

## WHY SHOULD I INSTALL A SALTWATER POOL

in preference to

**A POOL USING OZONE, LIQUID OR POWDERED CHLORINE OR OTHER CHEMICAL MEANS AS THE SIMPLE BIOCIDES.**

### WHY SHOULD I USE AN ISOTONIC POOL WATER SOLUTION?

#### **WHY SHOULD I INSTALL A WATERMAID?**

There are three states of water conditioning for use in pools that are of interest to swimmers and pool owners. These are **isotonic solutions, hypo tonic solutions and hyper tonic solutions.**

**Isotonic solutions of pool water.** This water condition has an osmotic pressure that is equal to the osmotic pressure of blood serum and other body fluids. The body's cell tissue is sensitive to changes in osmotic pressure. In pool water that is isotonic with blood serum and other body fluids, the osmotic pressure is equal on each side of the cell membrane. There isn't a net transfer of fluids across the cell membrane.

**The saline solution used as an intravenous drip in hospitals is an isotonic solution.**

An isotonic solution is an ideal pool water condition that provides maximum comfort for people swimming in the pool. Swimmers feel good when they are swimming in isotonic pool water. Stretching and wrinkling of the skin at the fingertips, stretching and wrinkling of the skin on the underside of the toes and irritation of the eyes are noticeably reduced or eliminated. Children get the most benefit. They spend long periods of time in the pool.

**A pool with a sodium chloride salt concentration of 9000 ppm is isotonic with blood serum and body fluids.**

All Watermaid installations since 1992 can be immediately upgraded to a pool concentration of 9000 ppm. Installations earlier than 1992 may not be suitable for upgrading.

There are a couple of important definitions.

**A semi permeable membrane.** Nature uses a semi permeable membrane to enclose each single cell of body tissue. For the purpose of this article and to assist the ease with which the function of the membrane can be visualised, it can be said that the membrane behaves as a screen (but it is acknowledged that this definition is not technically correct). The membrane allows the passage of smaller molecules (such as water) but disallows the passage of larger molecules (such as sodium chloride).

**Osmotic pressure.** It's easy to confuse people when trying to describe the concept of osmotic pressure. In this article, it's sufficient to say:

Osmotic pressure is an expression that relates to the behaviour of salt in a pool water solution. The expression doesn't say much at all about the water in the solution.

To assist in the understanding of this concept, can be said:  
When the osmotic pressure of the pool water solution is high then the pressure that causes water to diffuse across the semi-permeable membrane of a cell is low.

And visa versa.

When the osmotic pressure of the pool water solution is low then the pressure that causes water to diffuse across the semi-permeable membrane of a cell is high.

**Hypo tonic solutions of pool water.** This pool water condition has an osmotic pressure that is lower than the osmotic pressure of blood serum and other body fluids.

The pressure that might cause pool water to diffuse across the semi-permeable membrane and into the cell is high. The equivalent but opposing pressure inside the cell is low by comparison. Since the pressures on each side of the cell membrane are not equal, there is a net transfer of fluid from the pool and into the cell.

The cell is hydrated by this process (inflated like a balloon). The cell swells and membrane damage is likely to occur. It's a painful experience when it happens. A less drastic situation occurs when hydration causes the cells to swell only a little and the cells occupy more space. Under these conditions, the skin stretches and then folds to accommodate the extra length of the skin. This is the reason why long periods in the pool produce stretching and wrinkling of the skin at the fingertips, stretching and wrinkling of the skin on the underside of the toes and irritation of the eyes.

Most people are aware that injections are painful when sterile, pure water is used as the vehicle for carrying the drug. This solution is hypo tonic. When pure water is used, the sensitive cells lining the vein are hydrated and the cell membrane is damaged.

If sterile, pure water is used as the vehicle for carrying the drug used in an intravenous drip, the patient might die. An intravenous drip normally remains in place for a long period of time and has the potential to dispense a large volume of hypo tonic fluid into the body.

Injections and intravenous drips must not be hypo tonic solutions. They must be isotonic.

A pool with a sodium chloride (salt) concentration of less than 9000 ppm is *hypo tonic* with blood serum and body fluids. Most manufacturers design chlorinators that can only operate continuously in a hypo tonic solution of pool water. Most recommend using a salt concentration of only 3000-4500 ppm.

Pool owners using chemical means, such as liquid or powdered chlorine for biocidal control are the worst affected. The resulting osmotic pressure of the

solutions in these pools isn't much different from tap water. These water solutions are seriously hypo tonic.

This pool water is not so comfortable for swimmers.

And the children in the neighbourhood demonstrate this.....

It's common to see children choosing to swim in the pools in the neighbourhood that are salt water chlorinated in preference to the ones that use chemicals as the biocide.

Spa and hot tub water have the same problems. A large majority of these installations use ozone or perhaps bromine sticks as the biocide. These systems of water conditioning ignore the osmotic pressure of the spa water solution and the water is seriously hypo tonic. The comfort of bathers using spas conditioned in this way is compromised.

It's fair to say that liquid chlorine or ozone conditioning is often accompanied by water treatment to adjust the Langlier index to bring the water into chemical balance. Some salts are added to the water for this purpose. But not much. When the Langlier Index is properly adjusted and the water is in balance, these pool solutions remain seriously hypo tonic.

**Hyper tonic solutions of pool water.** This pool water condition has an osmotic pressure that is higher than the osmotic pressure of blood serum and other body fluids.

The pressure that might cause pool water to diffuse across the semi-permeable membrane and into the cell is low. The equivalent but opposing pressure inside the cell is high by comparison. Since the pressures on each side of the cell membrane are not equal, there is a net transfer of fluid from the cell and into the pool.

The cell is dehydrated by this process (deflated like a punctured football bladder) and the cell ceases to continue functioning normally until it is re-hydrated.

Everyone knows about the fellow who struggled in the desert for a week with no water. When he finally saw the clean, cool water of the sea, he dragged his badly dehydrated body beyond the first breaker and relaxed in a floating position while he took a long, cool refreshing drink. He was dead in minutes. The hyper tonic seawater drained the last remaining nutrient laden fluids from his cells.

Seawater isn't so aggressive for conventional swimmers of course. Conventional swimmers aren't pre-conditioned by extreme dehydration when they enter the water but seawater does dehydrate their cells and the kidneys do clear the surplus water from their bodies. They become thirsty. Hyper tonic solutions behave as a diuretic.

Hyper tonic pool water is not an ideal condition for maximum comfort.

A pool with a sodium chloride salt concentration greater than 9000 ppm is *hyper tonic* with blood serum and body fluids. Seawater has a salt concentration of 30-35000 ppm.

**Who will be interested in the Watermaid system of chlorinating and conditioning pool water?** Everyone. This system will appeal to those people who simply like to feel good when they are in their own pool and are quietly pleased when they notice the difference between swimming in their own pool and swimming in their neighbour's pool.

There are hidden advantages too. Ten or more years ago, a child nearly drowned in a well-known Olympic sized swimming pool.

This pool was equipped with the Watermaid system of chlorinating and conditioning pool water. The pool owner reported that the child was unconscious with his head under the water for ten or fifteen minutes. He said that the doctor on duty at the hospital advised that the child had suffered a near-drowning experience in a salt-water solution that was almost isotonic with the blood. The doctor said that the child was lucky. There was no damage to the tissues in the lungs and the child survived as a consequence.

None of our competitors recommends using isotonic pool water solutions.

*But we do.*

There are significant benefits for pool owners.

#### **PRICE COMPETITION versus EQUIPMENT COMPETITION.**

Watermaid has been criticised because its saltwater chlorinators are a little more expensive than those manufactured by some of our competitors. We agree there's a difference when the comparison is based on price alone but there are more expensive chlorinators on the market and there are properties of our units that transform our prices into an unimportant issue for many pool owners.

**We are not manufacturing units that are directly comparable.**

**And we are not competing on price alone. We are competing with equipment design and function.**

In the area of equipment design, we are recognised as being leaders in our industry. Our chlorinators do more than simply disinfect water. They provide a wide range of design features and perform a wide range of functions to satisfy the personal preferences of individual pool owners.

This is the primary reason for the apparent price difference.

But our chlorinators are not more expensive. Measured against others on a design-feature-for-design-feature basis and adjusted accordingly, our chlorinators are cheaper. This article is written:

- To bring many of the design and function differences into sharper focus.
- To explain the benefits of using the Watermaid system for chlorinating and conditioning pool water.

- To identify the benefits of adjusting the osmotic pressure of pool water to a level that is isotonic with blood serum and other body fluids.

#### **EQUIPMENT COMPARISONS.**

Manufacturers who are competing against one another with prices and others who are competing against one another with equipment are not necessarily going to produce comparable units. This has been demonstrated by the wide range of quality being offered to pool owners as "comparable units". Some manufacturers strive so hard to achieve a "cheaper price" that they've allowed their price competitive spirit to stand in the way of their design excellence. They've taken short cuts and their resulting products are not so good.

For example, some manufacturers have designed a circuit board that can't operate continuously in an overload condition for long periods of time. Certain electronic elements in the control board overheat and fail in these units and this generally occurs when the chlorinators are operated in salt concentrations that are higher than the recommended level.

Other manufacturers use a 240-volt AC electric light dimmer switch to control the 8 V DC output. In a crude way, these controllers chop large sections from the waveform and the DC output is modified to conform more closely to one of the higher frequency harmonics. Ferro-resonant characteristics are excited in the transformer and at lower output; the 8-volt DC output is unstable. Heat is generated in the transformer and this shortens the life of the transformer or limits the concentration of salt that can be used in the pool.

Other manufacturers have designed a 240-volt AC control unit using a simple capacitor and variable resistor. These simple components only manage to regulate chlorine production from 100% down to 80% of full output. A compromise has been designed into these chlorinators by installing a smaller transformer and reducing the maximum output of the chlorinator.

Some manufacturers use more sophisticated control circuits on the 240-volt AC side to gain a wider range of regulation but these units unveil the inherent instability that exists with 240-volt AC controllers at low output. Transformers and other circuit components overheat and fail.

Many manufacturers recommend a salt concentration of 3000-4500 ppm as being the optimum concentration for their system of chlorinating and conditioning pool water. This has occurred when the standard for the industry is 6000 ppm. This salt concentration has been aggressively marketed as a financial advantage for the pool owner and the manufacturers proudly explain that the cost of salt and the cost of delivering it to the pool are reduced by a third or more in pools using their system.

These manufacturers have missed the point. Their system of chlorinating and conditioning the water in the pool doesn't address one of the most important issues.

Some manufacturers have designed special cells that have closely spaced plates for use in pools where price competitive pressures encourage the reduction of salt concentration in the pool. These cells allow a saving in the cost of buying salt and delivering it to the pool but the cells are also taking the salt concentration in the wrong direction for optimum comfort in the pool.

*These cells cater more for the interests of competitive tendering than for the interests of the pool owner.*

*When the pool owner wants to upgrade the quality of the pool and enjoy the benefits of using a higher salt concentration, it's then necessary to purchase and install a different cell.*

Some manufacturers do recommend using a salt concentration of 6000 ppm but the equipment supplied by these manufacturers fails in other areas. For example, some rate their chlorinators not to exceed 11 grams per hour. Others set the top limit at 15 grams per hour. Others go a bit higher.

These systems have no spare chlorine manufacturing capacity that can be used to fight sudden emergencies and very quickly extinguish infectious contamination of the

pool.

These units fail the most essential of all the tests.

Other manufacturers, who recommend 3000-4500 ppm as the optimum concentration, also claim that their chlorinators can operate in seawater. This may be true. But their units are not continuously rated to operate in seawater. It's an empty statement. These manufacturers have installed a circuit board with components that have a life of only three or four years when operating in their own recommended optimum salt water concentration. These units can't be continuously rated for use in a seawater concentration of 30-35000 ppm. This would place an even larger load on the transformer and circuit board components that are already overloaded when operating in the design load.

Perhaps the best example of the competitive price spirit of some manufacturers is the short cut taken with the size of their transformers. It's not hard to multiply 30 amps by 8 volts to discover that the cell load and heat losses in a chlorinator are 240 watts. At the design load, most chlorinators have a power factor of approximately 0.6. In rough terms, the rating of chlorinator transformers should therefore be 240 watts divided by 0.6 or 400 VA.

Watermaid is one of the few manufacturers that use a 400 VA transformer. Other manufacturers install transformers rated from 150 VA through to 250 VA. The 250 VA transformers are continuously rated to produce only 19 grams of chlorine per hour at a power factor of 0.6 ( $30 \times 250 / 400$ ). The 150 VA transformers are continuously rated at only 12 grams per hour.

None of these transformers have sufficient capacity to operate continuously at 30 grams per hour and none of them have sufficient spare chlorine manufacturing capacity to fight sudden emergencies and very quickly extinguish infectious contamination of the pool. There are other examples.

*We believe that it's in the interests of the pool owner to purchase a cell that costs a little more up-front but lasts three times as long.*

The life of the platinum coating on the terminals of a cell is determined by many factors but two important determinants are the current density flowing across the plates and the quality of the platinum coating.

Watermaid cells are continuously rated at 30 amps when the current density is 500 amps per square metre of terminal. This is the platinum coating manufacturer's recommendation. Some manufacturers use current densities as high as 1200 amps per square metre. These cells don't have a very long life.

There are three main grades of platinum coating available in Australia.

The premium quality and more expensive coating provides a cell life of about 5 - 10 years. Watermaid cells have a life of about 5 - 10 years. The lower quality and less expensive platinum coating provides a life of about 3 years. Some manufacturers get only two or three years life out of their cells.

Watermaid only uses premium quality platinum in its cells. Within this context, it's not necessary for us to provide a five-year pro-rata warranty to supplement the poor

performance of a lower grade platinum coating. We don't use a lower grade platinum coating.

But there is another issue. We have been advised by our clients and customers that we are losing a competitive marketing advantage for our cells because we don't have a pro-rata warranty. For this reason we introduced a five-year defect free warranty, several years ago, that is more advantageous in all respects to that of our competitors.

*But we still use premium quality platinum coatings in all our cells, including the platinum coating we use in our "look-alike" cells.*

A lower grade of platinum coating is used for reverse polarity cells. We don't produce cells of this type. They have the advantage that less frequent cell cleaning is required. They have the disadvantage that the continuously reversing polarity of the terminals undermines and destroys the platinum coating. These cells have a life of about two to three years.

The following picture is that of a self cleaning electrode, manufactured by a competitor, at an age of less than two years, that has failed.

The pictures show the platinum coating flaking away, rendering the cell useless.

10x Magnification



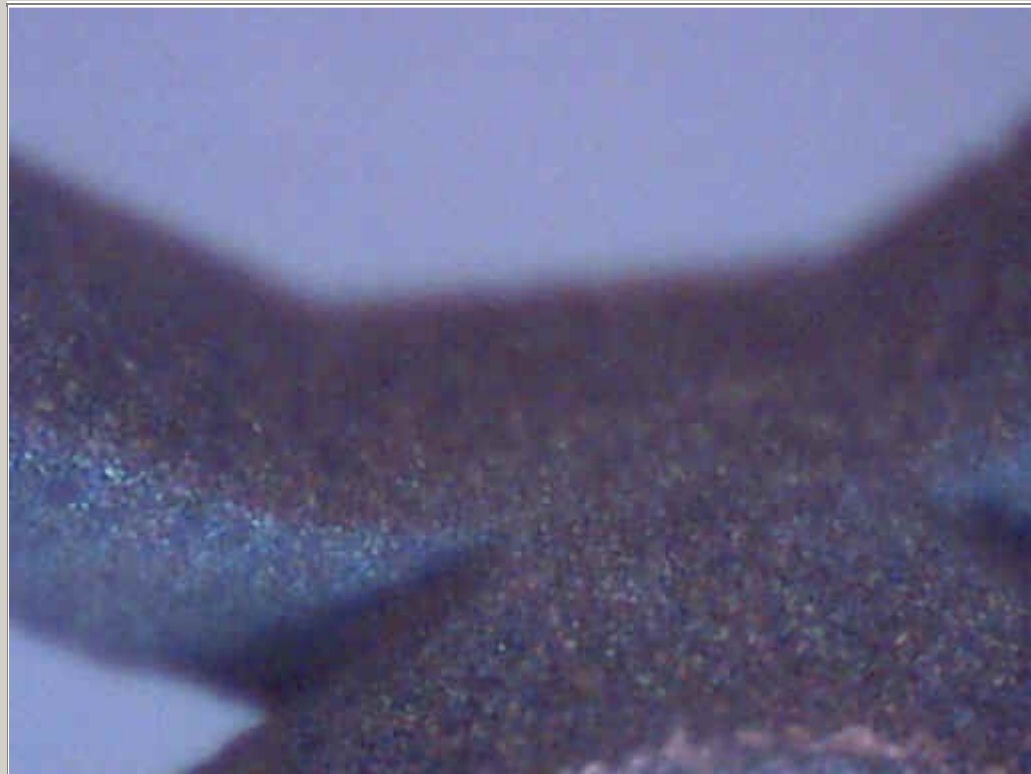
60x Magnification



These cells are also the most expensive of all cells to purchase at a cost of about \$450.00 - \$600.00

***Watermaid's premium quality platinum coating.***

***Used BEFORE 1990. Magnified 60 times.***



***Notice the properties of the platinum coating and its colour.***

***Notice the fine size of the particles.***

***Notice the dense packing of the particles, the thickness of the coating and the uniformity of dispersion.***

***This coating has been electro-deposited and fired in an oven. It is resistant to erosion.***



***Notice the change to a rich bronze-gold colour.***

***The colour is caused by an IRIDIUM addition to the platinum mixture. Coatings manufacturers made the change in 1990.***

***It is a more expensive coating that has a longer life.***

***This coating has also been electro-deposited and fired in an oven. It is resistant to erosion.***

***One manufacturer's coating.***

***Current November 1999. Magnified 60 times.***



***This is a cheaper grade of platinum coating. Notice that the bronze-gold colour is not so rich. This coating has less iridium than a premium quality coating.***

***Notice the texture. This coating has been laid with a brush. Coarser, cheaper particles have been used. Notice the holes and furrows in the coating.***

***Excessive erosion will occur in the holes and furrows. This will result in undermining and flaking.***



***This is also a cheaper grade of platinum coating.***

***Notice the texture. This coating has been laid with a brush. Coarser, cheaper particles have been used. Notice the holes and the porous, uneven thickness of the coating.***

***Excessive erosion will occur in the holes and where the coating is thin. This will result in undermining and flaking.***

**So,**

**WHY SHOULD I INSTALL A SALTWATER POOL**

in preference to  
A POOL USING OZONE, LIQUID OR POWDERED CHLORINE  
OR OTHER CHEMICAL MEANS AS THE SIMPLE BIOCIDES?

There's a simple answer. It's much cheaper to own. A saltwater chlorinator will eliminate the high expense associated with regular purchases of biocidal chemicals. And it will eliminate the need to find a safe place to store these dangerous chemicals.

**WHY SHOULD I USE AN ISOTONIC POOL WATER SOLUTION?**

There's a simple answer to this question as well. An isotonic pool solution is extremely pleasant for relaxation...it feels good...even after long periods in the pool. But there's another reason.

It's just a shade safer for the children.

But think about it carefully. Your children might become very popular. All the kids in the neighbourhood might prefer to swim in the pool with the isotonic pool solution.

**WHY SHOULD I INSTALL A WATERMAID?**

This is the simplest of the three questions to answer. Watermaid has been designed to use the best of the long-life materials that are available and the most reliable components. It's the best chlorinator on the market and the only one that has been explicitly designed for use in isotonic pool solutions.