Date Issued	Sept 24
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Helpful Information for You and Your Pool

Effects of Water Temperature and pH on the Langelier Saturation Index (LSI) in Your Pool

Introduction:

The temperature of your pool water coupled with its pH does affect many parts of the water balance equation, the LSI. (Langelier Saturation Index).
This is more often the case for salt water chlorinated swimming pools.
Depending on the location of your pool, will dictate the annual temperature range. In tropical and desert areas pool water temperature can reach 30C often. And in the winter be in the range of 20 to 5C respectively.

Whereas in the more moderate parts, the summer pool temperature is likely to be in the high 20's and falls to around 5 C in the cold winter.

So is your pool water management framework taking note of these variations and adjusting the chemical demands and replacements accordingly. (Make sure your pool shop adjusts the pool water test temperature to reflect current reality, otherwise you will get incorrect readings and thereby the wrong dosages. This is a very common issue).

Saturation Matters:

Over-saturation (high LSI) Scaling
These factors are usually pH and water temperature rising, or maybe too large of an increase in alkalinity or calcium hardness by the pool owner or operator. The result of over-saturation is calcium precipitation in the warmest places first, followed by all surfaces in time including the filtration system.

Under-saturation (low LSI) Corrosive
If calcium hardness levels are too low the water is undersaturated, causing the water to be aggressive as it attempts to pull out the calcium it needs. This type of water will start to corrode surfaces inside the pool, such as plaster or other minerals, to maintain its hardness demand. It can also attack any metal parts in the pool or filtration system.

pH Influence on Effectiveness of the Sanitiser:

The pH in a pool or spa impacts the sanitiser efficacy of chlorine tremendously. For example, at a pH of 7.2, chlorine is 65 percent effective; at 7.8, 32 percent effective; and at 8.0, 20 percent. As you can see, **chlorine effectiveness decreases dramatically as the pH in water increases.**

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This study tells us two things: The first is that salt generators will cause the pH in a swimming pool to rise quickly. The second is that once-a-week testing and adjustment is not enough to maintain proper pH levels.
How many of your customers and homeowners with saltwater pools are hand-dosing multiple times a week?
If the answer is most, then they're savvier than the average customer who bought into this technology under the assumption of a maintenance-free pool.

And you and I know that just isn't the truth.

So, how can you keep your pool free and clear of scaling, calcium build-up and other problems that arise when pH and alkalinity are off the charts?

What is LSI and why is it important for your pool?

The Langelier Saturation Index, often called the "LSI," the "saturation index," or the "stability index," is a numerical value indicating whether or not water is balanced.

Saturation Index is: The water. If LSI Index is between -0.3 and +0.3 pool water is Balanced. When pool water is balanced, it has no effect on the pool or equipment.

The Saturation Index is a tool for determining if your pool's water is corrosive or scaling. If your water is corrosive, the pool's water will dissolve calcium in pool linings and protective coatings. If your water is scaling, calcium will be deposited on surfaces, pipelines, filters, valves, and pump.

For more details, on LSI please refer to INFOSheet: What is LSI or Langelier Saturation Index?

We often talk about swimming pool water balance and how important this is for the health of your pool. But what does that mean? How do the pH and pool water temperature impact on the LSI? (The Balance)

Some Examples to Help You Understand the Relationship between Pool water Temperature, pH and LSI results.

NOTE: Answers in Yellow are corrosive and in Red are scaling, Green is Balanced

TA = Total Alkalinity. Ca = Calcium Hardness

Example 1

TA 100, Ca 250ppm (Recommended)

This is an ideal situation, and you can see the variations in pool water temp have minimal effects on LSI, with pH about 7.4- 7.8 (A wide spread with basically with little impact on the LSI)

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.5	10	-0.3	10	-0.12	10	+0.1	10	+0.3
16	-0.4	16	-0.22	16	-0.02	16	+0.15	16	+0.36
21	-0.35	21	-0.15	21	+0.05	21	+0.22	21	+0.42
26	-0.3	26	-0.1	26	+0.1	26	+0.28	26	+0.5
27	-0.27	27	-0.07	27	+0.17	27	+0.32	27	+0.55
32	-0.18	32	0.00	32	+0.2	32	+0.4	32	+0.6

Example 2

TA 70 (Low), Ca 250ppm (Recommended)

Here we have the TA rather low and the Ca still as recommended. You can see the area of balance is reduced and you need to keep the pH nearer to the 7.6 bracket to be in balance across the temp range. If pH drops it becomes more corrosive and if pH rises, little change from example #1

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.7	10	-0.5	10	-0.25	10	+0.05	10	+0.15
16	-0.6	16	-0.4	16	-0.15	16	+0.05	16	+0.2
21	-0.55	21	-0.35	21	-0.1	21	+0.13	21	+0.3
26	-0.5	26	-0.25	26	0.0	26	+0.18	26	+0.35
27	-0.45	27	-0.22	27	+0.07	27	+0.22	27	+0.4
32	-0.35	32	-0.15	32	+0.1	32	+0.3	32	+0.45

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Example 3

TA 130 (High), Ca 250ppm (Recommended)

Here we have the TA rather high and the Ca still as recommended. You can see the area of balance is still good at pH 7.4 - 7.8 with a medium temp range. If pH drops at low temp, it becomes more corrosive and if pH rises not much change compared to #1, the recommended ranges.

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.45	10	-0.2	10	0.00	10	+0.2	10	+0.3
16	-0.35	16	-0.1	16	-0.1	16	+0.3	16	+0.4
21	-0.25	21	0.00	21	+0.2	21	+0.4	21	+0.48
26	-0.2	26	+0.08	26	+0.25	26	+0.45	26	+0.53
27	-0.18	27	+0.1	27	+0.26	27	+0.5	27	+0.55
32	-0.1	32	+0.15	32	+0.33	32	+0.55	32	+0.65

Example 4

TA 100 (Recommended) Ca 150ppm (Low)

We have the TA still as recommended and the Ca rather low. You can see the area of balance moves to a higher pH range across a wide temperature span, compared to #1. Keep the pH nearer to the 7.6- 7.8 bracket to be in balance. If pH drops it becomes quickly corrosive and if pH rises not much change seen.

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.8	10	-0.55	10	-0.35	10	-0.15	10	+0.05
16	-0.65	16	-0.45	16	-0.25	16	-0.05	16	+0.12
21	-0.58	21	-0.37	21	-0.17	21	+0.04	21	+0.2
26	-0.5	26	-0.3	26	-0.1	26	+0.1	26	+0.25
27	-0.47	27	-0.27	27	-0.03	27	+0.13	27	+0.3
32	-0.4	32	-0.2	32	0.00	32	+0.2	32	+0.36

Example 5

TA 100 (Recommended) Ca 350ppm (High) (ideal for winter)

Here we have the TA still as recommended and the Ca rather high. You can see the area of balance moves to a lower pH range across a wide temperature span, compared to #1. Keep the pH nearer to the 7.4 - 7.6 bracket to be in balance. If pH drops it becomes slowly corrosive and if pH rises, a quick change is seen, and becomes very scaling, compared to #1.

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.4	10	-0.18	10	+0.05	10	+0.25	10	+0.42
16	-0.3	16	-0.08	16	+0.15	16	+0.35	16	+0.5
21	-0.2	21	0.00	21	+0.2	21	+0.4	21	+0.58
26	-0.15	26	+0.05	26	+0.28	26	+0.48	26	+0.65
27	-0.1	27	+0.13	27	+0.3	27	+0.5	27	+0.69
32	-0.05	32	+0.17	32	+0.38	32	+0.58	32	+0.75

Example 6

TA 130 (High) Ca 350ppm (high)

The TA and Ca are rather high. You can see the area of balance moves to a much lower pH range across a wide temperature span, compared to #1. Keep the pH nearer to the 7.2 - 7.4 bracket to be in balance. If pH rises a very quick change is seen, and becomes very scaling, compared to #1.

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.25	10	-0.05	10	+0.15	10	+0.35	10	+0.55
16	-0.18	16	0.05	16	+0.22	16	+0.43	16	+0.65
21	-0.1	21	+0.13	21	+0.3	21	+0.5	21	+0.75
26	-0.03	26	+0.18	26	+0.35	26	+0.56	26	+0.8
27	0.00	27	+0.2	27	+0.4	27	+0.6	27	+0.83
32	+0.08	32	+0.28	32	+0.46	32	+0.68	32	+0.9

Example 7

TA 70 (Low) Ca 150ppm (Low)

Now the TA and Ca are rather low. You can see the area of balance moves to a much higher pH range across a wide temperature span, compared to #1. Keep the pH nearer to the 7.8 bracket to be in balance. If pH falls a very quick change is seen, and becomes very corrosive, compared to #1.

pH 7.2		pH 7.4		pH 7.6		pH 7.8		pH 8	
Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI	Temp	LSI
10	-0.9	10	-0.7	10	-0.5	10	-0.30	10	-0.1
16	-0.8	16	-0.6	16	-0.4	16	-0.2	16	-0.03
21	-0.73	21	-0.55	21	-0.35	21	-0.13	21	+0.05
26	-0.65	26	-0.48	26	-0.28	26	-0.05	26	+0.12
27	-0.62	27	-0.45	27	-0.22	27	-0.03	27	+0.15
32	-0.55	32	+0.35	32	-0.17	32	+0.05	32	+0.22

Summary:

You can see there are significant impacts on the LSI from the effects of pH and temperature changes. The biggest issue we see is more often in the example of low Ca and low Ta like example 7 being usually corrosive and #4, with high pH and rising to pH 8 +, and the LSI changes quickly to scaling if pH not bought back. The scaling only needs to happen once to see the effects. Saltwater chlorinators will naturally increase the pH and so you need to keep this in mind.

So, with
increasing temperature: more scale, PLUS increasing pH: more scale and the
lower the temperature: more corrosion PLUS lower pH more corrosion

See the helpful Watergram table on next page.

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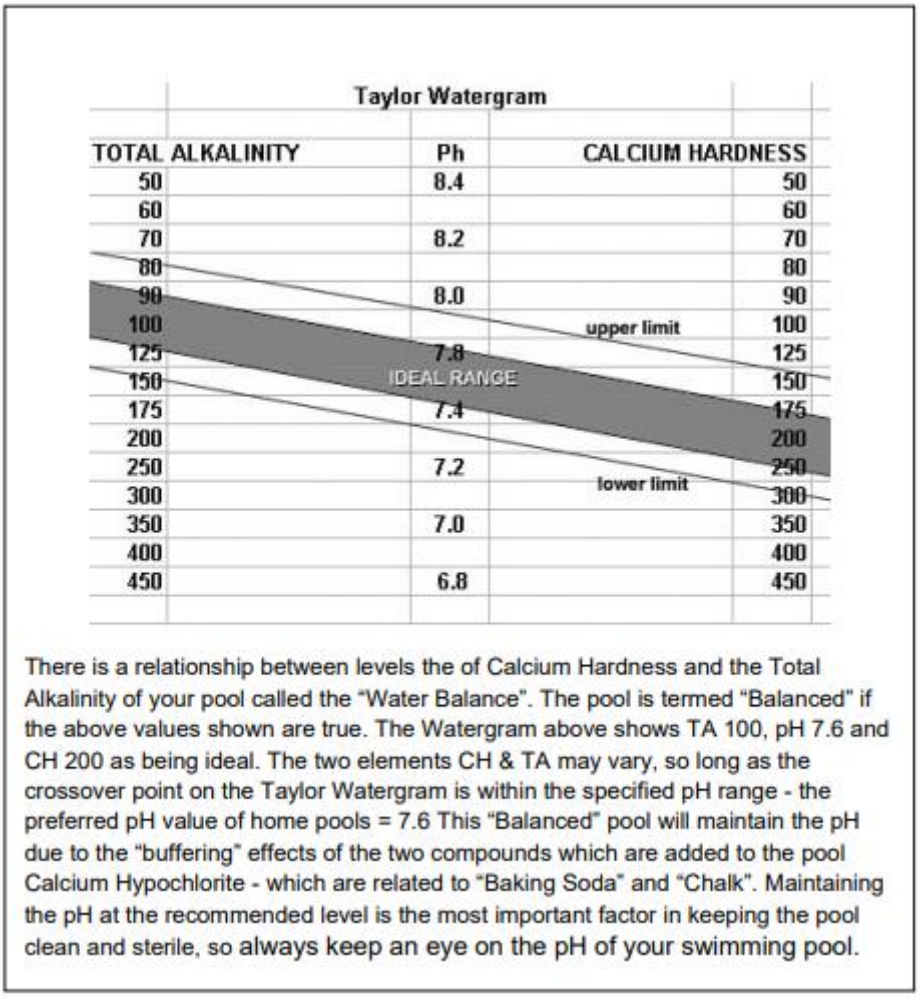
The table is for 25C water temperature.



For Winter Pool Management (Saltwater pools)
Look to increase the Ca to about 350ppm and keep TA at 100 ppm. Turn the chlorinator down to about 1 ppm and make sure pH stays in the range 7.4 – 7.6 Check monthly and adjust as needed.
(If you use a pool blanket in winter, then it's VITAL to keep the chlorine level low, as too high will destroy the blanket.)

This will keep the pool water chemistry in good condition. (neither scaling nor corrosive) This is because your water temperature will be near 13 – 15 C and not 20 – 25 C and thus the LSI is close to 0.00. When summer comes and the water is at 25 – 28 C, and the pH in the range of **7.2 to 7.4** (ideal) then the LSI is close to 0.00 again.

Note temperature has a significant impact on the LSI, result. And be mindful, the pH in saltwater pools tends to increase.

NOTE: The above Table is for 25C water temperature.