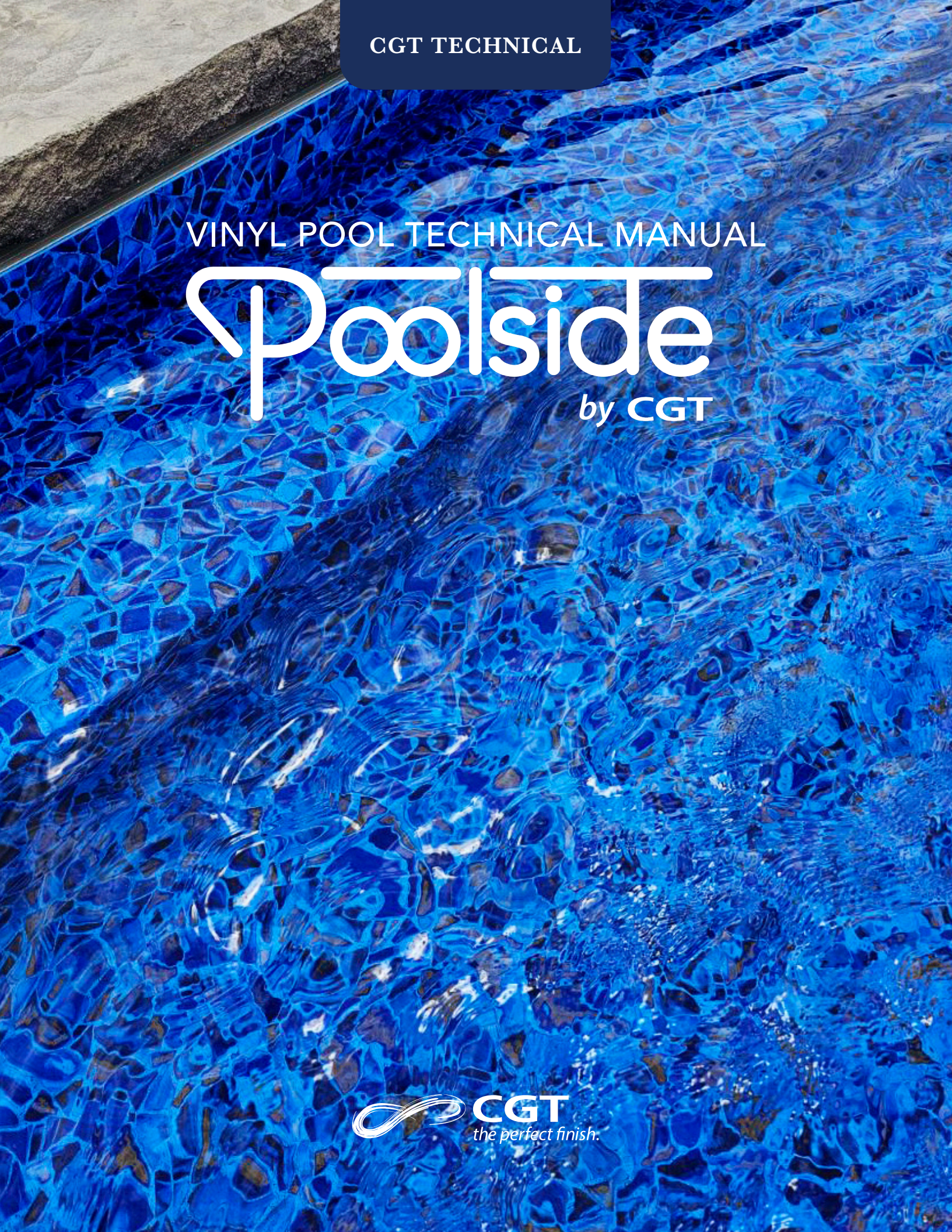
CGT TECHNICAL

VINYL POOL TECHNICAL MANUAL

Poolside by CGT



CGT
the perfect finish.

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INTRODUCTION

CGT is one of the world's leading producers of polymeric films for automotive and industrial applications. Since its beginnings as 'Victoria Wheel Works' in 1869, CGT has manufactured billions of yards of material to suit many applications – every yard bearing the same first-class quality.

CGT first began producing vinyl pool liner film at the Cambridge, Ontario plant in 1968. Today, it is the largest manufacturer of vinyl for inground pools in North America – and every yard is still manufactured in Cambridge, Ontario, Canada. CGT is the first step in the supply chain carrying high quality vinyl to your swimming pool. In our process, we transform raw chemicals into rolled vinyl goods. Design and printing are done in-house, allowing CGT to remain at the cutting edge of design trends much larger than what goes into a pool. Our rolled goods are shipped to our skilled customers – liner fabricators – who cut and weld our printed film to fit the custom shape of every pool.

The purpose of this manual is to bring into one place information that supports dealers and homeowners when they experience issues, directions toward solving some somewhat uncommon problems, and clarity regarding some myths about vinyl liners that are present in the industry (or on the internet).

VINYL POOL LINER:

CGT vinyl is engineered to provide an impervious, water-tight finish to various types of pool structures, while also giving the pool surface a pleasant feel and appearance. The customizability allows homeowners to choose a vinyl liner that suits their personal tastes, whether that's a classic mosaic tile or a soft natural marble.

The combination of design and technical requirements make vinyl liners quite a unique product.

Benefits

Vinyl is the most flexible finish available for swimming pools. Most commonly used as a surface in pools constructed of stainless steel, vinyl can be welded into any shape that can be drawn and cut. Vinyl pools can therefore be larger and deeper than those made from materials like fiberglass. A common misconception about vinyl liners is that they don't last a long time. Rest assured that there are examples of high-quality liners – combined with excellent care – that have remained water-tight more than 20 years. It is noteworthy that the structural components of the pool (e.g. steel or concrete) can last longer still – even more than 40 years.

Within the lifetime of the pool, the owner may feel the need for an update. CGT has a huge range of vinyl colours and prints available, giving a lot of options that suit many styles. A wide range of colours also means a variety of pool water colours can be achieved. When it's time, a brand-new liner can be installed with only a few days' work. Steel structures can be changed relatively easily as well. Renovations including the addition of steps or widening of a pool are possible and come at a much-reduced cost compared to a whole new pool.

A great benefit of vinyl is its recyclability. As a thermoplastic, vinyl can be recirculated through manufacturing processes instead of heading directly to landfill. At CGT, over 91% of waste material is reused or recycled, with no impact on the final properties of the material. Vinyl is also a great candidate for the recycling of post-consumer waste, as used material can be re-ground and used in lower-value products like window profiles, fences, and in multi-ply construction products.

Technology

CGT vinyl is an engineered material. Choosing high quality film ingredients ensures that we meet our own strict specifications for pool film, and high quality pigments and printing inks ensure a lasting finish to every pool made using CGT material. It is important to know that not all vinyl is created equal – our fabricators purchase material from multiple sources to suit their design and pricing needs – so be sure to ask which materials are from CGT.

Characteristics of pool vinyl can be modified to better suit the requirements of the end-user. For example, heavier gauge pool material may be used where liners run higher risk of puncture, like if the pool is utilized by pets. Multi-ply reinforced materials may be used in commercial applications, where bather loads are very high, or where even greater longevity of the material is required. In fact, it is not recommended to supply non-reinforced vinyl pool liners for commercial applications as operation of these pools at or below the maximum recommended sanitizer levels does not appear to be feasible. The best material for commercial installations is reinforced 3-ply PVC pool liner sheeting.

CGT's collection of residential vinyl liners also contains premium products that are enhanced with exclusive decorative effects and added protection to the vinyl. Some designs may combine two or more aqua features and are marked with each applicable feature icon.

A few features that add decorative finishes are aquashift, aquashimmer, aquasense, and aquasculpt. Aquashift adds a colour changing sparkle. Aquashimmer adds a shimmering metallic golden or silver ink. Aquasense adds an embossed texture for a realistic look and feel. Aquasculpt is a groundbreaking process that redefines vinyl pool liner surface design by combining advanced printing techniques with intricate embossing. This innovative method creates decorative textures that enhances the visual appeal of any vinyl pool surface and offers a realistic look and feel that engages the senses for a completely new liner experience.

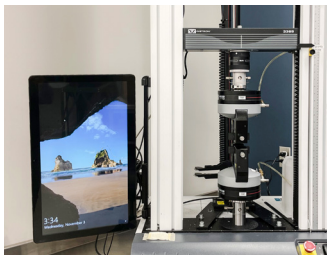
Specifications

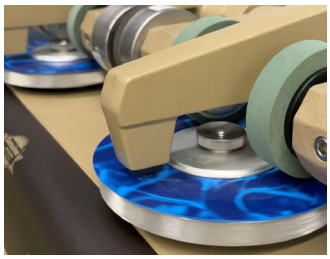
CGT pool vinyl goes through rigorous testing to guarantee a high level of performance. Physical tests like tensile strength and elongation, seam testing, and cold-weather impact guarantee the strength and durability of the material. Appearance-oriented tests like ink adhesion, UV weathering performance, and chlorine exposure, coupled with visual inspection of every printed yard, ensure pools look great for a long time. An overview of our testing parameters is provided on the next page.

These standards were written by the Chemical Fabrics & Film Association Inc. (CFFA) in collaboration with industry partners such as CGT. The CFFA is an international trade association representing manufacturers of polymer-based fabric and film products used in industries such as construction, automotive, and healthcare.

The CFFA Vinyl Pool Liner Standard Certification Program provides a practical means to identify vinyl film used for in-ground pool liners that is in compliance with CFFA's Recommended Minimum Performance Standards for Vinyl Swimming Pool Liners – In-Ground – CFFA-P-101 (CFFA-P-101). By choosing CFFA-P-101 certified products, you can be sure a product complies with the standard.

These are the minimum performance standard for vinyl used as in-ground swimming pool liners and should not be construed as a technical datasheet. For access to our full technical datasheets, please contact our sales team.




PROPERTY	TEST METHOD	VALUE
Accelerated Light Aging* Xenon Arc UV Fluorescent	CFFA 2b CFFA 2c	200 hours for min. film color change. 1500 hours for min. polymer degradation. No cracking**
CaCO3 Content, %	CFFA 210	3% Max.
Density ***	CFFA 21	1.23 – 1.28
Dimensional Stability (% change max., 212oF (100oC) for 15 min.	CFFA 22	MD -4.0% change max
Lay-flat (Belly or Baggy Center)	CFFA 221	-0%, +1.8%
Low Temperature Impact (Pass, degrees F, +/-2o) at -20o	CFFA 23	8 out of 10 is passing
Mildew Resistance	CFFA 120	No Growth
Pink Stain	CFFA 121	No Stain
Print Abrasion Resistance **** Taber Method (CS 17 Wheels, 500 gram weight, for 300 cycles)	CFFA 200b	No ink loss
PVC Roll Contour or Racetracking	CFFA 240	+1.8%
Snap Back (%, max.)	CFFA 241	-2.0% max
Soapy Water Extraction: % weight loss, max., 24 hrs @ 104°F (40°C)	CFFA 25	0.35
Tear Resistance:	CFFA 26a Graves Method	MD 220 lbs./in, min TD 220 lbs./in., min
Tensile Properties of Thin Plastic Sheeting Tensile Strength at Break Elongation @ Break (Ultimate Elongation) 100% Modulus	CFFA 27	MD 2300 psi min. TD 2000 psi min. MD 300% min. TD 300% min. MD 950 psi min. TD 950 psi min.
Thickness, Specified Value +/-5% Minimum nominal thickness 20 mil	CFFA 700	Nominal
Volatility (% weight loss, max.)	CFFA 270	1.0

POOL AND LINER CARE

CGT works closely with industry professionals to understand optimal water chemistry and treatment protocols to ensure a sanitary and enjoyable swimming pool. For our detailed recommendations on water chemistry and cleaning, see our Vinyl Pool Care Manual: https://www.poolsidebycgt.com/technical-information/.

Caution **– Always follow the chemical manufacturers recommended procedure for chemical handling and addition to a swimming pool. Chemicals purchased for use in a pool are highly concentrated and therefore hazardous upon exposure. CGT cannot take responsibility for any damage incurred resulting from the `use of the chemicals below.**

POOL CHEMICALS

Alkalinity

Total Alkalinity (TA) is a measure of pool water's ability to resist changes in pH. It is critical to maintain alkalinity to keep a stable pH and ensure effective sanitization of the pool.

Sodium bicarbonate (baking soda, bicarb) is used to increase the alkalinity of swimming pools. It is a weakly basic chemical that naturally maintains a buffer called the carbonate buffer. According to Arm & Hammer, a rule of thumb is that for every 10,000 gallons of water in the pool, 1.5 lbs of bicarb will increase alkalinity by about 10 ppm.

Calcium Hardness

Calcium hardness is related to the same 'water hardness' that can cause scale in sinks and showers. It is critical to maintain an appropriate calcium hardness level to prevent corrosion of fixtures (water is too soft) or scaling of pool surfaces (water too hard).

Calcium Chloride is used to increase the hardness of pool water

Calcium hardness reducers cannot permanently decrease the level of calcium in the water. They bond with the calcium, precipitate out of the water, and then must be vacuumed up. While doing this, it helps to softly brush the walls of the pool to lift any calcium deposits. If left in the pool water, within a month the calcium-reducer product will break down again, and the water will return to its original hardness level.

Typically, water must be drained and re-filled in order to remove calcium, but this will only be feasible if the calcium in the fill water is significantly lower than that in the pool. There are products that can reduce scaling if decreasing calcium is not possible by this method, such as chelating agents.

pH

pH is a measure of the acidity / basicity of water. Acidic water has a pH below 7.0, and alkaline (or basic) water has a pH above 7.0. A pH of 7.0 is neutral. The ideal range for pH in a pool is between 7.4 and 7.6, which is slightly basic. pH should not be brought below 7.2 or allowed to rise above 7.8. The natural tendency of pools is for pH to drift higher.

Muriatic Acid (hydrochloric acid, HCl) is the most common pH reducer and comes in liquid form. You should know that: acids like muriatic acid are inherently harmful to vinyl under direct contact. Care should be taken not to let acids drip down the wall of the pool, and areas where there has been exposure should be rinsed. Avoid large single additions of muriatic acid by diluting portions of your total at a time and adding them with good circulation.

Sodium Bisulfate (dry acid) is used to decrease the pH in a pool and comes in powder form – hence the common name dry acid. It is popular because many operators find it easier to handle than liquid muriatic acid. You should know that: sodium bisulfite should never be used with saltwater chlorine generators as it will corrode the surface of the electrode. It may also cause corrosion of fixtures, or scale vinyl pool liners if used for extended periods of time.

Sodium Carbonate (soda ash) is used to raise the pH of a pool. It is a stronger base than bicarb and has a much smaller impact on the alkalinity.

Sodium bicarbonate (baking soda, bicarb) can be used to raise the pH of a pool. It is weakly basic, so you should know that you might need a large amount to change the pH. You should note that bicarb will raise the alkalinity of the pool significantly, which should be avoided if it is already within range.

Sanitizers – Chlorine and its Sources

A swimming pool is at its most appealing when the water is clear and sparkling, which is only achievable if it is kept free of algae. The process of discouraging / destroying microorganisms is called sanitization. This subsection is the first of two discussing different sanitizing chemicals and focuses on the one which is by far the most common – chlorine.

There are several different chemicals that can introduce chlorine into the water, but they all create the same active form once dissolved – hypochlorous acid (HOCl). A key characteristic of chlorine-based sanitizers that is sometimes missed in discussions is that they are strong oxidizers. This means that not only do they kill living microorganisms, but they also break down non-living organic contaminants such as natural skin oils, waste products, skin care products, and organic contaminants from leaves, soil, etc. (e.g. humic acids, tannins).

Five common forms of chlorine are described below. They are differentiated as being either ‘stabilized’, or ‘un-stabilized.’ For more details on stabilization, see the Stabilizer section.

Sodium hypochlorite (liquid chlorine, chlorine bleach) is a basic liquid

Calcium hypochlorite (Cal hypo) is solid, unstabilized, basic, introduces calcium (increases water hardness), slow to dissolve

Trichloroisocyanuric Acid (Trichlor) is solid, stabilized, acidic, introduces cyanuric acid, influences alkalinity), very slow to dissolve (filter pump should be left on)

Dichloroisocyanuric Acid (Dichlor) is stabilized, solid, slightly acidic / almost neutral, introduces CYA, good solubility

Sanitizers – Non-Chlorine Sanitizers

There is often a disconnect between how much chlorine is necessary and how much is used in a pool. Overuse has given chlorine a reputation as a harsh and strong-smelling sanitizer. As a result, alternate sanitizers have gained some popularity on the basis of being ‘chlorine free.’ The two most common non-chlorine sanitizers are bromine and biguanide.

Bromine is the most common alternative to chlorine, as it has some benefits over chlorine for spas and indoor pools. Bromine is more stable at higher temperatures but cannot be stabilized by cyanuric acid the same way as chlorine leading to worse UV stability. Also, bromine is both more expensive and a worse sanitizer than chlorine. Like chlorine, bromine is an oxidizer and still has the capacity to irritate the skin, but many people experience noticeably less skin and eye irritation in a bromine pool. A harsh smell is most noticeable in a pool when chlorine reacts with ammonia present in organic contaminants to form chloramines. Unlike chloramines, bromamines still act as sanitizers and are less likely to become gaseous, so swimmers are less likely to smell them.

Biguanide (PHMB, polyhexamethylene biguanide) is a notable alternative sanitizer that is much less common than chlorine and bromine. It is considered gentler on skin than halogen sanitizers and has less of an odour. You should know that: biguanide is not an oxidizer, and while it kills microorganisms, it doesn't breakdown organic contaminants the way that chlorine and bromine do. It is also incompatible with chlorine / bromine – a biguanide pool / spa must only use biguanide. See non-chlorine shocks for information about oxidants that can be used with biguanide. Lastly, biguanide can contribute to the formation of sticky substances (e.g. scum, pool tar) because it doesn't break down organics in the same way as strong oxidants.

Stabilizer

Cyanuric Acid (CYA) is referred to as stabilizer, though conditioner is used interchangeably. CYA has been described as 'sunscreen for your pool.' Its purpose is to prevent ultraviolet (UV) rays from sunlight from breaking down the chlorine in your pool. Maintaining a consistent level of CYA in your pool is critical to maintaining a consistent chlorine concentration. There are three main chemicals that will increase the concentration of CYA if your water:

Cyanuric Acid (CYA) can be purchased and added to a pool 'neat' – that is without introducing other chemical species. It will not significantly change alkalinity or pH. This is a common practice – and a requirement – when sanitizing solely with un-stabilized sanitizers like cal hypo. You should know: if you don't use CYA but are using un-stabilized chlorine, you will need to use several times more sanitizer to maintain the same levels of free chlorine. CYA concentrations decrease very slowly in a pool, so if too much is present, water typically needs to be drained and replaced.

Trichloroisocyanuric Acid (Trichlor) may be the most used chemical that introduces CYA into swimming pools. Chlorine 'pucks' are typically comprised of trichlor. You should know that: trichlor is strongly acidic (will decrease pH) and will damage the vinyl liner if it sits directly on top, even for as brief a period as a couple hours. There is danger of this happening if pucks are 'tossed' in the pool, because it is very slow to dissolve.

Dichloroisocyanuric Acid (Dichlor) is like the little brother of trichlor. It is granular, much less acidic, and faster dissolving than trichlor. Therefore, it won't affect pH and provides a smaller increase in chlorine.

You should know that: CYA remains in the pool even after the chlorine it is stabilizing has dissipated. If trichlor or dichlor is continually added to a pool, the level of CYA will continue to climb. Excessive CYA levels – in some places cited as greater than 70 ppm – create excessive chlorine demand, contributing to what is sometimes called chlorine lock. For more details on chlorine lock / chlorine demand, see Chlorine Lock in the Maintenance and Troubleshooting section.

Pool Shocks

In the broadest of terms, shocking a pool refers to adding strongly oxidizing chemicals to break down organic contaminants. Shocking chemicals can be divided into two categories: chlorine- and non-chlorine shocks.

Shocking with chlorine-based shocks is sometimes called superchlorination, as the chemicals used will also raise the free chlorine in the water. There is overlap between these chemicals and un-stabilized sanitizers.

Chlorine is an oxidizer and sanitizer, while non-chlorine shock is only an oxidizer. The difference is that sanitization is the killing of living contaminants/microorganisms, while oxidization breaks down contaminants such as sweat, lotions, and urine into smaller components. A strong enough oxidizer can break down the cell walls of microorganisms, but this likely won't be the case at concentrations in a pool. Although non-chlorine shock isn't very effective against algae or bacteria, the lower toxicity means swimmers can return to their pools sooner after shocking.

Sodium hypochlorite (liquid chlorine, chlorine bleach) non-stabilized, liquid, basic

Calcium hypochlorite (Cal hypo) non-stabilized, solid, basic, introduces calcium, slow to dissolve

Lithium hypochlorite non-stabilized, solid, basic, fastest to dissolve

Dichloroisocyanuric Acid (Dichlor) increases CYA, not much affect to pH,

Potassium monopersulfate (MPS) is non-chlorine shock, quick dissolving

Salts

Sodium Chloride (NaCl) is the most common salt used in swimming pools. It is solid, pH neutral, highly soluble and fast dissolving. Saltwater Chlorine Generators convert NaCl to chlorine gas, which reacts with water to form aqueous hypochlorous acid (HOCl). HOCl is the same active sanitizing species that is produced from other chlorine-based sanitizers.

Sodium Bromide (NaBr) is used very similarly to sodium chloride. A bromine generator would use electrolysis to convert bromide salts to bromine, which then can sanitize the pool. Keep in mind that Health Canada does not recommend the use of sodium bromide or any other bromine products in combination with any ionizer (electrolysis), ozone-generating or ultra-violet (UV) devices in swimming pools and spas. Through oxidation, bromine can be converted to bromate, a possible carcinogen when ingested.

Algaecides

Algae are the most dreaded microorganism in the eyes of the pool operator – they are unsightly, slimy, and at times, difficult to remove. Fortunately, vinyl pools are much less likely to experience this issue, because of built in antimicrobial agents and because vinyl is less porous as compared to other types of pool surfaces.

Algae spores are all around us, and they can commonly be introduced to the pool by failing to wash a bathing suit that has been in a lake. After successfully dealing with algae, remember to thoroughly wash all pool toys, bathing suits, and water features so the algae don't quickly return. Small issues such as poor circulation, low chlorine, and imbalances in pH or alkalinity are also common causes.

Algae is also more common in warmer climates, because warm weather promotes bacteria growth. Also, a large temperature difference between a water's surface and deepest point can cause the water to settle into 'layers' with different densities. The stagnant warmest layer at the water's edge is the perfect environment for algae to grow. Other factors that increase algae growth are lots of sunlight, and a high presence of phosphorous and nitrogen.

There are four main types of algae:

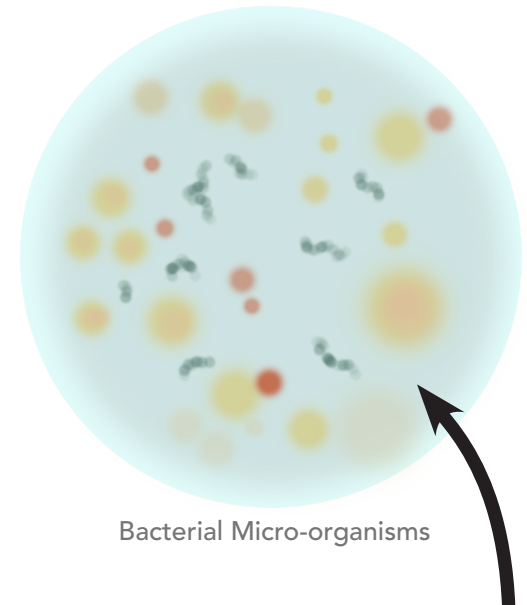
Green algae, which is the most common type and usually first presents as a slippery or slimy feeling on pool surfaces.

Yellow or mustard algae can often be first confused for sand at the bottom of a pool. It tends to grow on the walls and floors of the shaded side of a pool, which can differentiate it from other yellow contaminants such as pollen, which will sink evenly on the pool floor. Compared to green algae, yellow algae are much more chlorine resistant and typically require additional shock and algaecide.

Black 'algae' are considered to be the most resistant form of algae, but they aren't actually algae. Black 'algae' are bacteria, cyanobacteria, which along with being a very annoying microbe are believed to be the first organisms to have produced oxygen on Earth. Black algae also isn't black. Take a piece of the algae and spread it over a sheet of paper and

you will see a blue-green paste, which is how you get the 'cyan' part of cyanobacteria. Black algae have strong roots that embed themselves into rough, porous surfaces, such as pool plaster or tile grout. It can be difficult to fully destroy the roots, leading to the bacteria 'head' easily growing back. Black algae also have protective layers, so vigorous brushing is required to rupture the barrier and prevent it from reforming. Typically, a repeated combination of scrubbing to destroy the protective layer and shocking to kill the unprotected bacteria is needed to deal with black algae.

Pink 'algae' is also not actually algae but the bacteria, Serratia marcescens. It's commonly found on many damp surfaces, such as boat seats and showers.



Algaecides are chemicals marketed to prevent the growth of these microorganisms, but they may do more harm than good if not utilized properly. A properly sanitized and maintained pool should not grow algae, even without the use of algaecides. In fact, algaecide 'uses up' chlorine, so it's not uncommon to have a very low free chlorine reading after its use, which can contribute to more algae growth.

Common types of algaecides are described below:

Quaternary Ammonium (quat) algaecides are simple, liquid, organic chemicals that work by disrupting the cell wall of algae. They are typically used for algae prevention, rather than removal. Too much quat may lead to excess foaming and odor, but they aren't metal based so they are less likely to cause staining.

Polyquat algaecides are polymeric, liquid, organic chemicals that work by disrupting the cell wall of algae in a similar way to quaternary ammonium algaecides. Polyquats are used to remove active algae blooms. They can contribute to 'pool goo' but are also not metal based so less likely to stain.

Metal-based algaecide is sold in two varieties. Copper-based, which can be in solid or liquid form, or silver-based, which are liquids. Silver-based algaecides are the most expensive algaecide type, so they are used less often. High levels of metal-based algaecides can stain anything from pool surfaces to hair. To avoid staining, use metallic algaecides that are 'chelated', which means to be bonded. Molecules called ligands bond to the copper, forming a protective barrier around the metal ion. Chelated metals won't be used up as quickly, because they are trapped in that bonded state until contact with water or heat or algae releases them. The ligands also allow the product to be suspended and circulated for longer before falling to the pool floor, increasing the area of effect of the algaecide. In this case, the metal is around for longer, so a lower volume of a less concentrated product can be used.

Sequestrants

Metals are ubiquitous in water, whether it's in lakes and ponds, drinking water, or swimming pools. Perhaps the most common issue caused by high concentration of certain metals in pool water may be telltale stains seen on concrete or vinyl. The main culprits are iron, copper, and manganese. Sequestrants seek to prevent metals from staining pool surfaces by chemically capturing (i.e. sequestering) them, which prevents them from depositing on surfaces and creating stains.

Common sequestrants include HEDP (hydroxyethylidene diphosphonic acid), PAA (polyacrylic acid), and EDTA (ethylenediaminetetraacetic acid).

Clarifiers and Flocculants

Cloudy water is often seen after an algae bloom or when first opening a pool. Other common causes that should first be addressed are poor filtration, poor water chemistry, low chlorine, or contamination. Pool clarifiers and flocculants are both options for dealing with clarity issues, the prior for more mild cases and the later for more severe.

Clarifiers work by clumping together the small particles and contaminants that are clouding the water. The larger clumps can then be captured by a pool filter, instead of simply passing through. Remember to clean and backwash all filters after the use of a clarifier. At most, a clarifier should be used once a week. At high concentrations, a clarifier will act as a dispersant instead of a coagulant, causing more cloudiness. This can happen even more readily if a sequestrant is also being used, as it is also a coagulant.

A flocculant clumps together larger particles that will sink to the bottom of a pool and then must be vacuumed up. Using a flocculant will require more manual labour, but they work faster and are more powerful. While a clarifier may take a few days to work, a flocculant can clean up a pool in a few hours.

Flocculants shouldn't be used in pools with a cartridge filter. The particles can get trapped in the filter, damaging the cartridge. With any filter, the filter should be shut down or in recirculate-mode, because the flocculant particles will become trapped in the filter and will both gum up and the filter and eventually break down, leading to a cloudy pool again. These particles must be vacuumed out, not filtered.

The most common types of clarifiers are aluminum chlorohydrate (cationic polyectrolyte), ammonium chloride (PolyDADMAC, also known as polydiallyldimethylammonium chloride), and aluminum sulfate.

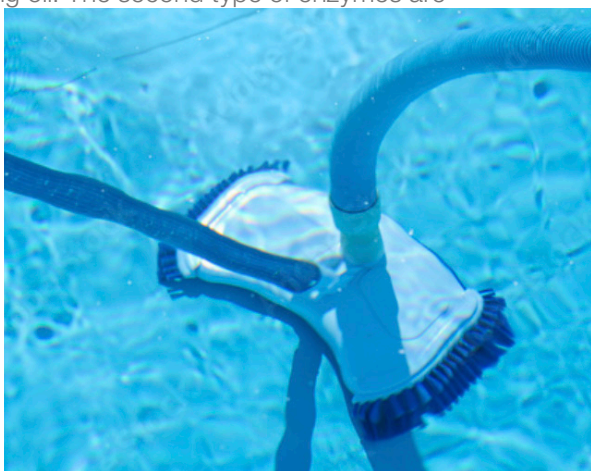
There are two main types of flocculants: inorganic (Aluminum sulfate or ferric chloride) and organic (polymer based). Inorganic flocculants tend to be the more affordable option.

Enzymes

It requires energy to start most chemical reactions. Enzymes are proteins that catalyze a reaction. In other words, they decrease the amount of energy it takes to make something start happening. Enzymes are very specific. Each type will support a specific reaction in a specific environment.

Naturally, organic matter breaks down into carbon dioxide and water. Some pool professionals add enzymes to their pools, which target this reaction. The enzymes thereby speed up the reaction that breaks down organic contaminants such as hair, dead leaves, sunscreen, etc. This keeps the pool cleaner and decreases the overall need for pool sanitizers.

The first main type of enzymes available are blended enzymes, which specifically target fats and oils. These are most applicable to a spa environment or if you notice a very prevalent scum line or see floating oil. The second type of enzymes are broad-spectrum enzymes, which are a more powerful tool in destroying all kinds of organic matter. Cleaning



Cleaning the pool is part of a regular maintenance routine. A couple aspects of the pool need to be maintained.

Skimming the pool is important for preventing the buildup of organic contaminants such as insects and plant life in the pool. These contaminants can cause black stains on the pool floor and will increase the chlorine demand of the pool. Metal objects such as coins can also leave stains on the pool floor.

Vacuuming the pool floor is also important for preventing staining and abrasion by particulates/leaves.

Cleaning the border/scum line. Vinyl pool liners are hydrophobic (non polar) as are many pool contaminants. In general, organic substances from insects, plants, as well as from skin products like sunblock or tanning oil are also non-polar. As a result, when they collect on the liner surface, it is difficult for water to get in between the substances and the liner, making them harder to remove. It is recommended to use a non-abrasive cleaner purposely build for vinyl liners.

It is especially important to clean sunscreen and suntan oils from the water line. Chemical-based sunscreens, especially those containing phenoxyethanol and octocrylene, can damage the inks used on patterned pool liners. Also, copper, which can be found in metal pool fittings and water softener, can react with suntan oils causing yellow stains.

CLOSING / WINTERIZING

The following steps should be followed to properly winterize a pool:

- Consult with pool professionals whenever closing or draining a pool. A liner pool should be kept full of water at all times. If the pool is emptied, the liner may move out of position.
- Remove all debris
- Properly disperse all chemicals. Never close a pool without circulating the pool water for several hours after the final addition of chemicals - chlorine may settle in the deep end and bleach the liner if not allowed to thoroughly disperse in the pool water.
- Test water balance
- Clean and vacuum
- Use a well-fitting cover. This will prevent the accumulation of debris such as leaves and insects during the winter.

LINER STORAGE AND HANDLING (BEFORE IT GOES IN THE POOL)

Depending on whether you are working for a liner fabricator, distribution center, pool store, or are yourself a pool owner, you are probably a few steps removed from CGT's manufacturing process. There is a lot of handling that goes on between the time our vinyl leaves our plant, and when it is installed in a pool. Some information on the best practices for handling the material prior to installation are given below, in order to address some issues that have been seen in CGT's history.

Pressure Cracking During Storage

Under certain conditions, vinyl liners can develop "pressure cracks". This is believed to be the major type of deterioration that occurs to vinyl liners in storage. More recent investigation of this phenomenon has revealed that it is a two-phase process.

Phase I

During Phase I, a heavy crease develops on the inside of a double or triple fold. The severity of the crease depends on several factors: length of time folded, amount of pressure on the fold, and temperature. High temperatures during storage can soften the vinyl, leading to a greater amount of material displacement in the crease areas.

Phase II

Phase II is by far the more critical part of the process and occurs if the liner is unfolded and flattened at a moderately low temperature of 3-10°C (38-50°F).

If the liner is not allowed to completely warm up to 20-22°C (70- 72°F), the deformed inner loop of the crease, which has become shorter due to creep and is stiffer because of the lower temperature, cannot withstand the excess tension caused by the unfolding action, splits open, transforming the crease into a crack.

If, however, the liner returns to room temperature, flexibility increases, minimizing the tension on the inner loop and greatly reducing the probability of splits developing.

Liners that are installed in a pool are held immobile by the beading and the water pressure. Incidents of failure due to cold crack are extremely rare since it is not possible for the liner to flex. Damage caused by ice is rupture due to high pressure rather than low temperature failure. On the other hand, liners moved around warehouses, shipped on unheated transport trucks, or allowed to drop during unloading may occasionally crack if the combined effect of low temperatures and impact is severe enough.

Recommendations for Minimizing Formation of "Pressure Cracks"

- Do not unfold liners at temperatures below 20°C (70°F), in the plant or prior to installation of the liner at the pool site. This is especially critical during installation in the fall, when morning as well as daytime temperature can be well below 22°C (72°F)
- Do not store a boxed liner outside or in an unheated storage area prior to installation at the pool site during the cooler spring or fall season. The liner may not necessarily warm up sufficiently in a span of a few hours in the morning due to insulation provided by the outer layers of the liner
- Minimize the length of time finished liners are stored in cartons
- Minimize or eliminate stacking of cartons to reduce pressure
- Keep the number of folds in the liner to a minimum
- Use larger cartons for large liners; cartons that resist collapsing under pressure will afford more protection to the liner
- If possible, avoid shipping liners when temperatures are likely to fall below -23°C (-10°F).
- Secure the cartons or drums containing the liner so that they are not able to bounce or shift when being transported over rough roads.
- Handle liners with care in cold weather. Do not store liners in containers outdoors. Do not allow containers to drop or be hit by any moving object

Cold Crack Properties

CGT in-ground swimming pool vinyl has been formulated to meet a cold crack rating of -35°F according to test method ASTM D1790. The temperature determined by the above test method is the lowest temperature at which at least 50% of the samples folded into a loop and subjected to sever impact, do not crack into two separate pieces.

This method can be thought of as a yardstick which can be used to compare the inherent cold crack resistance of different materials under the same conditions of impact. Vinyl materials with a cold crack rating of 4°C (40°F) (i.e., possessing virtually no inherent cold crack resistance) can be subjected to temperatures as low as 40°C (-40°F) and -46°C (-50°F) and remain free of cracks or breaks, as long as they remain immobile. Therefore, it is apparent that the severity of impact or flexing is the most important factor that results in failure of vinyl materials at low temperatures.

MAINTENANCE AND TROUBLESHOOTING

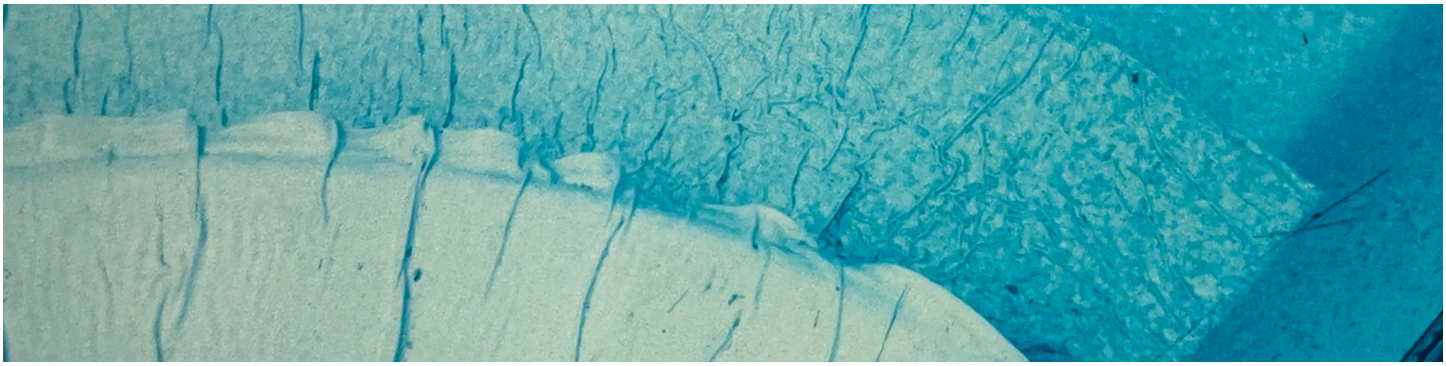
Maintaining a swimming pool can be a challenging endeavor. The ever-shifting chemical balance in the pool is hard to maintain, and cleaning – while some may find it therapeutic – can be tedious. In working with installers and other pool professionals, CGT has gained some insight into a number of issues seen by pool owners that range from fairly common to quite rare.

WRINKLING

Vinyl pools have been described – whether accurately or not – as a 'bag in a box.' A vinyl liner is a flexible, water-proof bag that is cut and welded to fit inside the rigid structure of a pool. Whether it can be termed a box is questionable, since a strength of vinyl liners is fitting into freeform pool shapes, but the principle is sound. In order to get the best fit, the practice by liner fabricators is to slightly undersize the liner and stretch it into place. The key reason for this is to avoid a 'baggy' or 'wrinkled' appearance of the lined pool. Wrinkles in the finished liner are perhaps the most common issue seen with vinyl liner pools but are not typically related to poor fit.

The most common cause of liner wrinkles is shifting of the liner because of water between the liner and pool structure. When this occurs, foot traffic or other personal contact with the liner will cause it to crease. For this reason, newly constructed pools often have equipment installed that will help remove water behind the liner, such as sump pumps in areas with a high-water table.

Distance between wrinkles is an indicator of cause. Tight wrinkling is typical of a chemical imbalance, while a larger distance between wrinkles that run towards the deep end likely indicate water behind the liner.



Improper Chemical Treatment

All vinyl liners absorb a small amount of water throughout their lifetime. Vinyl manufacturers and liner fabricators, as well as other pool professionals like service people and chemical manufacturers, make strong recommendations for the chemical levels at which to maintain a pool. It is well known that levels outside of the recommended ranges will cause vinyl to absorb more water, thus making the 'bag' larger, and ill-fitting within the 'box.'

Technical articles published in the past have stressed the adverse effect of low pH as the main cause of liner swelling. However, recent experiments have shown that up to five times the normal amount of water can be absorbed when sanitizer levels are high. Therefore, controlling sanitizer levels is the number one priority to avoid wrinkling issues.

Cyanuric acid stabilizer levels and pH are important secondary factors because they control the activity of the sanitizer. However, once wrinkles have developed, correction of pH or stabilizer content will not reverse the amount of water absorbed into

the liner. In some cases, draining the pool and allowing the water to slowly desorb and evaporate has reduced or eliminated wrinkles. This procedure is not without risk because some liners, depending on age, may over-shrink and not stretch back into place without failing. It has also been shown that when the surface of the liner has been affected by the sanitizer, water can rapidly reabsorb, and the wrinkles may quickly reappear.

Recommendations

1. Maintain pH levels in the 7.2 - 7.8 range.
2. Do not allow free chlorine levels to exceed a maximum of 3 ppm, bromine levels a maximum of 4 ppm for long periods. Peak chlorine levels of 5-10 ppm are required for superchlorination but should be allowed return to the 2-3 ppm range by natural dissipation. If bleaching of the blue liner colour is occurring, it is a direct indication that the chlorine levels have been too high.
3. Routinely stabilize outdoor and indoor chlorinated swimming pools with cyanuric acid stabilizer and maintain a minimum level of 50 ppm. It is recommended that levels be checked every 3-4 weeks.
4. Test result accuracy can be adversely affected by poor quality test kits and reagents. Keep reagents current by replacing them every 6 months and use a professional quality test kit recommended by your pool dealer.
5. Use non-chlorine shock to reduce organic contaminants, rather than high levels of chlorine or bromine during the pool season, as well as preparing the pool for winter.
6. Use flocculants and a filtration system in proper operational condition to remove undissolved particulate matter instead of high levels of chlorine/bromine oxidizer, to attain sparkling clear pool water.
7. It is important to maintain thorough circulation of the pool water to prevent settling and concentration build-up of chemicals on the pool bottom. Even liquid chlorine can settle to the bottom if sufficient inter-mixing is not achieved.
8. Frequent reports have been received concerning wrinkle development on walls of pools employing automatic pool covers. The phenomenon is most likely a result of chlorine concentration build up due to the airtight nature of the cover design and/or temperature differentials between waterside and ground- side of liner causing accumulation of moisture from condensation that forms ripples.

Floating Liners

Vinyl liners' flexibility is a benefit in many cases, protecting them from damage from typical impacts that come with the enjoyment of the pool. There are a handful of instances that the flexibility – or perhaps, moveability – of the liner may present a challenge to pool owners.

Returning to our 'bag-in-a-box' model, it is important to note that typically liners in residential applications are not anchored to the pool shell, but rather, are held in place by the hydrostatic pressure of the water. Since this is the case, it is possible for materials – in particular water – to get in between the liner and the pool shell. This unwanted water will fight back against the hydrostatic pressure, and in severe cases, can cause the pool liner to lose contact with the shell – sometimes called 'floating.' A floating liner may shift within the shell, and once the un-wanted water is removed, it may end up in a slightly different position than where it started. This may affect the tension being experienced by the liner walls, as it is now pulling unevenly

on either side of the pool. This unequal stress can damage the liner outright, but may also cause issues if paired with some other situations outlined below:

If the liner shifts like described above, it may pop out of the track of the pool. It might be the reflex of the pool owner to pop the liner back in, but this can contribute to too much stress there causing stretch of the print pattern or thinning of the material which may result in the formation of a hole. It may be necessary to drain the pool in order to re-position the liner. If you must do so, always contact your dealer for more information.

CHANGES IN LINER APPEARANCE

Newly manufactured vinyl liners are exceptionally eye-catching. Whether they're designed to mimic natural patterns like those of moving water or hand-made materials like tiles, the range of designs using vinyl is far greater than with any other pool surface solution. Because pool liners are expected to withstand the harsh environment of chlorinated water and direct sunlight, over time, some changes in appearance are expected. CGT vinyl is engineered to limit these changes. Several causes of more rapid and noticeable changes are described below.

Fading

Fading will take place gradually over the course of a liner's life. Not all fading looks the same, and differences in where the fading is happening can give clues to the cause. All over fading (especially below the waterline) strongly indicates a chemical imbalance that has persisted in the pool long enough for the colourants to be damaged. On the other hand, spot fading indicates unequal treatment of the liner. For example, trichlor pucks thrown into the same spot of the pool will cause fading in that area.

Chlorine exposure over the lifetime of a vinyl liner will affect its appearance. Hypochlorous acid – which is the active sanitizing species in most pools – is a strong oxidant and will chemically alter many pigments over time. CGT prioritizes the use of oxidatively stable materials, which should limit the colour change observed. Other oxidants used in pools, like hydrogen peroxide, have similar effects. Keeping an eye on your chlorine levels and following manufacturer recommendations will improve the performance seen from any liner.

UV exposure is the second largest cause of liner fading. Sunlight is known to cause changes to many chemical species through the formation of radicals, in a process sometimes called sun-dyeing. The prevalence of these changes can be limited by covering the pool when it is not in use.

Interestingly the intensity of UV radiation drops off sharply in water. In other words, the damage of sunlight below the water line is less severe because much of the energy has been dissipated. Damage from UV is most likely to occur above the waterline. In the case of vinyl over steps, some fading from UV may be seen on steps not covered by water.

A spot that appears particularly degraded may be caused by a reflective point that is beaming sunlight on to that location.

Print Removal

A vast majority of residential pool liners are printed in the same way other industrial products like wallpaper or magazines are printed. While manufacturers like CGT take strides to protect the ink using a protective topcoat and by ensuring strong bonding between the ink and substrate, inks remain susceptible to removal when liners are mistreated.

Abrasion is a well-known consequence of over-zealous scrubbing practices, with ink being literally rubbed off the surface when improper brushes are used. It may also occur in high-traffic areas such as on steps or ledges.

Attack by sunscreen is another potential cause of print removal, especially with the growing usage of skin care products

over the last few decades. Active ingredients in sunscreen are chosen to absorb UV radiation before it reaches the skin, thus preventing damage to key skin components like DNA, collagen, elastin, and lipids. These various components in sunscreen lotions can cause issues with vinyl pool liners if some precautions are not taken.

Sunscreen formulation is the key driving factor to cause ink disturbances. There are two types of sunscreens, mineral and chemical. Mineral sunscreen is thicker and contains minerals such as titanium dioxide and zinc oxide that act as a shield, blocking UV light. Chemical sunscreen is thinner, transparent, and contains chemicals that absorb UV light before they can hit the skin. Both spray-on and lotion-type sunscreens were seen to disturb the liner print when applied directly, however this effect can be minimized by avoiding chemical sunscreens containing phenoxyethanol and octocrylene.

CGT has made the following observations:

1. All SPF levels showed about the same impact on print damage
2. Sunscreens that remained in contact with vinyl longer seemed to have a greater likelihood of print damage
3. Print disturbance seemed to happen more rapidly or be more extensive at higher temperatures
4. Skin oils and oily sunscreens appeared to be less likely to cause ink disturbances

It is recommended to wait some time for sunscreen to be absorbed before heading into the pool, and to avoid touching the liner immediately after applying sunscreen

Staining

Stains caused by organic matter

Perhaps the most common type of stains are brown stains left by organic matter (i.e. leaves, bugs) that have not been skimmed out of the pool. If these materials settle to the bottom and sit on the liner, they will leave unappealing dark marks.

Stains caused by metals

Copper, iron and manganese naturally occur in water and can stain a liner if they aren't controlled. These stains are generally black, brown, or grey in colour. The metals are often introduced into the pool via the water source used to fill the pool, but copper can also dissolve from copper or brass fittings in the plumbing when pool water pH conditions of less than 7.0 occur. Copper may also be present in some algaecides, although most now use copper in a chelated or complex form that remains in solution.

The presence of metal staining can be confirmed by treating a small portion of the stained area with a pH reducer to dissolve the metals. If the stain can be removed by this treatment, the staining is a result of metal deposits, and the remainder of the stains can be treated in a similar manner. If not, the stain may be related to organic matter or to microorganisms. Getting the fill water analyzed can help narrow down the source of staining metal ions. If it's found to be in the source water, products like sequestrant/chelating agent may be needed to help prevent them from staining the liner.

Another metal-related issue can cause pools to have purple staining or crystals. Copper and cyanuric acid can react to produce copper cyanurate. It is believed this issue appears most often in spring, because the lower temperatures decrease the solubility of copper cyanurate in water, leading the crystals to be deposited all along the pool. A similar issue is seen in pools with high levels of manganese, as well. If this issue occurs, it is recommended to talk to your trusted pool professional.

A common stain remover for metal stains is ascorbic acid (also known as vitamin C). A common way to check for metal stains is to place a vitamin C tablet on top of the stain for 2 minutes and see if it is lightened. After dealing with metal staining, the pool water should be replaced, or a sequestering agent should be used to gather the metal, so the stain does not return. Oxalic acid is an alternative to ascorbic acid, but it has a higher toxicity and at higher concentrations can precipitate calcium oxalate.

Stains caused by microorganisms

Algae should not appear in pools where the appropriate levels of chlorine are maintained. If they do occur in a pool, they are very tenacious. The most tenacious being black algae, which first appear as a series of small black spots on the pool liner. Treatment requires several steps:

1. The algae spots must first be brushed (using a nylon brush) to open the algae coating.
2. Test the pH of the water and reduce it to the lower limit of the normal operating range (pH=7.2) to improve the effectiveness of the chlorine.
3. Super-chlorinate the pool to around 10 ppm free available chlorine. You may also choose to add a dose of a quaternary (quat) type algaecide. The quaternary algaecide will wet the algae's coating to improve the penetration of chemicals.
4. Continue to brush the algae stains to maximize the penetration of the chemicals. Vacuum the dead algae to the drain once they have been killed, as they will now have been liberated from the vinyl liner.
5. Twenty-four hours after super-chlorination, add a dose of a polymer algaecide (polyquat) as per the manufacturer's recommendations. Polyquats are more expensive than regular quaternary algaecides but are more effective in controlling these resistant types of algae.
6. Once the staining has been removed, resume normal chlorination and water balance.

Remember, the best protection against algae growth is a constantly held free chlorine level in the range of 1-3 ppm.

Pink blotches have been known to appear on pool surfaces where proper quantities of sanitizing chemicals are not maintained. The cause is a naturally occurring pink dye excreted by bacterial micro-organisms like streptomyces, which cannot grow in the presence of chlorine. Because the dye is non-polar and highly soluble in the plasticizers used in flexible PVC pool liners, it can easily migrate through the entire thickness of the liner. Treatment is straightforward, but getting rid of all the dye that has permeated the liner may take some time. The portion of the dye that is exposed on the surface can be bleached by chlorine, but new dye will migrate to the surface and will appear as though the chlorine is having little to no effect. The bacterial micro-organisms can become established on either the water side or the back side of the liner. Superchlorination at this stage will rid the pool water of the contamination, but if the dye happened to penetrate below the surface, the staining tends to linger indefinitely.

Growth on the back side may not take place directly on the liner, but rather on some other material in contact with the liner such as soil or a backing material like Styrofoam, felts, or taping. Even though an anti-microbial agent is incorporated into the vinyl formulation, the dye can migrate from unprotected components and stain areas well beyond the point of infestation. If there is a lot of pink dye visible on the back side or any backing material, it will certainly be the source of the problem.

If the liner is replaced, all contaminated materials must be removed, and the entire pool shell must be disinfected with a liquid chlorine spray or other the applicable disinfectant. Special problems are presented by locations that have high water tables of which continually bring water loaded with micro-organisms to the back side of the liner. Using disinfectants at these sites may be ineffective since they will be quickly washed away. A possible defence may be some type of barrier layer; either a plastic sheet, perhaps polyethylene between the pool shell and liner or a barrier coating of some kind applied directly to the pool shell.

Stains caused by incompatible material

Other materials present between the pool shell and the liner may cause staining if they are incompatible with the vinyl. Installers should ensure any carpet underlay, foams, hardboard, or tapes are pvc compatible. Incompatible materials can promote plasticizer migration out of the liner, leading to wrinkling and discolouration. For example, duct tape is incompatible and can stain the liner. Always consult the liner manufacturer before using materials beneath the liner.

Mineral Deposits

Calcium deposits – also called lime or scale – are familiar to plumbing fixtures in bathrooms but may also form on pool surfaces or on equipment like pumps and heaters when water chemistry is not properly maintained. In relative terms, mineral deposits on the liner are a much less serious problem than calcium deposits in equipment. To prevent damage from happening, you should take steps to reduce the calcium buildup. Maintaining the correct calcium hardness and pH are the most critical parameters for preventing scaling. Keeping these values in the correct ranges will seriously help. Some surface deposits are actually calcium phosphate, and so it happens that even when calcium is maintained in the proper range, excess phosphates from the surrounding area, source water, or even from pool chemicals, may contribute to surface deposits.

Rust is another deposit/stain that may be seen in pools. Its orange color is unmistakable and denotes the corrosion of metal in the pool. Chlorine is a strongly oxidizing substance and will rust just about anything. pH also has a huge effect on corrosion. pH below 7.2 will affect the fittings. There are certainly some effects of using high-quality fittings, as well.

Pool Goo

There are numerous sticky substances that can be found in pools, and they often gather around the waterline. Collectively, these substances are known as pool goo, pool scum, or pool tar. Some sources and causes include:

1. A combination of sunscreen, cosmetic products, body oils, and organic contaminants can leave a greasy yellow substance on a pool liner
2. Algaecides (quat, polyquat) interacting with organic compounds from decaying material such as leaves, grass, and insects.
3. Algaecide (quat, polyquat) interaction with chlorine (Cl-) can form sticky material if both chlorine and algaecide exceed the recommended dosage levels, especially if using polyquat algaecides for extended periods.
4. Organic material from cosmetics or tanning lotions can be oxidized by chlorine to form a waxy beige material.
5. A light coating of vinyl plasticizer may exude to the surface of newly installed liners during the first idle period of winterization. This material is clear and only turns dark if contaminated with dirt. It is attributed to lack of circulation, since it has never been observed in a pool that has been circulated over the winter. It will almost always re-absorb in two or three weeks if the water is allowed to warm up and is circulated and shocked with chlorine every couple of days. The problem is not known to occur more than once in the life of a liner and always the first time the pool is re-opened after winterization.

LEAKS

Identifying and finding a pool leak can be a difficult task. Uncovered outdoor pools lose 1/8 to 1/4 inch of water every day, so it can be hard to distinguish leaking from evaporation. Without an expert, it is also difficult to figure out where the leak is coming from. Leaks can occur due to puncturing of the vinyl, weld failure, corrosion of the plumbing, loose or broken fittings, or movement in the ground.

Most of these causes are difficult for a homeowner to avoid, but there are many ways to protect the pool vinyl from puncturing. By ensuring that pool chemistry is properly balanced the vinyl will not weaken and by avoiding using sharp equipment around the vinyl (ex. garden tools) puncturing is unlikely.

One warning sign of leaking is if it hasn't rained recently but there is standing water around the swimming pool. Take a chlorine test and test the puddles. If chlorine is present, then a leak is likely.

Another method for determining whether a leak is present is “The Bucket Test”. Fill a water bucket with pool water, place it in your pool, and mark the water line both inside and outside the bucket. Compare the water loss over the course of several days. If the water loss outside the bucket is significantly greater than inside the bucket, then a leak is likely. This test should also be repeated with the pump on and off to determine whether that is the location of the leak. If the loss changes significantly with the pump running, then you know there is an issue with the pressure/suction side of the pump.

Once a leak has been identified, the next step is to figure out the location. It is possible to find a leak by dropping dye in areas where a leak is suspected and see if the dye moves towards the exit point. However, professionals have a variety of electronic pressure, video, and sonic equipment that can much more effectively identify the location.

CHLORINE LOCK

A myth exists that high concentrations of cyanuric acid impedes chlorine’s ability to kill bacteria. This is not true. Chlorine lock describes a situation where the chlorine in a pool is not available to be used to sanitize the pool. You may have previously seen the terms FAC (free available chlorine) and TAC (total available chlorine). Free chlorine is available chlorine, and total chlorine is free plus locked/combined chlorine.

The relationship between cyanuric acid and this phenomenon comes from the fact that there are bacteria that can convert cyanuric acid to ammonia, which then react with chlorine to form chloramines, or combined chlorine. High cyanuric acid does not necessitate the presence of chloramines, ammonia can be found in the water supply or in algae.

Chlorine demand refers to the amount of chlorine required to maintain a balanced water chemistry. A high chlorine demand could indicate chlorine lock, but it could also just mean there are more sources of contaminants that require sanitization. Chlorine demand will be higher with the addition of body chemicals, microorganisms such as bacteria and algae, and increased bather load. They’ll also be a higher chlorine demand on hot sunny summer days. UV light breaks down chlorine. Higher temperatures create an ideal environment for swimming and bacterial growth.

There are several ways to identify chlorine lock. Look for a strong chlorine smell or irritated eyes, which are both caused by chloramines. Also, most chlorine tests will identify total and free chlorine in a pool. If those numbers are unequal or if you see a rapid decrease in free chlorine levels, you may have chlorine lock. If the addition of chlorine is not increasing the free chlorine or helping with algae growth, that is also likely chlorine lock.

Most pool professionals will recommend shocking the pool until the organic contaminants have been oxidized and increasing the free chlorine is possible. It may also be recommended to partially drain the pool water to reduce the bacterial load.

CLOUDY WATER

Pool water clarity is often reduced by undissolved particulate matter introduced by bather load. Often, these particles can be flocculated using a clarifier and removed by filtration. The filtration system must be operated at its optimal level since sanitizer alone cannot eliminate excessive particulate matter present in the pool. See section [Clarifiers and Flocculants] for more information on this topic.

Before jumping to a complex chemical solution for this issue, the underlying cause of the issue should be addressed. The main causes of cloudy water are algae blooms, poor filtration, poor water chemistry, low chlorine, and contamination. Clarifiers and flocculants are not designed to deal with any of those issues. Instead, the filter may need to run more often or an algaecide may need to be used.

EQUIPMENT AND CONSIDERATIONS

Over the years, various technologies have been developed that help maintain the condition of a pool. Instruments that monitor the pH, cleanliness, even chlorine concentration. Details about this equipment, as well as some considerations for their use, are included here.

SALT WATER CHLORINE GENERATORS

The use of salt-water chlorine generators to supply free chlorine to pool water for sanitization has increased significantly in recent years. Although these units provide more consistent dosing of chlorine to pool water than manual dosing there are several factors to consider so that their use does not lead to abuse and cause exposure of the liner material to excessive levels of free chlorine. Many homeowners who have been sold salt-water chlorine generators do not realize that their system is indeed a chlorine generator and not simply the use of salt to sanitize their pool. As such many are sold on the idea of “set it and forget it” as an easy and time saving method to treat the pool water. The first thing to remember with the use of these systems is that the requirement for diligence in testing and balancing pool water to maintain parameters within the recommended ranges is as important as it is with manual chemical additions.

To maintain a vinyl pool liner and maximize its service life CGT recommends controlling the water chemistry parameters within the following ranges:

1. Total Alkalinity: 80 – 120 ppm
2. pH: 7.2 – 7.6
3. Calcium Hardness: 200 - 400 ppm
4. Free Chlorine: 1.0 – 3.0 ppm
5. Cyanuric Acid Stabilizer: 25 – 50 ppm

Exposure of the vinyl liner material to the water chemistry parameters outside of the recommended ranges can result in a variety of negative effects. Some of these include liner wrinkling, liner color loss/staining and stiffening of the liner material which can lead to premature tearing and failure of the liner to hold water. All these result in a shortened service life for the liner.

ROBOTIC POOL CLEANERS

Many homeowners have turned to robotic pool cleaners to shorten the amount of time spent cleaning their pools. As with all pool equipment, it is important to choose cleaning products specifically designed for vinyl pool liners. Robotic pool cleaners designed for harder surfaces, such as concrete, require stronger suction and harder brushes that may damage vinyl liners.

Robotic pool cleaners should not be left unattended for long periods, as they can get stuck around walls, stairs, and drains. This can lead to removal of the liner print, especially if the vinyl has been weakened through exposure to improper pool chemistry.

AUTOMATIC POOL COVERS

Pool covers exist in many different forms and for a variety of different purposes. Safety covers prevent children and pets from getting into the pool unsupervised, solar covers reduce operating costs by minimizing water and chemical loss due to evaporation, and leaf nets prevent debris from getting into the pool. These different types have various advantages and disadvantages. This section will focus on the impact of automatic pool covers on vinyl lined pools.

Automatic pool covers, as the name implies, offer an easy method to open and close the cover at the push of a button. They are typically made of interlocking slats which can be easily reeled and unreeled to cover and uncover the pool.

Unfortunately, there are some negative impacts that are worthy of note. Due to the tight-fitting nature of automatic pool covers, they can allow for a buildup of heat and chlorine between the pool water and the underside of the cover. This area of high temperature and high chlorine can lead to increased water absorption into a vinyl pool liner. Increased water absorption can cause liner wrinkling and discoloration in the same way that it can occur when an excessive level of free chlorine is maintained in the pool water, thereby shortening the life of the liner. If these elevated exposure conditions are present, increased wrinkling and discoloration may be seen in excess in the area between the water surface and cover. It may also be seen on the underside of the cover, depending on the material.

It is important that automatic covers be vented or periodically opened to minimize the heat buildup and increased free chlorine conditions. Also, when adding any chemicals, they should be allowed to circulate before covering the pool. If the chemical concentrations have not been returned to acceptable levels before closing, then there is an added risk of damage to the vinyl and cover. Without taking these steps wrinkling and discoloration of the vinyl pool liner are likely to occur.

SUMP PUMPS

Many homeowners know the struggles that come with a high-water table, but a cracking and flooding basements aren't the only structural problems a homeowner may experience. All kinds of pool structures are susceptible to damage when enough water gathers behind them. Fiberglass pools are most susceptible to popping out of the ground and taking the deck along

with it, but vinyl and concrete pools are also capable of floating. Luckily, a floating liner is a much easier fix than the foundation of your pool rising and cracking. The key sign of a floating liner is what appears to be a large air bubble.

Sump pumps are commonly used in basements or construction sites to remove water that has accumulated in a 'sump pit', a pit that collects water from surrounding soil. The sump pump will pump water into a sewer or storm drain, instead of it flowing into a now-flooded basement. Sump pumps installed behind swimming pools function in the exact same fashion. A sump pump well will receive nearby water, and when it becomes full, the pump turns on and will be pumped out of a hose.

Keep in mind that is against many municipal guidelines to discharge sump pumps into sewers, and many municipalities also have strict regulations on where pool water can be discharged due to the high concentration of chemicals.

SUBMERSIBLE PUMP

Submersible pumps are similar to sump pumps, but they are designed to be used underwater instead of outside a pool. They can be used to quickly remove large volumes of water from a pool.

UV SANITIZATION SYSTEMS

UV Sanitization Systems utilize ultraviolet light to eliminate chloramines, eliminate bacterial contaminants, and lower the chlorine demand of a pool. In this system, after water flows through a traditional filter, it will flow through a UV lamp at an intensity that will disrupt the DNA of microorganisms and prevent them from reproducing. Less chlorine is then needed to remove the smaller colony of contaminants.

Unlike with sanitization using chlorine, the pool water isn't being continuously sanitized, because only the water currently going through the filter is being sanitized at one time.

This system is not typically used in outdoor pools, because the presence of chlorine and sunlight can make the use of a UV sanitization system redundant. This system is, however, seen often in indoor pools, because the enclosed space makes the presence of chloramines much more irritating to the senses.

Should you have any questions about your pool, call your dealer – they are your pool professionals.

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