

## **Supplement to Operation Manual** **Water Balance and Trouble-Shooting Guide**

*Proper pool maintenance, water balance and testing are an integral part of having and maintaining a clear, clean, sanitary pool.*

### **CIRCULATION AND FILTRATION**

*Proper circulation and filtration is necessary for clear water. Make sure your filter system is adequate and operating properly. Good circulation and adequate water turnover is important. Follow the recommendations of the manufacturer for pump and filter maintenance.*

### **WATER TESTING**

*Test pH and Copper at least once a week. A full water test should be done monthly. Use one of the commercially available test kits or have your pool maintenance company do this for you.*

### **WATER CHEMISTRY AND BALANCE**

	<i>Recommended Levels</i>
<i>pH</i>	<i>7.2-7.4</i>
<i>Total Alkalinity</i>	<i>80-120 PPM</i>
<i>Calcium Hardness</i>	<i>200-275 PPM for gunite, less than 350 for vinyl pools</i>
<i>TDS</i>	<i>300-1000 PPM</i>
<i>Copper</i>	<i>0.25-0.4 PPM</i>
<i>Free Available Chlorine</i>	<i>0.6 PPM</i>

### **OXIDIZE REGULARLY**

*The ionization process is extremely effective at preventing the growth of algae through the destruction of the organism's enzyme balance. However, the process is unable to address the removal of organic material, body oils, suntan lotions. The presence of these materials can cause cloudiness in the water or an oily residue along the walls at the water line level. A treatment of potassium monopersulfate or a chlorine shock will remove the organic material from the water.*

### **DEVELOP AN EFFECTIVE AND TIMELY MAINTENANCE SCHEDULE**

*Take the time and develop a comfortable consistent regime for looking after your pool. Pool maintenance can be reduced by adopting some routine maintenance habits. Perform the required tests and water balancing procedures to maintain a healthy, clear swimming pool. Regular vacuuming, backwashing of sand filters and cleaning of the cartridge filters is important. The skimmer and strainer basket should be checked for debris, and the water chemistry such as pH and ion level tested weekly. A good test kit will be a great help. Keep the scum line clean and inspect the deck equipment to ensure it is in good repair.*

*The key to water treatment is an understanding of how chemicals interact in the pool water, a constant play between demand and balance.*

*The term "demand" is the need to add chemicals and/or disinfectants to the water. Balance means all chemicals that have been added to the water are working efficiently within recommended ranges.*

*When the pH, total alkalinity, calcium hardness and total dissolved solid concentrations are at the desired levels, the chemicals are working most efficiently and the pool is most easily and economically maintained. Sanitation is most easily affected when pool water is in balance.*

## **pH CONTROL**

*pH is the term used to describe water being acidic or basic. It is measured on a scale from 0-14 with the acceptable level for pools being between 7.2 - 7.4.*

*The following scale provides a basic rule of when and how to adjust pH.*

<i>6.8 - 7.2</i>	<i>acidic, add soda</i>
<i>7.2 - 7.4</i>	<i>acceptable</i>
<i>7.4 - 8.0</i>	<i>basic, add acid</i>

*Soda and acids may be purchased at any pool store. During the swimming season, pH should be monitored at least once a week. The pH should always be tested after rain storms or heavy bather loads. If the pool is covered, it is important to check pH as a covered pool is more susceptible to scaling. Maintaining a total alkalinity of 80-120 parts per million will help to stabilize the pH.*

*A new plaster pool will leach high pH into the water during the first few months of use and will usually require frequent pH adjustments before the plaster cures and finally settles down.*

*Muriatic acid, if applied incorrectly, can reduce the total alkalinity of your water. We suggest the use of dry or granule acid to reduce pH without changing the total alkalinity.*

*As pH climbs, free copper ions in the water will be reduced as they combine with other minerals to form precipitates. Additionally, water with high pH can cause scale building up on plaster walls and prohibit most chemicals from working. The ionization process will work in acidic water; however, if the pH falls below 7.0, the water will become corrosive. Acidic water can damage pool equipment, pipes, fixtures, stain pool plaster, irritate swimmer eyes and noses and decrease the useful life of electrodes.*

## **TOTAL ALKALINITY**

*Total alkalinity refers to the amount of hydroxides, bicarbonates and carbonates (baking soda) present in the pool water. As mentioned above, keeping the total alkalinity at a level of 80 - 120 PPM will help keep a stable pH level of 7.2 - 7.4.*

## **CALCIUM HARDNESS**

*Calcium water hardness refers to the amount of calcium carbonate and magnesium in solution. A high hardness level in combination with a high alkalinity can cause scaling on plaster and pool equipment. Hardness also affects the rate at which the system will ionize water. Hard water, at levels above 350 PPM will cause greater electrical conductivity and thus a faster rate of ionization.*

*Opposite to "hard" water is "soft" water, or water in which there is a low level of calcium and magnesium. While the virtues of soft water are often desired in reference to washing one's hair or clothes, soft water is not desirable in swimming pools. In plaster pools, lack of calcium in the water may cause weakening and/or etching of the walls. The same conditions will cause a deterioration of the grouting between the tiles. In addition, soft*

water can be corrosive to pool fixtures.

-2-

## **WATER BALANCE**

1. *Total alkalinity should be between 80 - 120 PPM. 100 PPM is optimum.*
  - a. *INCREASE total alkalinity by adding buffer or booster while the pump is running.*
  - b. *DECREASE the total alkalinity by adding liquid muriatic acid. Turn the pump OFF and add small amounts to numerous spots in the water.*

**NOTE: If you adjust the total alkalinity, wait 24 hours before testing the pH.**

2. *The pH should be between 7.2 - 7.4.*
  - a. *INCREASE the pH by adding a commercial pH increaser or soda-ash while the pump is running.*
  - b. *DECREASE the pH by adding a commercial pH decreaser or dry acid while the pump is running.*
3. *The calcium hardness should be within the following range: CONCRETE OR GUNITE POOLS 200 - 275 PPM, VINYL LINER POOLS less than 350 PPM. Adjust the calcium hardness.*
  - a. *INCREASE the calcium by using calcium chlorite or a calcium booster.*
  - b. *DECREASE the calcium by diluting the water. Consult a specialist before attempting this.*
4. *The total dissolved solids should be less than 1800 PPM.*

*DECREASE the total dissolved solids by diluting the water. Consult a specialist before attempting this.*
5. *The copper level should be kept between 0.3 - 0.5 PPM.*
  - a. *INCREASE the copper content of the water by adjusting the controller to a higher setting.*
  - b. *DECREASE the copper by turning the system down. The control unit can be turned off if the copper level is over 0.5 PPM.*
6. *Free chlorine levels in excess of 1 PPM may interfere with the copper test kit. A chlorine neutralizer will be required, or a low chlorine residual to ensure the accuracy of the copper test.*
7. *As the pH rises, some of the free copper ions will combine and show a low copper reading. Verify the pH is below 7.4 for the most accurate copper test.*

## **PROBLEM SOLVING**

*Go back to basics. Check to see that your equipment is working correctly, the water is in balance and there is adequate sanitizer and algae control. If there is no immediate solution or you encounter problems you cannot solve, contact your pool service professional. They have the knowledge and equipment to solve problems.*

*Here are a few specific problems and their solutions.*

1. *Bathers get burning eyes:*
  - a. *High pH: Lower the pH to between 7.2 - 7.4*
  - b. *High organic loading: Oxidation is required. Use Oxy-Brite or similar product or an unstabilized chlorine shock*

-3-

2. *Cloudy water:*
  - a. *Green-looking water can be caused by algae, poor filtration, poor circulation.*
    - 1) *Make sure the copper level is 0.3 PPM or higher.*
    - 2) *Make sure the pH is less than 7.6.*
    - 3) *Backwash the sand filter or clean the cartridge filter. Shock the pool with an unstabilized chlorine.*
    - 4) *Run the pump filter for at least 72 continuous hours.*
  - b. *White cloudy water can be caused by:*
    - 1) *Organic loading from body oils, perspiration or suntan lotion. Remedy: Add an oxidizing agent such as liquid chlorine, Oxy-Brite, Oxy-Out or Shockline.*
    - 2) *Poor circulation or filtration. Remedy: Run the pump and filter continuously, backwash sand filters and clean cartridge filters.*
    - 3) *High pH. Remedy: Test the pH and add dry acid such as pH Down if it is over 7.7*
    - 4) *High total alkalinity. Remedy: Test the total alkalinity and add liquid muriatic acid if it is over 120 PPM. (turn the pump off and add small amounts to numerous places in the water.)*
    - 5) *High total dissolved solids. Remedy: High total dissolved solids over 1800 PPM can only be reduced by diluting water. Sometimes a water clarifier or flocculent will help.*
    - 6) *Did you recently install the ionization system? Remedy: Sometimes the ionization process will react with existing chemistry in water. Cloudy water occurs with older equipment and previous bromine use. This is a short-term problem which will rectify itself in 3-7 days. Run the pump and filter continuously. Backwash sand filters and clean cartridge filters frequently.*

## ALGAE

1. *In vinyl pools the walls will be slippery, in concrete or gunite pools, there will be green marks at various places around the pool.*
2. *Algae can be caused by the following:*
  - a. *High pH. Remedy: Test the pH and decrease it with dry acid if it is over 7.6. Verify the total alkalinity is less than 120 PPM.*
  - b. *Low copper. Remedy: Test the copper level and turn the unit up if the copper level is less than 0.3 PPM. In some cases a copper level of 0.5 or 0.6 PPM may be required. For example, if there are a lot of trees or shrubbery close by, high pollen counts or excessive consistent bather loads.*
  - c. *Too much sequestering agent. Remedy: Products like Cop-Out, Min-Arrest and Sequasol are designed to attack the copper ion in water. If these products are used the ion system will not function properly. Sequestering agents just mentioned will slowly dissipate from the water over a 2-3 week time period. The use of chlorine or a non-copper-based algacide will be needed to contain the algae growth until the sequestering agent has left the water.*
  - d. *Copper resistant strain of algae. Remedy: Some algae have built up an immunity to copper ions. If this strain of algae grows, then an unstabilized chlorine shock treatment will be required.*

3. *In all cases, a shock treatment of unstabilized chlorine will normally kill the growth.*

-4-

### **DISCOLORED WATER**

1. *Red/brown water is usually high iron. Remedy: For iron, the use of Metal Magnet, MSR, Min-Arrest or Sequasol or similar product will remove the iron. These products can also remove or disrupt the ability of ions to kill algae. Therefore, algae may develop and a chlorine shock treatment will be required.*
2. *Green water normally can be traced back to algae or caused by high combined copper. Remedy: For algae, see the "Algae" section. For high combined copper, turn off the ionization system and wait for the copper to dissipate through normal use. If the high copper has started to stain the equipment, follow the remedy described above.*

### **STAINS**

*Stains of various colors and sizes are almost inevitable on pool walls. There are a number of causes and covering them all is difficult. Some common causes are water balance, organics such as leaves and fertilizers, and uncontrolled or excessive metals*

*Calcium deposits can form when the chemical balance is not monitored carefully. Calcium in a pure state is white but will easily be stained by copper, dirt and other water-borne impurities.*

*Another source of staining can come from certain types of algae. Most algae are of a green or yellow variety and are easily eliminated by the ionization process. The algae will form protective bioshield which can make it resistant to ion or chemical treatment. In advanced outbreaks of algae brushing of the spots followed by a chlorine shock and algaecide may be needed to eliminate the algae. The final step that can be taken in extremely severe cases of algae and stains in a gunite pool may be an acid bath of the pool walls.*

*Vinyl pool liners, especially older liners, are very susceptible to stains. The vinyl material used in the liners is very porous in nature. Chlorine will act to leach out the polymers used to create the material. The result of this process is an initial fading of the vinyl and eventual disintegration of the liner. During this process, the material becomes very susceptible to permeation by both minerals and algae stains.*

*With the ionization technology and the proper water chemistry balance as mentioned earlier, staining from copper ions should be minimal.*

*Acrylic spas are not prone to stains, although misuse of chemicals can destroy the finish.*

*Stains can be almost any color but most predominant are brown, green or black.*

1. *Brown:*
  - a. *Iron or rust marks. Remedy: For iron spots, turn the pump off and sprinkle some granular pH reducer directly onto the spot. Wait 5 minutes then brush the spot, if the brown stain is all over the pool, lower the pH to 7.0 or less and wait a couple of days. Sometimes a low pH will*

*re-dissolve metal precipitation back into the water.*

- b. *Mustard algae. If the spot brushes off very easily but comes back in the same spot, it is probably mustard algae. Remedy: If mustard algae is growing, it is probably due to a pH over 7.6, a total alkalinity over 120 PPM or a copper level less than 0.3 PPM. Correct the parameter which is out of tolerance and wait a couple of days for the algae to be killed.*

-5-

2. *Green:*

- a. *Copper precipitation if it covers all of the pool, usually caused by a high pH or a high copper concentration. Remedy: To remove copper precipitation, lower the pH to 7.0 or less for a couple of days. Sometimes a low pH will re-dissolve the copper back into the water. For quick results, turn the pump off and add Easy-Down or some granular pH reducing product directly onto the stained areas. Sprinkle handfuls across the surface of the water and wait 10 minutes. The stains will come out on contact. Concrete or gunite pools may require a special procedure called a no-drain acid wash.*
- b. *Green algae if the stain is only in a few locations. Remedy: Green algae is the most common algae. Make sure the pH is less than 7.6, the total alkalinity is less than 120 PPM and the copper level is more than 0.3 PPM. Refer to the "Algae" section for a remedy.*

3. *Black:*

- a. *Copper stains due to a pH over 7.6 or a total alkalinity less than 60 PPM. Remedy: Turn the pump off and sprinkle Easy-Down or a granular pH reducer directly onto the black spots. Wait 10 minutes and brush the spot. If the stain persists, with the pump still off, put 250mL or 1 cup of granular pH down into the water directly above the stain. Immediately put 50mL or 1/4 cup of lite-sock or a lithium-based granular chlorine into the water above the spot. Wait 10 minutes and brush the spot. Concrete or gunite pools may require a special procedure. This will require a service call from an authorized service representative.*
- b. *Dirt. Remedy: Vacuum the dirt.*
- c. *Algae. Remedy: Vigorously brush the pool. Follow the brushing with algaecide or an unstabilized chlorine shock treatment.*
- d. *Black spots after shocking the water. Remedy: Did you recently shock the water with chlorine? Chlorine can knock copper ions out of solution. Especially if the pH is over 7.6, the total alkalinity is below 60 PPM, or the copper level is over 0.7 PPM. Chlorine oxidizes the ions, turns them black and drops them to the bottom of the pool. Turn the pump off and sprinkle Easy-Down or a granular pH reducer directly onto the black spots. Wait 10 minutes and brush the spot. Concrete or gunite pools may require a special procedure. This may require a service call from an authorized service representative. Adjust the total alkalinity to 100, wait one day and adjust the pH to between 7.2 - 7.4.*

### **CALCIUM HARDNESS**

*Recommended Levels, 200 - 275 PPM for gunite or concrete pools, less than 350 PPM for vinyl pools.*

*The term "hardness" comes from past folk terms. Water that contained high levels of calcium and/or magnesium consumed soap, forming a grey insoluble curd, before suds were formed. That is, this water was "hard to form*

suds." Rainwater gathered for laundry use, formed suds readily and was called "soft water."

### **LOW CALCIUM HARDNESS CAUSES**

- aggressive water
- pitting of concrete
- metals stripped
- staining
- low copper reading

-6-

### **HIGH CALCIUM CAUSES**

- scaling
- short filter runs
- reduced circulation
- cloudy pool
- over-Ionization

### **TOTAL ALKALINITY PROBLEMS**

Optimum between 80-120 PPM

Total alkalinity is the measure of the ability of a body of water to resist changes in pH. That is the ability to "buffer" water from wild swings in pH. It is essentially a measure of dissolved bicarbonate in pool water. TA is the governor of pH.

### **LOW TOTAL ALKALINITY CAUSES**

- corrosion
- pitting of concrete
- metals stripped
- staining
- pH hard to control

### **HIGH TOTAL ALKALINITY CAUSES**

- scaling
- short filter runs
- reduced circulation
- cloudy pool
- pH drift to 8.4
- ion inefficiency

### **CORRECTION OF PARAMETERS**

To Increase:	Total Alkalinity Sodium Bicarbonate	Calcium Hardness Calcium Chloride	pH Sodium Carbonate
To Decrease:	Muratic Acid	Dilution	Sodium Bisulphate

