User´s guide

Photo: Conny Sturesson

Pahlén

Day and night

User´s guide

A well-maintained pool with clean, clear, sparkling water promises many enjoyable moments, as well as a refreshing dip in the morning or an evening swim in the glow of the pool lights. Your pool will come to be the place where your family and friends naturally congregate.

We have produced this guide for you, the pool owner. In it we explain how a pool works and how you can look after it to get the greatest possible enjoyment from your pool installation. Many people think that looking after a pool involves a lot of work, but if you look after the circulation system and take care of the chemical cleaning as described in this guide you can look forward to many pleasant swims in a pool of clean, clear water with very little trouble.

The most important things about a pool are the ones you can´t see.

A reliable and steady water flow is essential. High-quality skimmers and inlet jets of acid-resistant stainless steel and bronze.

You can extend your pool use season by heating the water. Pahlén heating products of stainless acid-resistant steel are available for every type of pool.

Pool ladders must be stable. The one shown is in polished stainless steel with three steps. Fixed or hinged versions of ladders are available.

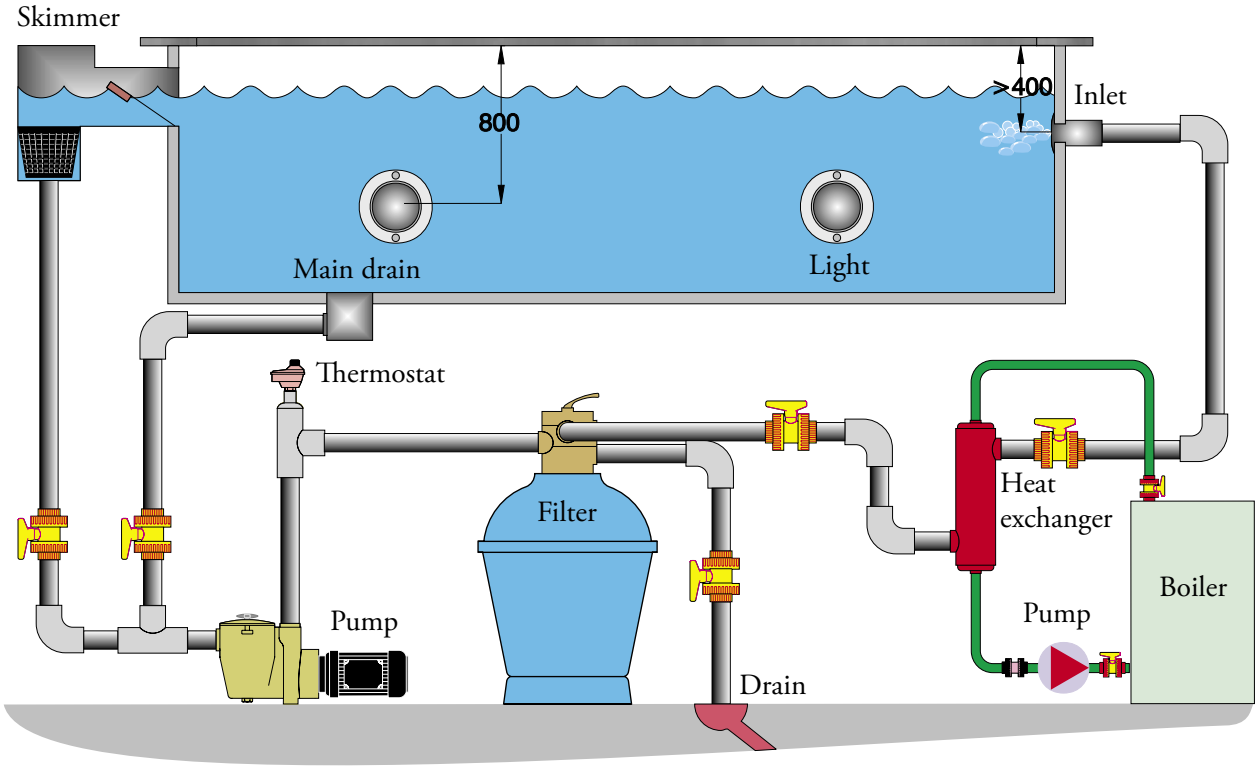
An evening swim or an evening atmosphere around the pool. A lighting package comprising a lamp unit and junction box of acid resistant stainless steel together with a transformer, cable and accessories.

Swimming for exercise has never been more fun or more effective than with a Pahlén Jet Swim in the pool. Complete Jet Swim packages in acid-resistant stainless steel with a bronze pump are available for both indoor and outdoor pools.

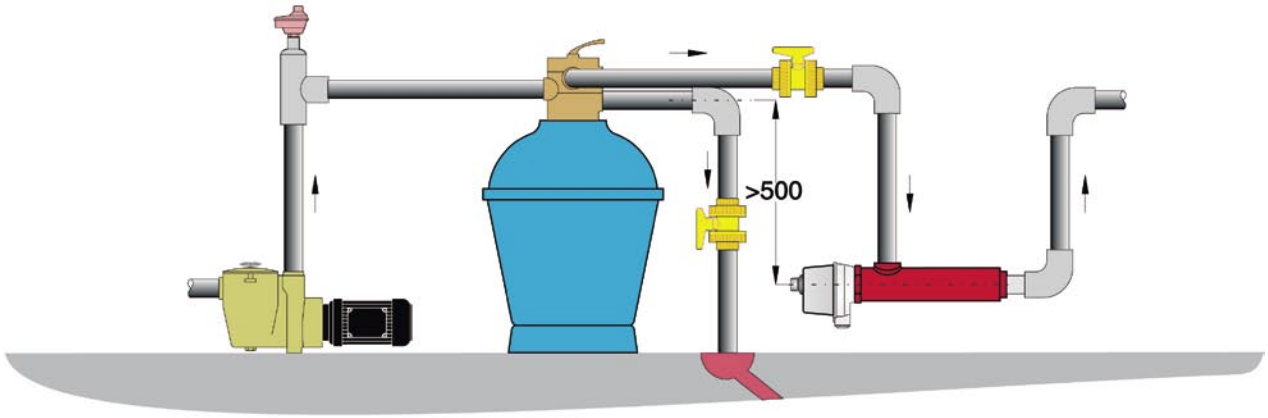
Pool water must be crystal clear. The sand filter and its pump are the heart of a pool and must be of the highest quality. This pump and backwash valve are made of bronze. The tank is GRP.

Pool schematic

With heat exchanger



With electric heater



Starting

Commissioning a newly-filled pool or starting in the spring

1. When starting in the spring, re-install pool components removed for the winter, close drain valves and refit drain plugs.

2. Fill the pool until the water level comes up to the middle of the skimmer opening.

3. Fill the filter basket housing on the pump with water. **NOTE: Never start the pump without water as this might damage the shaft seal.**

4. Open the valves of the vacuum, return and drain outlets.

5. Turn the lever on the backwash valve so the arrow points to BACKWASH. The lever turns more easily if you press it down.

6. Start the pump. When the pump has pumped the air out of the vacuum line (after about 1-3 minutes) and water is passing through the sight glass on the backwash valve drain outlet, rinse for about 1-2 minutes or until the water in the sight glass is clear. **NOTE: Any electric heater must be off.**

7. Stop the pump.

8. Turn the lever to RINSE, start the pump and rinse for about 15-30 seconds. Stop the pump and turn the lever to FILTER. This is the normal operating position.

9. Close the drain outlet valve and start the pump. **NOTE: Always stop the pump before moving the lever of the backwash valve.**

10. Check the pH and adjust it to 7.2 to 7.6. Shock-chlorinate via the skimmer to a chlorine level of 2 ppm (mg/l). With repeated chlorine dosing, wait three hours between tests to give the chlorine time to dissolve. After 24 hours, brush the bottom and sides of the pool clean and vacuum the bottom of the pool.

Vacuum cleaning

Attach the vacuum head to the telescopic handle and attach the vacuum hose to the vacuum head. Place the vacuum head on the bottom of the pool and feed the vacuum hose down under the surface of the water so that the hose fills with water and the air is forced out of the hose. Then bring the other end of the hose to the skimmer. Fix the SkimVac over the filter basket and connect the vacuum hose. If the vacuum at the vacuum head gets weaker, empty the skimmer filter basket. If the pool is very dirty, you may also need to empty the filter basket in the pump and backwash the filter. When you have finished vacuum cleaning, switch off the pump so that you can disconnect the SkimVac from the filter basket.

Cleaning the filter sand

After about 5-10 days, or when the reading of the pressure gauge on the pump side of the filter has increased by about 0.2 bar (20 kPa, 3 psi) since the last backwash, backwash the filter as follows:

1. Stop the pump.
2. Close the valves on the vacuum and return lines.
3. Open the cover of the pump and empty the filter basket.
4. Refit the cover.
5. Open the valve to the drain outlet.
6. Turn the lever to BACKWASH.
7. Open the valves to the vacuum and return lines.
8. Start the pump. Rinse the filter for about 1 to 2 minutes or until the water in the sight glass is clear. **NOTE: Any electric heater must be off.**
9. Stop the pump.
10. Turn the lever to RINSE, start the pump and rinse for about 15-30 seconds. Stop the pump and turn the lever to FILTER. This is the normal operating position.
11. Close the drain outlet valve and start the pump. Switch on the electric heater if any.

Positions of the backwash valve

FILTRATION	Normal filtering position.
BACKWASH	Cleaning the filter sand.
RINSE	Stabilizing the filter sand.
WASTE	For vacuum cleaning the bottom of the pool directly to waste, or for emptying the pool.
CLOSED	Closed.
CIRCULATION	Pumping water directly to the pool (no filtering).

The circulation system of the pool

Skimmer
Water is removed from the pool via an overflow (skimmer) which has a flap that positions itself according to the surface of the water. The skimmer increases the flow velocity of the surface water and draws any debris on the water surface into the skimmer. The debris accumulates in a filter basket. The basket must be emptied regularly, about once a week. If your pool has a main drain, the flow must be regulated so that about 30% of the water is taken from the bottom and about 70% from the skimmer.

Pump
The pump creates the vacuum (suction) at the skimmer and then forces the water through the cleaning filter, through the heater and back to the pool via the inlet jets. The filter basket in the prefilter of the pump must be emptied regularly, for example when backwashing. Before starting the pump, make sure that it is full of water, otherwise the shaft seal of the pump may be damaged. If the pump is above the surface of the pool water, the water drains back to the pool when the pump is stopped. Then, when the pump is started, it may take some time for the pump to evacuate all the air in the vacuum line and start pumping water. You can overcome this by closing the valve before the pump and then immediately switching off the pump. Doing this retains the water in the vacuum line.

Filter
The pool water is cleaned mechanically by a sand filter which filters out particles down to about 20 µ (microns, thousandths of a millimetre). On top of the filter tank there is a valve which controls the flow of water through the filter. The filter is two-thirds filled with filter sand with a grain size of 0.6-0.8 mm. As more and more dirt is trapped in the filter, the back-pressure increases. It can be read off on the backwash valve pressure gauge. When the back-pressure has increased by about 0.2 bar since the filter was last backwashed, the filter must be backwashed again. This means reversing the flow through the filter so that the dirt is released from the sand and flushed out via the drain. The filter sand should be changed after 6-8 years.

Heating
After the filter, the pool water is heated to a pleasant temperature. The water can be heated with an electric heater, by a heat exchanger connected to the domestic boiler, by solar panels or by a heat pump. Set the thermostat to the desired pool temperature.

Inlet jets
The cleaned and heated water is returned to the pool via the inlet jets. The jets should be aimed slightly upwards to move debris towards the skimmer.

Chemical cleaning

The pool water must be clear and totally free of both visible and invisible dirt. Visible dirt is mainly removed by the pool filter. The invisible dirt is made up not only of bacteria, which can multiply very rapidly and cause problems, but also algae and fungi of various kinds which spread to the pool, where they find the conditions pleasant. We use chemical agents to combat and control these.

To make sure the water in the pool is crystal clear and clean, it needs to be chemically treated for:

Disinfection
The pool water is disinfected to kill organisms such as bacteria, algae and fungi. Pool chemicals "burn off" the contaminants and make the water sparkling and fresh. The most widely used and effective agents are those that contain chlorine or bromine.

pH adjustment
Disinfecting agents work at their best within a narrow range of pH. The water must be neither too acid nor too basic. The ideal pH range for the pool and the human body is between 7.2 and 7.6.

Combating algae
Anti-algals prevent the algae from getting established and multiplying in the pool. Algae that have already become established need to be removed with an extra-high dose of chlorine (shock chlorination). With regular chlorination, there is normally no need for anti-algal treatment.

Flock dosing
If the pool water is filtered well, smaller amounts of chemicals will be needed to keep the water clean and clear. Flock and clarifier cause the micro-dirt to form larger particles, which are trapped by the filter. Only pools with a sand filter can be flocked.

Standard routines for good water care

Daily chlorination
Daily chlorination is the most effective way of disinfecting the pool water. Calcium hypochlorite in small tablets dissolves slowly and releases chlorine into the pool water. Place the tablets in the skimmer or in a floating dispenser.

Shock chlorination is done with calcium hypochlorite but in granular form. The granules dissolve quickly to give the pool water a rapid and powerful chlorine boost. Daily as well as shock chlorination raise the pH of the water. Use a pH-lowering agent to balance the pH once a week and after every shock chlorination.

Weekly chlorination
For weekly chlorination use a product containing slow-acting trichlorisocyanuric acid. E.g. 200 gram tablets dissolve slowly and continuously disinfect the pool water. Normally one tablet is enough for 20 m^3 of water for one week. Place the tablet in a dispenser. Use the test kit to check the free chlorine. If the reading is below 1.0 ppm (mg/l) apply additional chlorine.

Weekly chlorination is recommended in areas with relatively hard water. It contains a chlorine stabilizing agent (cyanuric acid) but no lime, since there is a risk that this would further increase the calcium hardness and lead to lime being precipitated in the pool. When using weekly chlorination, regular shock chlorination with calcium hypochlorite is recommended. The chlorine for weekly use lowers the pH of the water. This can be balanced with shock chlorination granular.

Halobrom
Halobrom is similar to the products for daily/weekly/shock chlorination in many respects, but it has the following advantages:
a. Halobrom can be used alternately with or at the same time as the products for daily/weekly/shock chlorination.
b. Halobrom retains its full disinfectant power within a significantly wider pH range than the chlorine products.
c. The typical chemical smell is non-existent. Halobrom is recommended for therapy baths, whirlpool baths and for individuals who are sensitive to chlorine.

Halobrom tablets can be placed in the skimmer, in dispenser or a brominator, a special pressure vessel for continuous dosing of bromine solution to the pool water.

The bromine demand depends entirely on how the pool is used. Dosing must take account of temperature and user frequency. The bromine content must be measured regularly to check the consumption.

pH - Chlorine

pH
The pH is a measure of the acidity of the water. The pH scale goes from 0 to 14, where pH 7 is neutral. If the pH is above 7, the water is basic; if it is below 7 the water is acid. The optimum pH for pool water is 7.4, since this is the same as the pH in human eyes and mucous membranes. A pH of 7.4 also gives good chlorine disinfection.

A low pH gives:
- aggressive water, which damages the mechanical components of the pool
- irritations of the eyes and mucous membranes
- damage to the pool liner

A high pH gives:
- poorer chlorine disinfection
- skin irritation
- lime precipitation
- cloudiness

The guideline pH figure is 7.2 – 7.6.
To lower the pH, use sodium bisulphate; to raise it use sodium carbonate.

Chlorine
Chlorine compounds may provide organic or inorganic chlorine. Organic chlorine is trichlorisocyanuric acid (for weekly chlorination) and dichlorisocyanuric acid (dissolves rapidly and is suitable for small pools). Inorganic chlorine is calcium hypochlorite (for daily and shock chlorination) and sodium hypochlorite (liquid).

When a pool is dosed with either organic or inorganic chlorine it is free chlorine that attacks bacteria and contaminants. As the chlorine acts it is converted into bound chlorine. Bound chlorine (also known as chloramines) is ineffective, smells of chlorine and may cause irritation of the eyes and mucous membranes.

To reduce the bound chlorine, the pool is shock chlorinated with calcium hypochlorite. The high chlorine content that forms temporarily on shock chlorination disappears quite quickly in an outdoor pool, but can also be lowered with chlorine reduction compounds. Chlorine is continuously consumed in the pool, and different factors determine the chlorine consumption, including bathing frequency, water temperature, sunlight and pool size. A test kit is used to measure the chlorine content. Most kits measure free chlorine, but to measure the bound chlorine you need to measure total chlorine. Total chlorine is the sum of free and bound chlorine.

If organic chlorine (weekly chlorination) is used, cyanuric acid accumulates in the pool. Where the cyanuric acid content is above 100 ppm (mg/l), chlorine blocking may occur, making the chlorine ineffective. Cyanuric acid can be removed by adding water from the mains supply.

Cyanuric acid acts as a chlorine stabilizer, preventing the sunlight from breaking down the chlorine, for example. It is therefore advisable for outdoor pools to have a cyanuric acid level of 10-20 ppm (mg/l).

Guideline values:
Free chlorine: 0.5-1.5 ppm (mg/l)
Bound chlorine: 0-0.5 ppm (mg/l)
Total chlorine: 0.5-1.5 ppm (mg/l)
Cyanuric acid: 0-50 ppm (mg/l)

Total alkalinity - Calcium hardness

Total alkalinity (TA)
Total alkalinity is a measure of the amount of alkaline substances in the water. These may cause the pH of the water to change in an uncontrolled manner. A low TA makes the water aggressive and causes rapid pH fluctuations. A high TA makes the pH difficult to adjust and causes cloudiness and lime precipitation. The guideline figure when using calcium hypochlorite (daily or shock chlorination) is 60-100 ppm (mg/l) and with trichlorisocyanuric acid (weekly chlorination) and Halobrom 90-125 ppm (mg/l).

Total alkalinity can be **reduced** with sodium bisulphate and **increased** with sodium bicarbonate.

Calcium hardness (CH)
The calcium hardness is a measure of the amount of lime dissolved in the water. Water with a CH of less than 100 ppm (mg/l) is described as soft water and draws lime out of, for example, the concrete of cast pools and tile grouting, leading to disintegration. It also makes the water aggressive.

Water with a CH above 300 ppm (mg/l) is described as hard water and causes lime to be precipitated. Lime precipitation causes limescale to form on the walls and pipes of the pool and in its mechanical equipment. The guideline figure is 100-300 ppm (mg/l).

The calcium hardness can be **reduced** by dilution with fresh mains water and **increased** with calcium chloride.

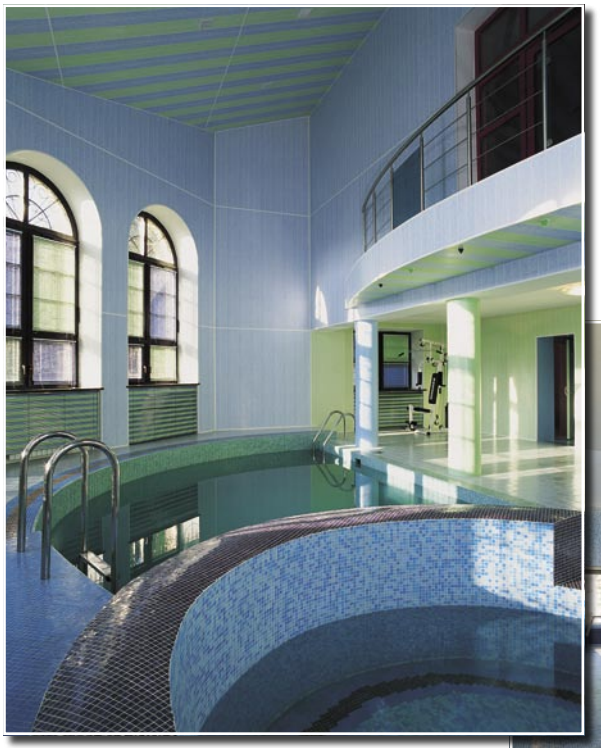


Photo: General Ecology

Balanced water

The balance of the pool water is determined on the basis of simultaneous measurement of temperature, pH, calcium hardness and total alkalinity.
Calculation of the water balance gives an idea of whether the pool water is aggressive or whether it will cause limescale deposits.

An index value above +0.5 gives
- lime-precipitating water.
- cloudy water and limescale deposits on the walls, pipes etc of the pool.

An index value below -0.5 gives
- aggressive water.
- irritation of the eyes and mucous membranes, as well as attacking the mechanical equipment of the pool.

The index value is calculated with this formula:
Index value = pH+TF+CF+AF-12.1

pH	pH
TF	temperature factor
CF	calcium hardness factor
AF	total alkalinity factor
12,1	a constant

See the table below for the factor for each parameter in the formula.

We recommend the Autocheck II photometric test kit for determining the water balance. This is in order to obtain an exact value for each parameter in the formula.

Temp °C	TF	Calcium hardness mg/l $CaCO_3$	CF	Total alkalinity mg/l $CaCO_3$	AF
20	0,52	25	1,00	25	1,40
22	0,56	50	1,30	50	1,70
24	0,60	100	1,60	70	1,86
25	0,62	120	1,68	80	1,92
26	0,64	140	1,76	90	1,96
27	0,66	150	1,80	100	2,00
28	0,68	170	1,84	120	2,08
30	0,72	200	1,90	150	2,20
32	0,76	250	2,00	200	2,30
34	0,80	300	2,10	300	2,50
41	0,90	400	2,20	400	2,60

Test kit

A test kit is used to check the free chlorine and pH of the pool water. Some test kits also measure total chlorine, total alkalinity, calcium hardness and cyanuric acid. The DPD test kit is available in a manual version, in which the test water is compared with a colour scale, and a photometric version, in which the value is displayed digitally to two decimal places. Every test kit is supplied with test tablets as follows:
DPD no. 1 measures free chlorine
DPD no. 3 measures total chlorine
Phenol red measures pH

Where the chlorine level is above 5 ppm (mg/l) the test water is bleached. The result may then indicate that there is no chlorine in the pool. If you suspect this, you can dilute the test water with ordinary tap water.
Avoid touching the test tablets with your fingers as this may cause incorrect results.

Test strips are dipped in the pool and their colour of the measurement areas is compared with the colour scale on the pack. For correct readings, move the test strip back and forth in the water for five seconds. Take the strip out of the water and wait five seconds before comparing the colours.

Photo: Conny Sturesson

Problems and solutions

Symptom	Cause	Action
Eye and skin irritation		
Red eyes	Incorrect pH	Adjust the pH
Skin irritation	High bound chlorine: (not enough free chlorine)	Shock chlorinate with calcium hypochlorite small tablets or chlorine granules
Limescale deposits		
Limescale on walls, pipes, filters and electric heaters	pH too high	Adjust with pH lowering agent
	Calcium hardness too high Total alkalinity too high	Determine water balance and adjust
High chlorine level		
Hair and bathing costumes are bleached	Too much chlorine	Add chlorine reducing agent
Possible eye irritation	Incorrect test readings	Check the test equipment
Algae		
Green algae, green water, slippery surfaces, cloudy water	Not enough chlorine	Adjust the pH and shock chlorinate
Spots of black algae		Adjust the pH, scrub the surfaces with chlorine solution Add anti-algal agent
High chlorine consumption		
Unusually high consumption of disinfection preparations	Large numbers of bathers Severe contamination High air and water temperature	Shock chlorinate with calcium hypochlorite
	Not enough stabilizing agent in the pool	Add cyanuric acid
Cloudy water		
Cloudy water	Signs of algae formation	Shock chlorinate with calcium hypochlorite
	Poor filtering	Check the filter
	pH too high	Adjust with pH lowering agent
Green water		
Green water	Algae	Shock chlorinate with calcium hypochlorite
	Copper corrosion (pH too low)	Increase the pH with pH-increasing agent
Discoloured water		
Brown	Iron	1. Adjust the pH
Black	Manganese	2. Shock chlorinate with calcium hypochlorite
Blue-green	Copper	3. Flock the pool water with flocking agent

Closing down for the winter

When the bathing season is over and winter is on the way, you need to check your pool and its equipment. Precisely when to do this depends partly on where the pool is geographically and partly on the way the pool is used. Here are some tips on what to do when the bathing season is over. Check whether the structure of your pool can withstand the water freezing. In some instances the surface of the water must be insulated and
circulation must be maintained.

For pools that can withstand freezing:

A Adjust the pH to 7.2-7.6 and switch off the pool heating.
B Allow the pump to circulate the pool water and continue with reduced chlorination until the temperature of the pool water falls below +7 °C. The final shutdown procedure is as follows:

The final shutdown procedure is as follows:

1. Brush down the sides of the pool and vacuum the pool thoroughly to make sure that it is really clean.

2. Backwash the filter thoroughly for 3 to 5 minutes. Then set the backwash valve lever to FILTER.

3. Switch off the electric power at the consumer unit (fusebox).

4. If there is a pool ladder, take it out, wipe it off and store it in a dry place.

5. Remove the filter basket and flap from the skimmer. Then install an expansion flask or pieces of cellular plastic where the filter basket was located. These will take up the expansion of the ice.

6. Remove the adjustable injection nozzles (the balls). If the pump/filter unit is below the water level, install winter plugs where the injection nozzles were removed.

7. Remove the lighting unit and store it in a plastic bag on the edge of the pool.

8. Drain down the filter tank by unscrewing the drain plug in the bottom of the tank.

9. Remove the pump cover and take out the filter basket. Remove the drain plugs from the pump housing and the pre-filter housing. If the pump is outdoors, the motor should be removed and stored indoors.

10. Remove the pressure gauge on the backwash valve of the filter.

11. If the heater is not in a frost-free location, remove the drain plug. If there is no drain plug, disconnect the pipe coupling between filter and heater, so that all water is drained from the heater.

12. Add anti-algal agent as recommended on the pack.

13. Shock-chlorinate by dissolving calcium hypochlorite in a bucket of warm water and tipping it into the pool.

14. If the pool has steps, provide something around the steps to take up expansion which will shrink when the ice moves, reducing any strain on the steps. This could be a few plastic containers partly filled with a mixture of water and antifreeze (glycol), held in place with a weight.

15. Place your pool cover over the pool.