

Maintenance recommendations for AGAM reinforced PVC residential swimming pool liners

Introduction: As owner of a new AGAM reinforced PVC (polyvinyl chloride) swimming pool liner you will want your pool to look beautiful for many seasons. The surface appearance of the liner is constantly exposed to extremely harsh elements like sunlight, temperature fluctuation, toxic chemicals and sometimes incorrect and uninformed cleaning methods. The two most frequent causes of damage to pool liners are:

- premature pattern wear due to abrasive cleaning methods, and
- Bleaching and staining due to improper chemical balance.

We recommend that you adhere to the following simple tips that will grant you many years of service, as well as savings on operational and up-keep expenses:

- Always carefully read and follow the manufacturers' directions for usage.
- Add chemicals to the water, never add water to chemicals.
- Add one chemical at a time. Never mix them together.
- Add each chemical through the skimmer, or equalization tank, for effective dispersion throughout pool's filtration system.
- Non dissolved chemicals in the water will sink and may cause unsightly stains on the liner floor.

There are four groups of chemicals for treating swimming pool water called balancers, sanitizers, oxidizers and algaecides. Each group is described in the following:

Balancers are chemicals that adjust three of the natural properties of water to provide a suitable environment for the other chemicals to function properly.

PH level

- In order to efficiently sanitize the pool water so that it is safe for bathing and will protect your liner, it is very important to frequently test and maintain a correct pH level, (a scale indicating when a liquid is acidic, neutral or alkaline).
- Water that is sanitized with **chlorine**, the pH value should be within the range of 7.2 – 7.6, so that the chlorine can be an effective sanitizer.
- For **bromine**-based sanitizers, an acceptable pH range is 7.2 to 7.8.
- A **low pH level** will damage the AGAM liner and pool equipment, and will:
 - cause stains on the liner surface
 - irritate the bathers' eyes
 - cause a rapid decrease in chlorine level
 - To **raise the pH level**, use an alkaline additive (Soda Ash or Caustic Soda), which is available from a local swimming pool supplier.
- A **high pH level** above 7.8 reduces the efficiency of the sanitizer, resulting in:
 - turbid (cloudy) water, and the
 - formation of scale on the liner and pool equipment
- To **lower the pH level**, add hydrochloric acid (HCl or pH Minus) which is available from any local pool supplier.

Alkalinity Level

- Alkalinity is the measure of dissolved alkaline salts in the water.
- Alkalinity above 200 mg/l can inhibit pH adjustment and cause cloudy water.
- To raise alkalinity levels use SODIUM BICARBONATE.
- To reduce the alkalinity levels, add HYDROCHLORIC ACID (muriatic acid).

Total Hardness

- Pool water is "soft " or "hard" depending on the amount of dissolved calcium and magnesium salts. Soft water has less than 50 mg/l of these salts and hard water more than 300 mg/l.
- Test swimming pool water periodically for total hardness and keep **calcium hardness** levels in check. Total hardness test strips can be purchased from local pool supplier.
- At least once a year, take a sample of pool water for laboratory testing. Consult with a professional if the calcium levels are extremely high and difficult to control.
- If the calcium hardness level is too low, the water may be corrosive. Add calcium chloride to the water to obtain an ideal level of 200 ppm.
- If the calcium hardness level is too high, the water may be inclined to form scale. Reduce the calcium hardness by replacing some of the water in the pool.

Sanitizers and Oxidizers are the first line of defense against bacteria, dirt, pollen, body oils, suntan lotion and organic waste.

Sanitizers penetrate the outer membrane of organic particles and destroy them. They also bind themselves to inorganic particles and render them ineffective on a molecular level. Both situations leave the remains of the bound or destroyed cells in the pool, which may appear as cloudy water.

Oxidizers burn up and remove the debris left by the sanitizer helping to keep the water clear and, for the most part, free of contaminants. Oxidizers also keep fungus and algae from taking up residence in your pool. Failure to eradicate these and other contaminants can lead to infection and sickness.

Following are the primary methods of sanitizing and oxidizing the pool water:

Chlorination

- Chlorination is a very popular method of sanitizing swimming pool water.
- The concentration of active **free chlorine** in the water shall not be less than 0.8 ppm or exceed 2.0 ppm (parts per million).
- Chlorine is quickly broken-up by UV radiation and needs to be stabilized with **cyanuric acid**, which must be kept below 60 ppm by periodic partial water replacement.
- Chlorine raises the pH level, which reduces the sanitizing power of the chlorine.
- **Combined chlorine** is chlorine that has joined with ammonia forming chloramines that adversely affect the sanitizing process. High levels of combined chlorine can cause a bad odor in the pool and irritation to bathers' skin and eyes. If the combined chlorine level exceeds 0.2 ppm, super-chlorination must be conducted (see below).
- Inhalation of chlorine vapors is irritating to the respiratory system and may cause throat pain and cough. Acute inhalation of chlorine at low to moderate levels will not cause permanent lung damage. At high levels, chlorine is corrosive to the respiratory tract and may cause lung damage.

Chlorine Gas

- Chlorine gas is 100% available chlorine and should NEVER be used in residential pools.
- Chlorine gas is best suited for commercial pools in hard water areas which counterbalances the above described acidity effect.

Sodium Hypochlorite

- Sodium hypochlorite is the most popular of the disinfectants used in swimming pool water.
- It is a pale yellow liquid with the characteristic smell of household bleach.
- The commercial product contains between 10 - 15% available chlorine which is considerably more than the domestic product.
- Requires a stabilizer (cyanuric acid) to increase its active duration in the water.
- Even with cool and dark storage conditions sodium hypochlorite slowly breaks down losing its available chlorine content.

Calcium Hypochlorite

- Calcium hypochlorite is a stable alternative to sodium hypochlorite. In some markets it is referred to as HTH.
- Available commercially in granular form, or as tablets, it usually contains 65% available chlorine, which is considerably more than sodium hypochlorite.
- Calcium Hypochlorite in granular form is dissolved in water and pumped into the pool circulation system automatically. The tablets are placed in a feeder system through which the pool water flows, or alternatively placed in the skimmer baskets.
- Calcium Hypochlorite is often used for super-chlorination and must be completely dissolved in water when used in pools with PVC liners. **Non dissolved particles will stain PVC floor.**

Chlorinated Isocyanurates (stabilized chlorine). Two popular compounds that combine chlorine and the stabilizing agent, cyanuric acid:

Di-Chlor (sodium dichloroisocyanurate) - in granular form:

- Contains about 60% available chlorine dissolves quickly in water and will not radically change the pH level of the water.
- When dissolved in water, Di-Chlor produces hypochlorous acid (free chlorine) and cyanuric acid.
- It is important to monitor the concentration level of the cyanuric acid to prevent **chlorine-lock**, which occurs when free chlorine is locked into over-stabilized water, rendering it inactive.

Tri-Chlor (tri-chloro-isocyanuric acid) - in tablet form:

- Contains about 90% available chlorine, dissolves slowly in water with a low pH that may necessitate adjustment with a pH plus product.
- When dissolved in water, Tri-Chlor produces hypochlorous acid and cyanuric acid.
- Like Di-Chlor, it has the same potential to cause chlorine-lock.
- Add to water via a flow-through erosion feeder, floaters or skimmer baskets.

Salt Electrolysis'

- Sanitizing with salt water has the benefits of conventional chlorinated water. This system softens the water, reduces swimsuit discoloration, dry skin and hair, eye irritation, and obnoxious odors.
- The amount of salt in the water can range from 3,000 to 5,000 ppm. Check the salt level periodically with salt test strips.
- When the water is circulating, the salt water passes through an electrode that uses electrolysis to break up the salt (sodium chloride) molecules into sodium and chlorine, also a hydrogen atom is released from the water molecules.
- The hydrogen and chloride join to form chlorine (sodium hypochlorite), which after sanitizing the water, reunites with the sodium turning back into salt, and the process begins over again.

- The salt chlorinator control box should alert when salt levels are low and need to be adjusted.
- Most salt water chlorinators use built-in reversed polarity to self-clean, but periodic submersion of the electrode in diluted hydrochloric acid is recommended.
- High calcium levels in the water can cause scale to clog the electrode.

Bromine

- Bromine has similar sanitizing properties to chlorine in the treatment of swimming pool water.
- Eye irritation is virtually totally absent in bromine treated pools.
- Due to special handling precautions, bromine is not popular.
- It is a heavy red corrosive liquid which gives off pungent fumes.

BCDMH (bromo-chloro-di-methyl-hydantoin)

- A safe system which contains both bromine and chlorine molecules.
- Usually supplied as tablets containing 61% available bromine and 27% available chlorine.
- BCDMH dissolves in the water to release both free bromine as the primary sanitizer, and free chlorine as a secondary sanitizer.
- BCDMH is a stable compound when kept in a cool and dry place.
- BCDMH may cause elderly bathers to develop an itch followed by a rash within 12 hours of exposure to water treated with this chemical.

Biguande

- Polyhexamethylene biguanide (PHMB) is a non-chlorine bactericide developed for use in private swimming pools fitted with an ozone device (see below).
- PHMB and chlorine are incompatible and must not be mixed in the water.
- It is crucial to get rid of all traces of chlorine from the water before adding PHMB, this is done by adding Sodium Thio-sulphate.
- PHMB also works as a flocculent so it is advised to backwash of the filter more often.

Ozone

- Ozone is a rapid sanitizer and a powerful oxidizing agent for water sanitization preventing the accumulation of undesirable, odor producing by-products.
- It is a dynamic gas which reacts upon contact with bacteria and impurities killing them faster than chlorine.
- Ozone is an unstable toxic gas that quickly reverts back to oxygen. It must be generated on-site and added immediately into the circulating pool water, after filtration, then removed from the water by means of a deozonising activated carbon filter, before reentering the pool.
- Ozone is an efficient flocculent leaving the treated water remarkably clear.
- In residential pools, ozone is sometimes the only method of sanitizing. A copper-based algaecide may provide a back up and a small amount of chlorine should be added after excessive bather load.

Super-chlorination

- Super chlorination, once a week, is the process of oxidizing pool water with a large dose of chlorine and keeps the water free from disease and parasites.
- Chloramines are formed when chlorine combines with organic and inorganic material in the water. These chloramines need to be removed from the water, along with ammonia resulting from urine and perspiration.
- This process will also relieve burning eyes, clear cloudy water and deal with bad smells.
- Super chlorination overpowers impurities and oxidizes contaminants.

- After cleaning the pool and a running a good back-wash; while the water is circulating, pour an adequate amount of Pool Shock (calcium hypochlorite) into the skimmer basket so that the free chlorine level rises to 10 ppm.
- Super chlorination is always done when there are **no bathers in the water**.

Note: Hydrogen peroxide is a primary ingredient in other oxidizers, which also requires careful handling due to its caustic nature.

Algaecides: Algae pose a danger causing the pool surfaces to be slippery. The water turns a cloudy green and the algae will eventually block the filter. Failure to always maintain adequate free chlorine in the water is why algae grow. There are three product types that avert algae:

- **Quaternary Ammonium Compounds** (QAC's) are a type of algaecide composed of ammonia compounds.
- **Polymeric Copper** binds organic molecules and reduces toxicity to bathers while still effective against algae. It is often used to prevent deterioration of the water over the winter season.
- **Copper Sulfate** is no longer used as an algaecide because it can cause problems with staining of pool surfaces, especially at pH values over 7.4.

Miscellaneous

Pool Water Temperature: The recommended water temperature for residential swimming pools is 24-29°C. Temperatures exceeding 32°C may cause damage or reduce the life span of the liner and pool equipment. The following may occur:

- Microbiological activity and chemical use will increase
- Liners could expand and lose their elasticity, wrinkle or become brittle or delaminate.
- Plastic hardware, pipes and fittings may distort.

Cleaning a swimming pool filter.

A swimming pool filter is a key component in the pools filtration system. The filter's function is to catch minute particles, algae and debris suspended in the pool water so it will be clean and clear. Pool filters need to be cleaned weekly to ensure maximum efficiency. Following are the key steps **how to clean** the most common filtration systems:

Cartridge Filter

- Turn off the circuit breaker.
- Close all valves on pipe lines to and from the pool.
- Press the safety latch and unscrew the filter lid counterclockwise. Lift off the lid and carefully lift out the filter cartridge.
- Wash the cartridge with a garden hose. Begin at the top of the filter and work down cleaning both the inside and out. Clean between all the pleats and continue to do so, until the water runs clean and clear from the cartridge.
- Wash the inside of the filter and let the water drain out.
- If necessary soak the cartridge in a diluted solution of laundry detergent and water. Dissolve the detergent in a bucket of water and place the cartridge in the solution to soak for several hours. Note: Some manufacturers provide cartridge cleaning containers.
- Rinse the cartridge well and reinstall it into the filter housing. Replace the lid onto the filter and screw tightly. The filter is now ready for use, open all valves, and restore power to the pump.

Sand Filter

- Sand filters are easy to clean and use. When the pressure gauge shows that the pressure is high, the filter needs to be cleaned.

- Set the multi-port valve on the filter to the backwash position. This allows the water to flow through the filter medium in a reversed direction and out to waste until the water is clear. This eliminates most of the debris in the filter.
- Then turn the multi-port valve to rinse and run until the water is clear. This phase helps to resettle the filter medium as per its specific weight. Repeat backwash and rinse again if needed.
- The sand should be changed after 5 years.
- **Note:** Turn off the pump every time the position on the multi-port valve is changed.

Diatomaceous Earth Filter

- Uses diatomaceous earth as the filter medium.
- The D.E. is added through the skimmer with the pump on, which deposits the D.E. on a grid and becomes the filter medium.
- Remove and charge the filter with diatomaceous earth as per to manufacturer's instructions.
- Never use flocculants with D.E. filters.

Cleaning the pool: The pool walls, on and above the water line, need to be cleaned from time to time with a non foaming soap and a non-abrasive soft sponge or cloth. The pool floor should be cleaned with a vacuum sweeper or robotic cleaner designed for PVC liner pools.

Flocculation: In order to remove finely dispersed particles suspended in the water, a flocculent is added to the pool water that causes the particles to bind and form larger particles which can be caught by the filter media and removed from the water. Following is a list of some of the more popular flocculants:

- ALUM (aluminum sulphate)
- PAC (polyaluminium chloride or aluminum hydroxychloride)
- SODIUM ALUMINATE

Chemically they all behave in similar ways by forming a gelatinous precipitate by hydrolysis.

How to care for a pool when not in use: The first step in preparing the swimming pool for winter is to check and adjust the chemistry balance of the water, (pH, Alkalinity and Calcium Hardness). This will protect the pool surface from staining and deterioration. Add a winterizing chemical kit to the water to help keep it blue and clear for the next season. Be sure to follow the manufacturer's instructions for the kit. Do not use a floater that contains a strong oxidizer (chlorine or bromine) as the floater may stick against the wall and stain or bleach the liner wall; DO NOT throw chlorine or bromine tablets into the pool. They will sink to the bottom and stain the surface of the floor.

When water freezes, it expands and causes damage to the pool structure, plumbing, and filter system. It is advisable to take precautions to prevent freeze damage. Even in moderate climates the temperature could fall below zero. A good idea is to float a number of empty sealed plastic bottles with anchors tied to the head – they will absorb the expanding surface ice and prevent damage to the swimming pool.

Lower the water just below the mouth of the skimmer(s). This will get the water out of the throat of the skimmer which can be damaged if the water was to freeze. Also, the water will continue to support the pool cover, if there is one.

Reset the timer so the pump will circulate water from the main drain only for short periods several times each day and during the night (depending on climate severity). This will maintain water integrity and prevent it from freezing in the pipes and pump.

Harmful materials:

Contact of reinforced PVC liner with the following materials must be prevented:



- Tar and bitumen
- Technical oils and grease
- Solvents and paints
- Petroleum products

In addition, rubber that comes in contact with the reinforced PVC liner, especially under direct solar radiation, might cause staining of the liner material.

Glossary:

Alkalinity	A measure of the ability of a solution to neutralize acids to the <u>equivalence point</u> of carbonate or bicarbonate. Sometimes incorrectly used interchangeably with <u>basicity</u> .	
Alum (hydrated aluminum potassium sulfate)	$KAl(SO_4)_2 \cdot 12H_2O$	Alum is added to the pool water that causes the particles to bind and form larger particles which can be caught by the filter media and removed from the water.
Aluminum Sulphate	$Al_2(SO_4)_3 \cdot 16H_2O$	Sometimes called alum in informal contexts, but this usage is not regarded as technically correct. Its properties are quite different.
BCDMH (bromo-chloro-di-methyl-hydantoin)	An excellent source of chlorine and bromine as it reacts slowly with water releasing hypochlorous acid. It is used as a chemical sanitizer for recreational water.	
Bromine	Br	Bromine is a powerful <u>oxidizing agent</u> . It reacts vigorously with metals, especially in the presence of water, as well as most organic compounds.
Calcium Hardness	The presence of calcium ions in water, from dissolved carbonates and bicarbonates.	
Calcium Hypochlorite (HTH)	$Ca(OCl)_2 \cdot 4H_2O$	A white powder, used as a bleaching agent and sanitizer in pools.
Caustic Soda (sodium hydroxide)	NaOH	Forms a strong <u>alkaline</u> solution when dissolved in water.
Chlorine	Cl	Chlorine is a powerful <u>oxidant</u> and is used in <u>bleaching</u> and disinfectants.
Cyanuric acid	$C_3H_3N_3O_3$	Used as a <u>stabilizer</u> in recreational <u>water</u> treatment to minimize the decomposition of <u>hypochlorous acid</u> by sunlight in outdoor <u>swimming pools</u> and <u>hot tubs</u> . It achieves this by absorbing UV radiation.
Di-Chlor (sodium dichloroisocyanurate)	$C_3Cl_2N_3NaO_3$	A stable source of <u>chlorine</u> used as a <u>disinfectant</u> , <u>biocide</u> , industrial <u>deodorant</u> and <u>detergent</u> . In small doses it is common in <u>water purification</u> tablets/filters.
Hydrochloric acid	HCl in <u>water</u> (H_2O)	Used to control the pH of water.
Hypochlorous acid	HClO	An active sanitizer in hypochlorite based swimming pool products. It forms when <u>chlorine</u> dissolves in water.
PAC (polyaluminium chloride)	$Al_2(OH)_NCl_{6-N}L_M$	It has high rapidity of flocculation and deposition.
pH (potential of hydrogen)	A measure of the <u>acidity</u> or <u>alkalinity</u> of a solution. The pH of 7.0 is defined as 'neutral' at 25 °C	
PHMB (polyhexamethylene biguanide)	A non-chlorine bactericide developed for use in private swimming pools fitted with an ozone device.	
Polymeric Copper	Binds organic molecules and reduces toxicity.	
PVC (Polyvinyl chloride)	A synthetic thermoplastic material made by polymerizing vinyl chloride.	
Quaternary Ammonium Compounds (QAC's)	A type of algacide composed of ammonia compounds.	
Sodium	$Na_2Al_2O_4$	Used as an addition to water softening systems, as a <u>coagulant</u> aid to

Aluminate		improve <u>flocculation</u> , and for removing dissolved <u>silica</u> and <u>phosphates</u> .
Soda Ash (Sodium carbonate)	(Na_2CO_3)	Used as a pH regulator to maintain stable alkaline conditions.
Sodium Bicarbonate	NaHCO_3	Sodium bicarbonate also has the unique ability to neutralize substances that are more basic than it is.
Sodium Hypochlorite	$\text{NaOCl}\cdot 5\text{H}_2\text{O}$	An unstable salt that is usually stored in solution and used as a fungicide and oxidizing bleach.
Sodium Thio-sulphate	$\text{Na}_2\text{S}_2\text{O}_3$	Used to remove excess chlorine from chlorinated water.
Tri-Chlor (tri-chloro-isocyanuric acid)	$\text{C}_3\text{Cl}_3\text{N}_3\text{O}_3$	A combined sanitizer, algacide and bactericide for swimming pools.