.7)
30 ppm	0.1 (0)	0.4 (0.1)	1.8 (0.8)	3.6 (1.6)	5.4 (2.5)	7.2 (3.3)	9 (4.1)
40 ppm	0.2 (0)	0.5 (0.2)	2.4 (1.1)	4.8 (2.2)	7.2 (3.3)	9.6 (4.4)	12 (5.5)
50 ppm	0.2 (0)	0.6 (0.3)	3.0 (1.4)	6.0 (2.7)	9 (4.1)	12.0 (5.5)	15 (6.8)
60 ppm	0.3 (0)	0.7 (0.3)	3.6 (1.6)	7.2 (3.3)	10.8 (4.9)	14.4 (6.5)	18 (8.2)
70 ppm	0.3 (0)	0.8 (0.4)	4.2 (1.9)	8.4 (3.8)	12.6 (5.7)	16.8 (7.6)	21 (9.5)
80 ppm	0.4 (0)	1 (0.4)	4.8 (2.2)	9.6 (4.4)	14.4 (6.5)	19.2 (8.7)	24 (10.9)
90 ppm	0.4 (0)	1.1 (0.5)	5.4 (2.4)	10.8 (4.9)	16.2 (7.3)	21.6 (9.8)	27 (12.2)
100 ppm	0.4 (0)	1.2 (0.5)	6.0 (2.7)	12 (5.4)	18 (8.1)	24 (10.9)	30 (13.6)

Table 6

OUNCES AND (GRAMS) OF SODA ASH (SODIUM CARBONATE) NEEDED TO RAISE pH TO THE RECOMMENDED RANGE

CURRENT pH	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
7.0 - 7.2	0.25 (8.5)	0.75 (21.3)	4 (113)	8 (227)	12 (340)	16 (454)	20 (568)
6.7 - 7.0	0.5 (14)	1.25 (35.4)	6 (170)	12 (340)	16 (454)	24 (681)	32 (908)
under 6.7	0.6 (17)	1.5 (42.5)	8 (227)	16 (454)	24 (681)	32 (908)	40 (1100)

Table 7

OUNCES AND (GRAMS) OF MURIATIC ACID NEEDED TO LOWER pH TO THE RECOMMENDED RANGE

CURRENT pH	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
7.8 - 8.0	0.6 (17)	1.5 (43)	8 (225)	16 (454)	24 (680)	32 (900)	40 (1125)
8.0 - 8.4	1.0 (28)	2.5 (70)	12 (340)	24 (680)	36 (1020)	48 (1360)	60 (1700)
over 8.4	1.2 (35)	3 (86)	16 (454)	32 (900)	48 (1350)	64 (1800)	80 (2250)

Balancing pool and spa water is perhaps the fundamental job of the service pro, and total alkalinity is a key parameter in that process.

The proper total alkalinity level in pool or spa water provides buffering so pH does not swing in and out of the proper range in response to sanitizer addition, bather load or other factors. With too little alkalinity, there will not be enough buffering and the pH may quickly drift out of the proper range. At excessively high bicarbonate/carbonate alkalinity, there will be a tendency for the pH of the water to drift upward, due to the rapid escape of carbon dioxide from the water into the air.

In addition to these effects on pH, the portion of the alkalinity coming from carbonate and bicarbonate, called carbonate alkalinity, also affects calcium carbonate saturation. The maintenance of calcium carbonate concentration within the recommended range reduces the tendency of pool water to scale or degrade pool surfaces. When total alkalinity is properly adjusted, optimum buffering results are achieved; pH, swimmer comfort, sanitizer efficacy, water balance and clarity are more easily maintained.

How To Adjust

Total alkalinity should be corrected before adjusting pH or sanitizer levels. (See notes below regarding "Adjusting for the Effect of Cyanuric Acid on Total Alkalinity.")

To reduce total alkalinity, acid is added to the water. Approximately 2.1 pounds of sodium bisulfate (94 percent) or 1.6 pints of muriatic acid (31 percent) will reduce the total alkalinity of 10,000 gallons of water by 10 ppm.

To increase total alkalinity, use sodium bicarbonate. Approximately 1.5 pounds of sodium bicarbonate (100 percent) will raise the total alkalinity of 10,000 gallons of water by 10 ppm.

Adjusting for Effect of Cyanuric Acid on Total Alkalinity:

Dichlor and trichlor sanitizers release cyanuric acid, which serves to stabilize the chlorine sanitizer. Cyanuric acid stabilizer may be added separately as well. The cyanurate system is a weak buffer and will contribute to the total alkalinity measurement.

To determine the carbonate alkalinity in a stabilized pool or spa:

1. Measure the pH
2. Measure total alkalinity (TA)
3. Measure cyanuric acid concentration (CA). If the CA is 90ppm or greater, it may be necessary to dilute the pool water sample with tap water to get an accurate reading.
4. Note the Cyanuric Acid Correction Factor in Table 1, based on the pH of the water.
5. Adjust the CA and subtract this result from the total alkalinity for the actual or corrected TA.
6. Formula : $\text{Measured TA} - (\text{CA} \times \text{Cyanuric Acid Correction Factor}) = \text{Carbonate Alkalinity}$

Example: pH is 7.4. Total Alkalinity measurement (Measured TA) is 110 ppm. Cyanuric Acid level is 100 ppm.

Cyanuric Acid Correction factor at pH 7.4 is 0.31. (See table above)

Using the formula:

$110 \text{ ppm} - (100 \times 0.31) = 110 - 31 = 79 \text{ ppm carbonate alkalinity}$

What is Total Alkalinity?

Total alkalinity is the amount of bicarbonate, plus the much smaller amount of carbonate, plus (in stabilized pools) the amount of cyanurate ions. It is a measure of the pH buffering capacity of water; that is, the ability of water to resist a pH change. Alkalinity is generally expressed in terms of the equivalent concentration of calcium carbonate in ppm.

The Right Amount of TA

Total alkalinity should be maintained between a minimum 60 and a maximum of 180 ppm as CaCO_3 (calcium carbonate). Ideally, total alkalinity should be maintained between 80 and 100 ppm as CaCO_3 where electrolytic chlorine generators, calcium hypochlorite, lithium hypochlorite and sodium hypochlorite are used, because these sanitizers cause the pH to rise. The ideal range where sodium dichlor, trichlor, chlorine gas and bromine compounds are used is between 100 and 120 ppm as CaCO_3 , because these sanitizers will cause the pH to drift downwards. Certain systems such as PHMB are relatively unaffected by and do not impact total alkalinity.

pH	Correction Factor
7.0	0.23
7.2	0.27
7.4	0.31
7.6	0.33
7.8	0.35
8.0	0.36