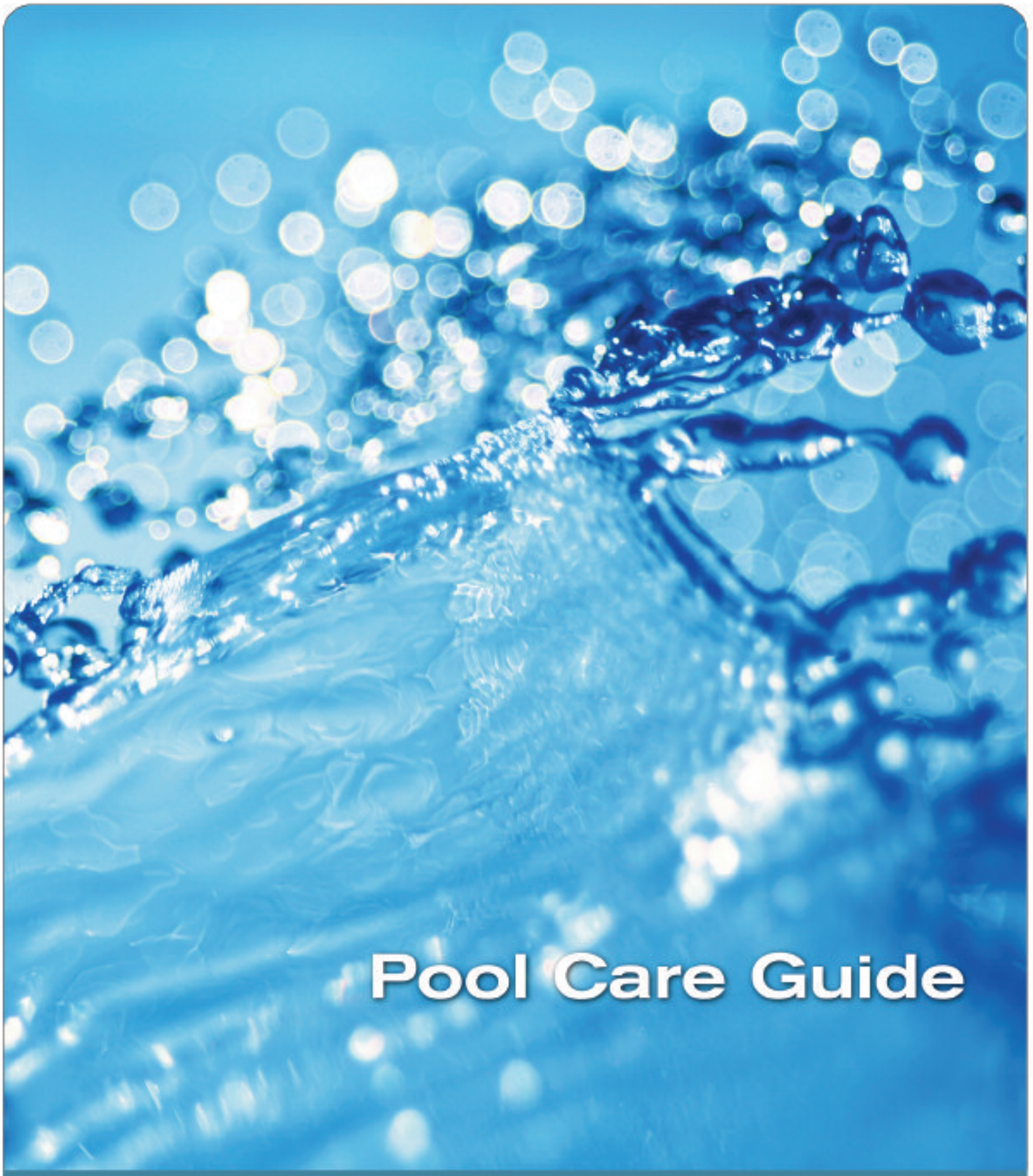

Pool Care Guide

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Cleaning Your Pool

BRUSHING THE POOL

Even though most modern swimming pools are equipped with an automatic cleaning system, there is no substitute for a thorough brushing of the walls and bottom of the pool. Most automatic cleaners can't scrub the floor to remove small debris and algae spores from the pores in the pool surface, and this must be done to ensure a stain and algae free pool surface. It is recommended that the pool be brushed with a standard 18-inch nylon bristle pool brush (found at any Pool retail showroom) at least twice per week. The entire process usually only takes 10 minutes and is well worth the time and effort. Be sure to brush the pool while the pump is operating, and to cover the entire pool from the tile line to the main drain. Sweep slowly and push the brush toward the main drain so that the debris will be pulled into the drain and then into the filter, where it will be removed from the water. If large amounts of debris were removed during this process, it is advisable to clean the filter afterward.

VACUUMING THE POOL

If the amount of debris in the pool is too great to be removed by either the automatic cleaning system or by brushing, the pool should be vacuumed to remove the debris before it becomes attached to the pool surface and requires special methods to remove. A manual vacuum system is available at any Pool retail showroom that will operate in any swimming pool. It consists of three major components: a vacuum head, a flexible vacuum hose, and a long telescopic pole.

The pole that is used for brushing can also be used for vacuuming as both the brush and the vacuum head are connected to the pole with a quick disconnect attachment. The process of vacuuming the pool manually can be accomplished by following these steps. First, make sure that the pump is operating and that the filter has recently

been cleaned. In fact, it is recommended that the filter be cleaned immediately before and after vacuuming the pool. Attach the vacuum head to the telescopic pole, and attach either end of the vacuum hose to the top of the vacuum head. Keeping the opposite end of the hose and the pole accessible, lower the vacuum head into the pool.

Before the vacuum hose can be attached to the suction line in the skimmer, it must be filled with water to prevent a large amount of air entering the pump and causing a loss of prime. This can be accomplished by either placing the free end of the vacuum hose over one of the main return lines, allowing water to flow into the hose and push out the air, or by inserting a garden hose into the vacuum hose and using the water from the garden hose to push air out of the vacuum hose. As the hose is filling with water, the vacuum head should be lifted from the bottom of the pool about 1 foot to assist in the escape of the trapped air. Once the bubbles have stopped flowing from the vacuum head, bring the free end of the vacuum hose to the skimmer, keeping the end of the hose beneath the water at all times so that no more air is allowed to enter the hose.

Remove the lid from the skimmer, and also remove the skimmer basket and float valve. Cover the free end of the vacuum hose with the palm of your hand and quickly lift the hose over the pool deck and into the skimmer through the opening at the top. Once the end of the hose is underwater, remove your hand and insert the hose into the suction hole in the bottom of the skimmer (the hole farthest from the pool)(If you have a Paramount In-Floor system with a booster pump make sure the booster pump is off or the vacuumed debris will be returned to the pool via the floor returns). The suction will hold the hose into the hole and will form a good seal. If the hole is too

large for the hose to seal properly, an adapter is available at any Pool retail showroom.

Once the connection has been made, slowly move the vacuum over the pool surface in a similar fashion as brushing, except with vacuuming, it is not necessary to push the vacuum toward the main drain. It is necessary to vacuum the entire pool, from the tile line to the drain, but care should be taken to keep the vacuum head underwater at all times to prevent air from entering the system. When the pool has been sufficiently cleaned, pull the vacuum hose out of the suction hole in the skimmer and wash the hose and head with fresh water to remove chemicals that could decrease the life of the equipment, and store them in a shaded area. Once again, it is recommended that the filter be cleaned immediately after vacuuming to remove the excess debris and increase the efficiency of the filter system. Replace the float valve, skimmer basket, and skimmer cover.

SKIMMING THE POOL

While vacuuming and brushing remove dirt and debris from the bottom of the pool, they do not remove the debris such as grass, leaves, and bugs which float on the water surface. The skimmer built into the pool deck usually removes this debris, but it can accumulate in large amounts and it may take the built-in skimmer an appreciable time to remove it. By using a hand skimmer, the debris can be quickly removed before it has the opportunity to become saturated with water and sink to the bottom. While there are no specific guidelines as to when the pool should be manually skimmed, it is recommended that it be done either before or after brushing. A manual skimmer can be used in conjunction with the same telescopic pole used for brushing and vacuuming, and can be found at any Pool retail showroom.

ATTACHED SPA

In the case where a spa is attached to the swimming pool and the water is allowed to overflow into the pool, both the pool and the spa share the same filter and pump systems, and they are connected to each other within the piping network. The spa will contain its own main drain, and may also have its own skimmer. In this case, the skimmer and main drain operate exactly the same as in the swimming pool, and the suction line in the skimmer meets that of the pool immediately adjacent to the hair and lint trap attached to the pump. A 3-way swing valve will be present at this junction to regulate the flow between the spa and the pool suction lines. For normal operation, the pool suction line should be considerably more open than that of the spa to ensure that the spa does not drain. Since the volume of water in the spa is small compared to that of the pool, very little suction is needed for proper circulation of the spa. If a separate skimmer is present for the spa, and the skimmer contains a float valve, set the flap in the same position as that in the pool skimmer, and adjust the 3-way valve near the pump so that the vast majority of the water is coming from the pool skimmer (i.e. adjust the 3-way valve so that the spa suction line is almost closed). On the pressure side of the system, there will be separate valves present to direct water flow to the therapy jets in the spa. To operate the therapy jets, simply open the swing valve that is labeled "therapy jets" and if needed for more flow, partially close the valve labeled "return". This will direct more water into the spa's therapy jets and less into the pool's main returns. Be aware that the water in the spa will overflow into the pool, and if the spa is heated, some heat may be lost to the pool.

POOL SAFETY

The use and care of a swimming pool should be a safe and enjoyable experience for everyone. Since there are a number of items in and around a swimming pool, including the pool itself, which can be a potential hazard, familiarization of the safety aspects of these items is mandatory. Please refer to the warning labels on any product for use in or near the swimming pool, and follow any directions for the safe and clean disposal of these items. Please refer to your equipment owner's manuals for all operating and safety precautions.

A. CHEMICALS

The chemicals used in a swimming pool pose a definite hazard to occupants and equipment. A few simple guidelines should be followed to ensure the safety of everyone. In this context, a "chemical" includes, but is not limited to, chlorine, acid, soda ash, any algaecide, diatomaceous earth, silica sand, and any cleaning agent.

· Never mix any two chemicals together, either away from or in the pool water.

· Never add water to a chemical . . . always add the chemical to water.

· Never handle a chemical without the use of protective gloves and a form of nose-mouth protection. This can be a disposable fabric mask or a respirator.

· Never add two different chemicals to the pool water at the same time . . . always allow at least 4 hours between applications unless otherwise directed by the chemical manufacturer.

· Never allow anyone to use the pool within 4 hours after the addition of chemicals.

· Never store any chemicals inside the house, in direct sunlight, or near the pool area.

· Keep all pool chemicals out of the reach of children.

· Never store two different chemicals adjacent to one another. Leakage of one could cause them to mix and a chemical reaction could result.
· Avoid contact of any chemical with the skin or mucous membranes, such as those in the mouth, eyes, and nose. If this occurs, flush the area with water and consult a physician immediately. Be sure to have the container of the chemical nearby to inform the physician of the agent involved.
· Be aware of the addition of any pool chemicals by another person, to avoid interaction or overdose.

B. WATER SAFETY

As more swimming pools are built and more people enjoy them, the incidence of near drowning and drowning continues to increase. Only by knowing the proper and safe use of the swimming pool may these tragedies be avoided. Primarily, be aware that in many municipalities, law requires that the swimming pool be inaccessible to children under six years old without the assistance of an adult. This means that there should be a self-locking barrier between the pool and the house. This includes, but is not limited to, a fence with a self-locking gate, a self-locking door if the pool is adjacent to the house with no fence in between, and an automatic safety cover that is secured on all sides of the pool and can support the weight of several adults. Remember that no matter how many barriers exist around the pool area, THERE IS NO SUBSTITUTE FOR CONSTANT DIRECT ADULT SUPERVISION. It only takes a few seconds for a child to fall into the swimming pool and drown. Also, this is NOT limited to children. Anyone who is not able to swim is in danger of drowning if he or she falls into the pool. Under no circumstances should anyone not able to swim be allowed in the pool area unsupervised. The American Red Cross conducts water rescue and CPR classes avail-

able to the public. Everyone is encouraged to enroll in these classes to become familiar with vital rescue and CPR procedures in the event someone were to fall into the pool. Contact your local American Red Cross office for more information on water rescue and CPR classes in your area. A number of safety devices and tools are available to make the pool area safe and enjoyable. These include signs for pool safety and rules, life rings to throw to a person in trouble, "shepherd's hooks" to use to extract an incapacitated person from the water, buoys and ropes to divide the shallow end from the deep end of a swimming pool, and alarms which emit a loud noise in the event someone were to fall into the pool. For more details on these and more safety devices, consult your nearest Pool retail showroom.

SUCTION SIDE CLEANERS

A suction-side pool cleaner is a type that uses the suction of the swimming pool's circulation system in order to operate. In other words, water is pulled through the cleaner, causing some driving device to make the cleaner move about the pool. There are a number of benefits to this type of cleaner, as well as some disadvantages. Among the benefits is the fact that the cleaner itself acts as a moving main drain, bringing water from all over the pool to the filter system, instead of bringing it only from the deep end where the drain is located. Also, this type of cleaner requires only the pools existing circulation system to operate (i.e. no additional pumps are required). Usually, suction-side cleaners possess relatively few moving parts, and thus are generally easier to maintain. These types of cleaners, however, possess non-moving parts that are in direct contact with, and scrape against, the pool surface. Since these parts are made of flexible materials, they tend to become worn rapidly, especially if the pool surface is rough.

A. OPERATION

In order to utilize the system's suction, the cleaner must be connected to a port that pulls water from the pool. The most logical and accessible of these ports is the suction hole in the bottom of the skimmer. The manufacturers of suction-side pool cleaners make a device, usually called a regulator valve, which inserts into the suction port of the skimmer. These valves serve two purposes: they regulate the flow through the pool cleaner so that it does not experience too much or too little suction, and they also possess a small port through which excess water may flow to allow the skimmer to continue functioning even though the cleaner is plugged into the suction port. Some pools with inadequate pumps may not allow the skimmer to operate with a suction-side cleaner attached. The cleaner itself may require all of the suction that the pump can produce. In all cases, the main drain in the swimming pool must not be operating while a suction-side cleaner is connected. There are two reasons for this. First, if the drain is operating, it is taking suction away from the cleaner. Since most suction-side cleaners require a large portion of the system's suction, an insufficient amount of suction may be allowed to flow through the cleaner, causing it to function inadequately. Second, suction cleaners, in general, form tight seals with the pool surface, and if the cleaner were to travel directly over an operating main drain, the two would exert opposing suction forces on one another, causing the cleaner to be stuck to the drain. There is no need to be concerned over the loss of the function of the main drain, since, as mentioned earlier, the cleaner itself serves as a moving main drain, performing the same function as the drain, except it is moving over the entire surface of the pool.

B. GENERAL TROUBLESHOOTING

While no two-pool cleaners are alike, many are susceptible to the same problems and can be restored to working condition in the same manner. Because of the wide variety of suction-side cleaners on the market, no one specific cleaner will be mentioned in detail here. Rather, some general troubleshooting hints and tips will be offered. If a problem arises which is not covered in this section, please consult your pool pro at your local Pool retail showroom.

Problem(s): The cleaner seems to be moving slowly and stops frequently.

Probable Cause(s): There is insufficient water flow through the cleaner.

Solution(s): (1) Check the cleaner head for any obstructions; it may be necessary to disassemble part or all of the head to visually check the openings.

(2) Inspect the cleaner's hose for leaks. First, check it visually. If no large openings are discovered, remove the hose from the cleaner head and from the suction port and force water through the cleaner hose using a garden hose, making sure to restrict the flow of water from the free end of the hose. If a leak is present, replace the damaged section of hose.

(3) Some cleaners use a flexible membrane to provide motion for the cleaner head. If the cleaner utilizes one of these membranes, inspect it for damage or dilation (stretching of the membrane). If the membrane is damaged or dilated, replace it.

(4) Adjust the cleaner's regulator valve at the suction port. Some cleaner's utilize an adjustable regulator valve, which can be manually adjusted to regulate the flow through the cleaner head. Adjust it so that more water is flowing through the cleaner, and less is flowing through the extra port on the side of the valve.

(5) Clean the filter. As the filter becomes clogged with debris, it does-

n't allow as much water to pass through the system. Suction decreases dramatically as the filter becomes dirty.
(6) It is possible that the pump may have insufficient suction to allow adequate operation of the cleaner. Check to see if the pump's impeller is clogged, worn or damaged and replace if necessary.
Problem(s): The cleaner becomes stuck to the pool surface and pulsates rapidly.
Probable Cause(s): There is too much suction through the cleaner/the cleaner is forming a tighter seal than usual against the pool surface.
Solution(s): (1) Adjust the flow through the cleaner manually using the flow control on the regulator valve. Allow more water to flow through the extra opening on the side of the valve, and less through the cleaner itself.
(2) Inspect the footpad of the cleaner for wear. Some cleaners possess a footpad that acts like the bottom of an athletic shoe. If the footpad becomes smooth, the cleaner will form a tighter seal than usual against the surface of the pool and the cleaner will become stuck.
Problem(s): The cleaner is not remaining upright.
Probable Cause(s): The ballast float is full of water.
Solution(s): Replace the ballast float. Once the ballast float (an air-filled container within the cleaner's head) becomes filled with water, the cleaner may tip over often. Replacing the float with a new one will remedy this problem.

PRESSURE-SIDE CLEANERS

IN-FLOOR (PCC2000®, PV3®, VANQUISH®, VANTAGE®, POOL VALET®)
In-Floor cleaners are built into the pool at construction. They work by placing nozzles throughout the pool floor and walls that sequentially

popup and spray water to sweep areas of the pool. The debris is then removed through the skimmer and main drain. Your In-Floor cleaning system allows you to enjoy your pool while the system takes care of the majority of the tedious maintenance involved with owning a pool. You will only need to empty a few baskets, clean the filter and maintain chemical balance.

MOBILE ROBOTS

Pressure-side pool cleaners use the pressure of a swimming pool's circulation system in order to operate. This means that they must be connected to a port that returns water back to the pool after it has passed through the pump and the filter. Pressure-side cleaners tend to clean the pool more rapidly than their suction-side counterparts, and also have the effect of enhancing the overall circulation of the swimming pool. Since it operates on the pressure side, rather than the suction side of the system, it does not interfere with the operation of the main drain or the skimmer. In addition, it does move water throughout the pool more rapidly, increasing the circulation.

A. OPERATION

As mentioned above, pressure-side cleaners are attached to a return port of the pool. The water flows through the cleaner, and causes various mechanisms to move the cleaner head through the water. There are two types of pressure-side cleaners available on the market: those which utilize the existing pool's circulation system, and those which require an additional "booster" pump to provide adequate water pressure for the movement and operation of the cleaner. Pressure-side cleaners are connected to a dedicated pressure line so that the flow of water through them can be regulated easier. These dedicated lines possess a control valve that can be manually adjusted to regulate the flow of water through either the cleaner or the rest of the

pool's circulation system. This valve is usually located between the pump and the filter, and a small, intermediate filter is present to ensure that large debris does not enter and clog the pool cleaner.

B. GENERAL TROUBLESHOOTING

Due to the existence of many different types of pressure-side cleaners, only general troubleshooting will be addressed here. If a problem develops outside the scope of this section, please consult with a pool pro at your nearest Pool retail showroom.

Problem(s): Cleaner moves slowly, or doesn't move at all.

Probable Cause(s): Insufficient water flow through the cleaner.

Solution(s): (1) Check the cleaner hose for leaks. Some cleaner hoses are composed of many small sections connected with swivels and/or jets which may become worn or damaged. In addition, the hoses themselves may become worn or kinked and develop leaks, preventing sufficient amounts of water from getting to the drive jets. Replace any damaged hoses or connectors.

(2) Clean the main filter and the strainer filter in the dedicated return line. When the filter becomes clogged with debris, the pressure in the circulation system decreases. Cleaning the filter will increase the pressure of the water entering the cleaner.

(3) Check and adjust the valve position. If the valve used to adjust the flow of water through the cleaner is positioned incorrectly, adjust it so that more water flows through the cleaner.

(4) Check the booster pump for operation (if installed). For cleaners that require a separate booster pump, if the booster pump is not functioning properly, insufficient water pressure will be delivered to the pool cleaner, and the cleaner will slow down. If necessary, disassemble the booster pump and inspect the impeller for damage, wear, and debris.

Problem(s): The cleaner's tips over, or does not lie flat on the pool

surface.
Probable Cause(s): The ballast float is full or water.
Solution(s): Inspect the ballast float in the cleaner's head and replace it if it is full of water.
Problem(s): The cleaner moves too rapidly.
Probable Cause(s): There is too much water pressure in the cleaning system.
Solution(s): (1) Check and adjust the valve position. If the valve used to adjust the flow of water through the cleaner is positioned incorrectly, adjust it so that less water flows through the cleaner.
(2) Add a restrictor washer to the fitting that connects the cleaner's hose to the pool wall. Some cleaning system manufacturers produce special washers that restrict the flow of water through the cleaner if placed inside the wall connector.

WATER CHEMISTRY

INTRODUCTION

From the moment your new swimming pool has been installed and filled with fresh water, proper care must be taken to ensure that algae or other organic contaminants do not accumulate. In addition to proper filtration and regular cleaning maintenance, the addition of chemicals is essential to keeping your pool sparkling clean. This section of the Pool Care Manual serves to introduce you, the pool owner, to the chemicals used in swimming pools, and to the testing and addition procedures required to maintain the levels of those chemicals. Each major chemical is defined in detail, along with the various testing and addition procedures, and some basic troubleshooting guides. While the information contained in the following guide is fairly comprehensive, it is recommended that you visit the pool professionals at your nearest Pool retail showroom regularly to keep abreast of the latest swimming pool treatment techniques and to have your pool water thoroughly tested by their computerized testing facilities (if available).

This section of the Pool Care Manual is divided into eight sections, each corresponding to a different aspect of swimming pool chemical care. Chlorine and pH, considered the "basics", are explained in detail, as well as total alkalinity, conditioner, water hardness, and Total Dissolved Solids (TDS). The most common metals (other than calcium), copper and iron, are also discussed. A thorough investigation into the major types of algae is presented, and the section is concluded with an introduction to the first few weeks of swimming pool care.

The addition of an In-Floor cleaning system will greatly increase the effectiveness of the chemicals in your pool by introducing them to the bottom of the pool and then mixing them thoroughly throughout the pool.

CHLORINE

In order to keep the pool water free from contaminants, it is necessary to add a chemical that is capable of killing algae before it becomes visible or a health hazard. As a rule, the presence of algae in water does not pose a significant risk to health, but it can enter open cuts or sores and cause an infection. Once the concentration of algae in the water becomes great, it is visible to the naked eye as discolored water or blemishes on the pool surface. At this stage, more drastic measures than just the routine addition of chlorine or some other water disinfectant are needed to bring it back into control. Approaches to visible algae control are covered in the last section of this manual. Here, the most common type of water sanitizer, chlorine, will be covered in detail, along with its testing procedures, and some troubleshooting guides.

A. TERMINOLOGY

Before discussing methods of using chlorine, some basic terms must be introduced. They will be presented in a "dictionary" format, and will include pronunciation guides when necessary.

Total Chlorine: The total amount of chlorine, in any form, dissolved in the pool water. It is measured in parts of chlorine per 1 million parts of water (by volume), and the measurement is abbreviated a ppm (parts per million). Total chlorine can be tested directly with an ordinary test kit.

Combined Chlorine: The amount of chlorine in the pool water, which is chemically combined with organic waste matter. This matter need not be algae, and, in fact, could include one or more of the following: suntan lotion, body oils, sweat, and other body fluids. While these materials are organic, they do not cause visible water discoloration at

normal concentrations. They do, however, prevent chlorine from effectively destroying algae. Combined chlorine is measured in ppm, but is not tested directly. To find the level of combined chlorine in the

pool water, subtract the free chlorine level (see below) from the total chlorine level.

Free Chlorine: The amount of chlorine in the pool water, which is active and available to effectively destroy algae. The free chlorine level is the most important chlorine test level, and can be tested directly using a deluxe home test kit or at the nearest Pool Retail Showroom.

Dry Chlorine: Any form of chlorine, which is neither a liquid nor a gas. Dry chlorine is available in tablet or granular form.

Liquid Chlorine: Also known as Sodium Hypochlorite, liquid chlorine is available only in one-gallon containers, usually in cardboard boxes containing two or more gallons. Liquid chlorine should not be confused with chlorine bleach, such as Clorox(r), as it is several times stronger than bleach.

Gas Chlorine: Gas chlorine can either be added directly to the pool water, or it can be manufactured from ordinary salt in a chlorine generator such as the AutoClear(r). In the long run, it is the least expensive of all three types of chlorine to use, but only the pool owner can use the generators. Direct injection of gas chlorine is done only by qualified and licensed pool care services. Chlorine is present in nature as a gas, and because of this it contains no fillers or by-products.

B. TYPES OF CHLORINE

Chlorine is manufactured in three different types: dry, liquid, and gas. Dry chlorine is made both in a tablet form and granular form. Liquid chlorine and gas chlorine each are made and sold in one form. All types of chlorine that are available to swimming pool owners are discussed in this section.

Tablets

Chlorine tablets are usually made in two different sizes: 3-inch and 1-inch diameters. Both sizes are available due to the fact that each requires a different method to introduce them into the pool water.

a. 3" tablets

3-inch tablets are by far the most common size of chlorine tablets. They dissolve very slowly, and are generally available at a lower cost to the customer. Both of these facts make 3-inch tablets far more cost effective than their 1-inch counterparts. 3-inch tablets can be introduced to the pool in a variety of ways. They can be used in an in-line chlorinator or a floating chlorinator.

b. 1" tablets

1-inch chlorine tablets are smaller, and thus dissolve faster than 3-inch tablets. This is advantageous in the case where there is relatively low water circulation, or if the only available method of introducing chlorine into the pool is the floating chlorinator. Since there tends to be very little water movement in floating chlorinators, and erosion of the tablets depends on water movement, the faster-dissolving 1-inch tablets would be the chlorine form of choice. Both 1-inch and 3-inch tablets are made from the same type of chlorine, thus they have equal strength. The only difference lies in the size of each tablet.
** Paramount does not recommend putting any form of chlorine in

the skimmer baskets, pump baskets, or ADR bags. Use an in-line chlorinator or floating chlorinator.

Granular Chlorine Dry chlorine is also available in granular form. The types of granular chlorine vary in strength, and care should be taken in choosing the strength that best suits the swimming pool's needs.

a. Sodium Dichlor

Sodium Dichlor is granular chlorine intended for concrete, vinyl-lined, and fiberglass swimming pools and cold-water spas. Since it only contains 62% available chlorine, it is not powerful enough to damage these surfaces. The use of Sodium Dichlor in plaster pools and heated spas is not recommended due to the relatively higher cost involved in maintaining an ideal chlorine level.

b. Trichlor

Trichlor is the most powerful dry chlorine available. It contains 89% available chlorine and also contains conditioner that, as explained in a later section, helps to increase the life of the chlorine once it has dissolved in the water. Because of its high strength, trichlor cannot be used in vinyl-lined or fiberglass pools or fiberglass spas. If used in one of these environments, the trichlor would damage the lining of the pool or spa, causing leakage and discoloration. However, it's higher concentration of available chlorine allows for smaller doses and longer times between applications, thus making it more cost effective than Sodium Dichlor.

c. Calcium Hypochlorite

Calcium Hypochlorite is another type of granular chlorine. As its name suggests, it contains calcium, a metal that can cause scale buildup on the tile and the pool surface. For this reason it is not recommended to use Calcium Hypochlorite on a regular basis as a primary source of chlorine. It is, however, widely used for super chlorination. This use is acceptable since super chlorination is only done periodically. However, prolonged or excessive use of Calcium Hypochlorite for super chlorination can result in scale buildup (see later section on super chlorination).

** Paramount recommends that the pool surface is completely clean before using, so as not to stain the pool surface.

Liquid Chlorine

Liquid chlorine is a very common type of chlorine used in swimming pools for super chlorination and algae removal. Because it contains only 10% available chlorine, and it contains no conditioner, it is not advisable to use liquid chlorine as a primary source of chlorine for the pool. It is, however, an excellent choice for super chlorination, as it is relatively inexpensive and dissipates within 12 to 24 hours, allowing use of the pool in a very short time. Liquid chlorine is sold only in one-gallon containers and is usually packaged with two gallons in one box. It does not have a long shelf life (about 2 weeks), and thus should not be stored for future use.

Gas Chlorine

Gas chlorine is the purest form of chlorine available. Since chlorine occurs naturally as a gas, it contains no by-products, and thus contains 100% available chlorine. Gas chlorine can be added to the pool in two ways: it can be directly injected into the pool water from a stor-

age container, or it can be manufactured from salt using a chlorine generator. The latter method is available to the consumer, but licensed pool service technicians can only do direct gas injection.

C. METHODS OF CHLORINE INTRODUCTION

In-line Chlorinator

In-line chlorinators are those, which are installed with the piping network of the swimming pool equipment. They hold either 3-inch or 1-inch tablets and have regulator valves to control the rate at which the chlorine dissolves. In-line chlorinators allow for longer times between applications of chlorine and keep the chlorine away from the reach of children animals.

Floating Dispenser

Floating chlorine dispensers are available in a variety of shapes and sizes, and sometimes are in the shape of decorative animals such as ducks and swans. In some cases they are pre-loaded with 1-inch tablets and are disposed of when empty. Others are refillable, allowing the use of either 3-inch or 1-inch tablets. In some cases, the chlorine demand for a certain pool is greater than the output of a single floating chlorinator. In these special cases, the best alternative is to use more than one floater, or to use the faster dissolving 1-inch tablets.

Skimmer

Contrary to some opinions, the pool's skimmer is a perfectly acceptable place for chlorine tablets.

The high water flow in the skimmer provides excellent erosion of 3-inch tablets, and the plastic construction of today's modern skim-

mers is not subject to corrosion by chlorine. In addition, PVC pipes, thermoplastic pumps, and fiberglass filters do not corrode in the presence of chlorine. However, copper heating elements and other metal objects found in some pool filtration systems may be corroded and have decreased life due to high concentrations of chlorine. In these cases, it is advisable to use one of the other two methods described above.

** Paramount recommends never putting any form of chlorine in the skimmer baskets, pump baskets or the ADR bags. Use an in-line chlorinator or floating chlorinator.

Direct Application

Direct chlorine application applies only to granular and liquid chlorine use. The only way to add granular or liquid chlorine to the pool water is to evenly sprinkle it over the water surface. Because of the harmful fumes and chlorines tendency to irritate skin, granular and liquid chlorines are generally rejected in favor of tablets.

Chlorine Generator

An alternative to directly adding chlorine to a pool using either tablets or granular chlorine is to generate the chlorine from ordinary salt, which is made from sodium and chlorine. One method is most often employed and involves the addition of granulated salt directly into the pool water. As it circulates through the filtration system, a special unit adds a small electric current to the mixture and the sodium and chlorine are separated and added simultaneously to the water. There is no sodium by-product to remove, and a small amount of salt is added to the pool about twice a year.

D. CHLORINE TESTING

In order to ensure the proper amount of chlorine is in the pool water, the water must be tested regularly. It is assumed that at least a standard pool water testing kit is present and that the instructions for the particular kit have been read and understood.

The Chlorine Scale

The concentration of chlorine in water is measured in parts per million (ppm), that is, parts of chlorine per one million parts of water. A standard test kit is graduated on one side from zero ppm to 3.0 ppm, although the concentration can be much higher than 3.0 ppm. Once the chlorine vial in the test kit is filled with pool water, and the proper number of drops of OTO (or tablets of DPD, for those test kits using such a chemical) is added to the sample, the color of the sample should change in the presence of chlorine. That is, if chlorine is present in the pool water, the color of the sample should change to a shade of yellow (or pink if DPD test tablets are used). The next step is to match the color of the sample with one of the colors corresponding to the chlorine concentrations on the test kit. If the color of the sample matches that of one of the concentrations on the test kit, the number corresponding to that color is the amount of TOTAL chlorine in the swimming pool (in the case of DPD test kits, the color of the

sample after adding DPD #1 is the FREE chlorine, and the color after adding DPD #3 is the TOTAL chlorine).

Ideal Levels

Most test kits are labeled with an "ideal" level for chlorine, usually between 1.0 and 1.5 ppm. While this level is adequate for most pools, it is recommended to maintain a higher chlorine concentration than this during the hot summer months. It has been found that a con-

centration of 1.5 ppm dissipates too quickly during days with temperatures above 95-100 degrees F, thus

It is recommended that a concentration of 3.0 ppm be maintained during the warmest summer months. This ensures that the minimum level of 1.5 ppm is present and also provides additional chlorine to combat the additional organic wastes present due to the increased pool use. Due to the fact that each swimming pool has different chlorine requirements, it is difficult to recommend the precise number of tablets, etc, that are required to maintain a 3.0-ppm chlorine level. For this reason, it is advised to experiment with a particular pool to determine its requirements. As a starting point, use the guide on the previous page.

Allow the system to circulate for 24 hours, and then test the chlorine concentration. If the level is too high, decrease the amount of chlorine used, or decrease the setting of the chlorinator. If the level is too low, add more tablets or granular chlorine, add another floater, or supplement using an additional method.

Time And Frequency Of Testing

During the summer months, a swimming pool must be tested every day, since the levels of chlorine and pH can vary dramatically within a matter of hours. Since the chlorine and pH are the two tests of primary interest, these are the only two that must be tested on a daily basis. The other tests, such as alkalinity, hardness, etc., are tested on a weekly and/or monthly basis, as discussed in later sections. As the outside temperatures decrease, the frequency of testing can decrease also. In other words, during non-summer months, testing for chlorine and pH can be done twice per week or even once per week in the coldest winter months.

During the middle of the afternoon, the temperature is warmest and the sun is usually able to shine into the water easiest, and it is at this time that algae grow most rapidly. Thus, this is also the time when the chlorine level should be at its highest, since it will be necessary to prevent the rapid spread of algae. It is for this reason that it is recommended to test the pool water during the warmest part of the day (i.e. between the hours of 3:00 pm and 5:00 pm). If the chlorine was tested at 9:00 in the morning, and the level is 3.0 ppm, it is entirely possible that the chlorine concentration may decrease dramatically, say to 1.0 ppm before the warmest portion of the day arrives. Therefore, an ideal chlorine level in the morning may not necessarily mean an ideal level in the afternoon, when it is needed most. If an ideal 3.0-ppm level is noticed at 5:00 pm, it can be assumed that it was at least that amount throughout the day, and the pool was properly protected against the spread of algae.

E. SUPERCHLORINATION

Super chlorination refers to a process by which the chlorine level in the swimming pool is raised to abnormally high levels over a very short period of time, usually a few hours. Since this requires rapid addition of chlorine, slow-dissolving tablets are not suitable for super chlorination. Instead, special granular or liquid chlorines are used which are packaged in appropriate sizes and which do not remain in the pool water for an extended period of time, allowing the pool to be used as soon as possible. Another common name for super chlorination is "shocking".

Reasons For Super chlorination

Over time and with extended use, organic wastes build up in the pool water. These wastes include body oils, sweat and other body fluids, and suntan lotions. Once these wastes are present, the chlorine begins to break them down, as it would any organic substance that enters the water. However, since the chlorine is working to eliminate these organic wastes, it is not available to eliminate spores of algae as they enter the water from the air. This can allow the algae spores to multiply, resulting in visible algae in a short period of time. It is therefore required to increase the pool's chlorine concentration rapidly in an effort to eliminate the organic wastes so that the chlorine is free to prevent the spread of algae.

Types Of Super chlorination Treatments

Over time and with extended use, organic wastes build up in the pool water. These wastes include body oils, sweat and other body fluids, and suntan lotions. Once these wastes are present, the chlorine begins to break them down, as it would any organic substance that enters the water. However, since the chlorine is working to eliminate these organic wastes, it is not available to eliminate spores of algae as they enter the water from the air. This can allow the algae spores to multiply, resulting in visible algae in a short period of time. It is therefore required to increase the pool's chlorine concentration rapidly in an effort to eliminate the organic wastes so that the chlorine is free to prevent the spread of algae.

Frequency

It is recommended to super chlorinate a swimming pool every two weeks in the summer, when the pool is used more, and the possibility of the presence of organic wastes is great. During the off- season, once per month is sufficient. It is also recommended that super chlo-

rination take place in the evening, after the sun has set, since this is when the pool is not being used and the treatment will not be removed by UV rays from the sun before it has the opportunity to perform its function.

pH

Every substance has a pH: water, juice, dirt, leaves, salt, food, and shampoo. All of these items have a certain amount of acid in them. The amount of acid in a substance is measured by the pH. Vinegar is also known as acetic acid. Citrus fruits and juices contain large amounts of citric acid. Baking soda contains a very small amount of acid, and is thus referred to as a base, or alkali. In swimming pools, a certain pH range is required to ensure proper efficiency of other chemicals, as well as the comfort of those using the pool. Proper care must be taken to ensure that the pH of the pool does not reach a level which could be harmful to swimmers, or which could damage equipment or the pool itself.

A. TERMINOLOGY

pH: pH stands for "power of hydrogen" and is so named because it is the presence of hydrogen that determined the acidity of a substance. The more hydrogen, the more acidic the substance is, and thus the lower the pH. It is often a misunderstanding that as the pH increases this means that the amount of acid in the water increases, when in fact the opposite is true.

Acid: Acid is a substance, either liquid or granular, which has the ability of lowering the pH of water. In liquid form it is quite concentrated, and thus only a small amount is required to lower the pH of an average swimming pool. Examples of common acids are muriatic (hydrochloric) acid, sulfuric acid, and sodium bisulfate (dry acid).

Base (or Alkali): A base is a substance, usually a granular product, which has the ability of raising the pH of water. Examples of common bases are soda ash and baking soda.

B. ACID

Acid lowers the pH of swimming pool water. There are three different types of acids used in pools, and they will be discussed here, along with testing methods and some other factors that affect the pH level of the pool water.

Types Of Acid

a. Muriatic (hydrochloric) Acid

Muriatic is the most common type of swimming pool acid, and it is also the strongest (most highly reactive) type of acid. It is also called hydrochloric acid, as it is made of only hydrogen and chlorine. The highest concentration available to the consumer is only 38%, but even at this relatively low concentration it is a very dangerous chemical. Care should be taken to avoid contact with the skin, clothing, and every other surface capable of corrosion. Never add water to acid . . . always add acid to water. Adding water to acid can cause the escape of harmful, perhaps fatal fumes and also the possibility of fire. Always keep all acids in a well-ventilated area outside of all living areas.

b. Sulfuric Acid

Sulfuric acid is one of the most commonly recognized acids in the public sector. It is, however, a much less reactive acid than muriatic acid, and is therefore referred to as a "weak" acid. Because of this, it can be found in much higher concentrations, as high as 93%. At this concentration, one cup of sulfuric acid will do the same job as 1

quart of muriatic acid. Care should be taken to avoid overdosing of the swimming pool using concentrated sulfuric acid. Even though it is less reactive than muriatic acid, the same care and precautions should be taken as with muriatic acid.

c. Sodium Bisulfate (dry)

Dry acid is a granular acid commonly used to lower the pH of fiberglass pools and spas, vinyl-lined pools, painted pools, and all pools whose surface could be damaged by strong liquid acids. Although it is a relatively weak acid, it can be a powerful irritant and thus the same safety precautions should be followed as with muriatic and sulfuric acid.

C. BASE (alkali)

A base raises the pH of swimming pool water. In most cases, routine addition of a base is not necessary, but a small amount of one, such as soda ash, may be needed in case too much acid is added either by the user or by nature.

Types Of Bases

a. Soda Ash

Soda ash is a chemical usually granular, which neutralizes acid. It is made from sodium, carbon, and oxygen, and can be as harmful and dangerous as acid, so care must be taken to avoid contact with skin, clothing, and anything subject to corrosion. Never add water to soda ash . . . always add soda ash to water. In addition, all of the same safety precautions taken with acid should also be taken with soda ash.

b. Baking Soda

Baking soda is a very common chemical found in virtually all households. It is also used in swimming pools in a limited capacity. Baking soda is a "weak" base, and because of this, it is an excellent means to control total alkalinity (discussed in Section 4). Unlike acid and soda ash, baking soda is relatively mild and generally does not irritate human tissues. However, since it does react with acid in a somewhat violent manner, care should be taken to avoid mixing baking soda and acid in any environment other than the swimming pool.

D. pH TESTING

The pH Scale

On a standard test kit, the pH scale is graduated from 6.8 to 8.2. These numbers are not in ppm. The numbers refer to the concentration of hydrogen (acid) in the water but the scale is somewhat in reverse. The scale actually ranges from a low of zero to a high of 14, but only the range from 6.8 to 8.2 is of concern for swimming pools. Water with a pH of zero is said to be pure acid, while water with a pH of 14 is said to be pure base (or alkali). A 7.0 pH indicates neutral water, meaning it has neither too much acid nor too much base. Muriatic acid has a pH of approximately 1.0, while soda ash has a pH of approximately 13.0. Water with a pH of 6.0 is 10 times more acidic than water with a pH of 7.0, and the same is true for the alkaline side of the scale. Thus it is imperative that the pH be kept within proper levels to ensure the safety of the swimmers, and the longevity of the pool equipment.

Ideal Levels

The ideal level for pH is generally the same for all swimming pools, regardless of climate, amount of use, temperature, or pool surface.

This ideal level falls between 7.4 and 7.6 for all pool surfaces. There are two important reasons for this ideal level. First, chlorine is most efficient at a pH of 7.0, when there is neither too much acid nor too much base to interfere with its function. However, the pH of human blood is approximately 7.42, and thus a 7.0 pH would cause discomfort to swimmers. Thus it is recommended to keep the pH as close to 7.4 as possible. Also, to ensure that no corrosion of the pool surface takes place, a slightly higher pH is needed, and as a result the ideal range for pH is between 7.4 and 7.6.

Time And Frequency Of Testing During the warm summer months, the pH of the swimming pool can change rapidly. For this reason it is advisable to test the pH level daily during these times. The specific time of day at which the pH should be tested is not as critical as that for chlorine, but for convenience, both should be tested at the same time, namely late afternoon.

E. OTHER FACTORS WHICH AFFECT pH

In addition to the addition of acid and soda ash by the user, there are a number of other factors that can vary the pH of a swimming pool. Among these are the presence of citrus plants, rain, dirt and debris, and the type of pool surface present.

Citrus Plants

As mentioned earlier, citrus plants contain a powerful acid called citric acid. Once this acid is introduced to the pool water, it lowers the pH, frequently to a large degree. In some cases, the amount of citric acid added to the water in this way is severe. In this case, it is advisable to keep as many leaves and citrus fruits out of the pool water as possible, whether by eliminating or relocating the plant, or by adding a cover to the pool.

Rain

In urban areas where a significant amount of air pollution exists, the rain that falls brings with it a significant amount of sulfuric acid. It is important to test the pH as soon as possible after a rainstorm to ensure that it does not remain below ideal levels for an extended period of time.

Dirt And Debris

Some soils, especially those in the southwest deserts, are very alkaline. Since alkaline substances neutralize acid and raise the pH of water, the presence of large amounts of dirt and debris in the swimming pool can increase the pH significantly. In cases where large amounts of dirt and debris are entering the pool water, it is advisable to keep the pool covered as much as possible.

Pool Surface

The type of surface used on a swimming pool can also affect the pH of the pool water. Plaster or concrete based pool surfaces, are porous, alkaline materials. They can absorb and neutralize acid in pool water, thereby raising its pH. In this case, small amounts of acid are generally needed to maintain a proper pH balance. Fiberglass, vinyl, and painted plaster pools, on the other hand, do not have porous surfaces, and thus do not absorb or neutralize acid in the water. Here, small amounts of soda ash or baking soda may be needed to keep the pH at a proper level after acid is added in the form of rain, citrus leaves, etc.

TOTAL ALKALINITY

Total alkalinity is a measure of the total amount of dissolved particles in the water whose pH is higher than 7.0. For this definition, a particle

is any object that does not break down completely when dissolved in water. Examples of particles include dirt, sand, and baking soda. Baking soda, unlike soda ash, does not break down completely, but instead remains as a compound and stays in the water for an extended period of time. Alkaline particles in pool water, at certain levels, act as a buffer to prevent rapid changes in the pool's pH. Thus, when the total alkalinity of the pool water is within the ideal levels, the pH of the water will tend to stay balanced for longer periods of time.

A. TERMINOLOGY

Alkalinity: See "Base" in section 3A above.
Buffer: A buffer is a substance that prevents rapid and large changes, usually in the pH of the environment it is in. In this case, the alkalinity of the water itself helps to minimize rapid changes in the pH of the water when reasonable amounts of acid are added.

B. TOTAL ALKALINITY TESTING

The Total Alkalinity Scale

Total alkalinity is measured in parts per million (ppm). The scale by which it is measured begins at zero ppm and has no upper limit. Generally, the maximum level concerning swimming pool users is on the order of 200 ppm, but the recommended ideal levels fall well below this amount.

Ideal Levels

The ideal level for total alkalinity varies with the type of surface the pool possesses. For all pool surfaces, the recommended level falls between 120 and 140 ppm if any trichlor, gas, or liquid chlorine, or bromine tablets or sticks are used, and 100-120 dichlor, liquid chlorine, calcium-or lithium- hypochlorite is used.

** Paramount recommends 120 ppm of alkalinity, no matter what form of chlorine is used.

Time And Frequency Of Testing

Unlike chlorine and pH, total alkalinity does not need to be tested on a daily basis, due to the fact that it does not change rapidly. It is generally recommended to test the total alkalinity 2 to 4 times per month throughout the year. However, if the pool's pH is not remaining balanced, or large amounts of acid, soda ash or baking soda have been added to the pool, it is advisable to have the total alkalinity tested as soon as possible. There is no specific time of day at which the alkalinity should be tested but, again, for convenience, it is recommended that it be tested at the same time as the chlorine and pH tests.

C. OTHER FACTORS WHICH AFFECT TOTAL ALKALINITY

All of the same factors that affect pH are also responsible for changes in the total alkalinity. For a reminder of what these factors are, refer to the pH Section 3E of this guide

CONDITIONER

Conditioner is a chemical that, to a certain extent, protects the chlorine from ultraviolet (UV) rays from the sun. Since UV light is partly responsible for the degradation of chlorine in pool water, conditioner helps to keep chlorine in the water for longer periods of time. Conditioner is generally added once after the pool is filled with fresh water, but if an excessive amount of water has been lost due to backwashing or a leak, it is recommended to have the conditioner level tested.

A. TERMINOLOGY

Conditioner: Conditioner is a name given to a chemical that inhibits the degradation of chlorine by UV light. Other commonly used names for conditioner include: stabilizer, sun-shield, or the chemical name cyanuric acid.

Stabilized Chlorine: Stabilized chlorine refers to chlorine that is made with a base of conditioner. The chlorine binds to the conditioner base, and as the chlorine dissolves, it leaves conditioner behind. The presence of conditioner in the chlorine serves two purposes. It affords a small amount of protection to the chlorine from UV light, and it also acts to supplement the pools conditioner level, as it is gradually reduced by backwashing and splashing. Chlorine that contains conditioner is usually marked with the words "Sun-Shielded". Usually, only tablets and some granular chlorine contain conditioner.

Unstabilized Chlorine: Unstabilized chlorine refers to chlorine that does not contain conditioner. This type of chlorine is generally used as a method of super chlorination, and is not recommended as the primary source of the swimming pool's chlorine residual.

B. TESTING OF CONDITIONER

The Conditioner Scale

Conditioner is measured in parts per million (ppm). The scale begins at zero ppm and has no upper limit. Generally, the maximum level concerning swimming pools is on the order of 200 ppm, but the recommended ideal range is well below this amount.

Ideal Levels

The recommended ideal level for conditioner in a swimming pool is between 40 and 100 ppm. It is advisable to begin the summer season with a level that is near 40 ppm and allow the conditioner present in the chlorine itself to raise the level toward 100 ppm throughout the season. If the chlorine used is not stabilized, small amounts of conditioner may be required to maintain an average of 70 ppm.

Time And Frequency Of Testing

Since the concentration of conditioner does not vary to a great extent, it is usually required to test it only once per month. If, however, a large chlorine demand is noticed, it is advisable to have the conditioner level tested as soon as possible. There is no specific time of day at which the conditioner level should be tested.

WATER HARDNESS AND TOTAL DISSOLVED SOLIDS (TDS)

One big source of problems for many pool owners is hard water. The same problems associated with hard water in household pipes, namely scale buildup, can be magnified many times in a swimming pool environment. Once hardness levels become high, scale may form on the pool tile, the pool surface, and even the pipes and equipment. Unfortunately, the causes of hard water in swimming pools are, for the most part, unavoidable. To begin with, the tap water used to fill a swimming pool contains a certain amount of calcium, the main component of hard water. It is the calcium in the water, combined with alkaline particles, which produces the visible scale buildup. Usually, the concentration of calcium in the tap water is well within, or even below, the recommended levels for swimming pools, but as the water in the pool evaporates, the calcium is left behind, since it is much heavier than the water itself. As the pool is being refilled, more

calcium is being added through the tap water, and thus the concentration of calcium in the swimming pool increases.

The level of total dissolved solids (TDS) in the pool is not as important as that of calcium hardness. TDS is usually used as a tool to determine the general condition of the pool water in terms of how many dissolved particles are present. As the water remains in the swimming pool for extended periods of time, particles accumulate and eventually become so plentiful as to interfere with the function of the pool's chemicals, as well as to cause significant loss in water clarity. ** Paramount recommends that prior to filling your pool, a sample of your tap water be tested by your nearest Pool retail store for hardness. Report the reading to the Pool Builder Construction Department, so they can take the necessary steps, if needed, to correct.

A. TERMINOLOGY

Water Hardness: Water hardness is a measure of the concentration of minerals, primarily calcium, present in the pool water. Water hardness is also referred to as calcium hardness, and at high levels, can cause scale buildup.

Total Dissolved Solids (TDS): TDS is a measure of all of the dissolved particles in the swimming pool water. These include calcium, manganese, copper, iron, other trace metals, total alkalinity, conditioner, and all substances not totally broken down by the pool water. It is generally used as a tool to determine the overall condition of the water and to determine whether or not the water should be removed and replaced with fresher tap water.

B. WATER HARDNESS AND TDS TESTING

Water hardness and TDS are both measured in parts per million (ppm). Both scales begin at zero ppm and have no upper limit. Generally, the maximum levels concerning swimming pools are on the order of 1000 ppm in the case of water hardness, and 2000 in the case of TDS.

Ideal Levels

The recommended ideal levels of water hardness and TDS are 200-400 ppm and 400-1500 ppm, respectively. The lower limit for water hardness is necessary to ensure the longevity of pool plaster and any metal components in direct contact with the pool water. Since pool plaster is composed partly of calcium, it is possible for soft pool water to pull the calcium from the plaster, causing degradation of the pool surface. Other pool surfaces, such as fiberglass, also contain some metals in them, and these metals would be removed in the presence of soft pool water. For these reasons, it is not recommended to add soft water in large amounts to the swimming pool. Concentrations of calcium higher than 400 ppm can cause scale buildup along the tile line, and on the surface of the pool itself. These scale deposits begin to appear as simply a rough surface finish, but as they progress, they darken to eventually resemble a brownish stain with a rough texture.

Low TDS levels are usually present only in soft water, and are not a major concern in ordinary tap water. It is not possible to have a lower TDS level than that of calcium, since TDS is partly composed of calcium, thus as long as the calcium is within the recommended ideal levels, the TDS should follow suit. High TDS levels, on the other hand, may cause a lack of water clarity, even if the calcium concentration is within ideal levels. If persistent cloudiness of the pool water is observed, test the TDS level as soon as possible.

Time And Frequency Of Testing

Since the evaporation rate is highest during the summer months, it is advisable to have the water hardness and TDS levels tested twice per month during this time. During the off-season, testing for these levels once per month is sufficient. There is no specific time of day to test for water hardness or TDS.

C. OTHER FACTORS WHICH AFFECT WATER HARDNESS AND TDS

Type Of Chlorine Used

Some types of chlorine contain relatively high levels of by-products, including calcium. It is advisable to check the ingredients for the presence of such by-products and avoid them whenever possible. It is always best to use chlorines possessing high amounts of available chlorine, that is, the actual amount of usable chlorine in the container. The highest amount of available chlorine is usually 89%, found in most tablets and some granular chlorine.

Type Of Filter Used

Some filters, such as sand and diatomaceous earth (D.E.), have the ability to be backwashed, or cleaned, using the pool's existing pump. During this process, some of the pool's water is lost, and as a result, so are some of the calcium and other minerals in the pool water. When done frequently, this can help to keep the water hardness and TDS levels within ideal levels. Other filters, such as cartridge filters, do not use this method of cleaning, and thus the pool water is not cleansed of minerals as it is with sand and D.E. filters. In this case, water hardness and TDS levels can climb at a more rapid rate.

Dirt And Debris

Some dirt, especially in the southwest deserts, is rich in calcium and other minerals; the presence of it in the swimming pool can introduce these minerals to the pool water. Care should be taken to ensure that as little dirt and debris as possible enter the pool water.

Metals

The presence of metals such as copper and iron can increase the TDS level of the pool water. If large amounts of these metals are entering the swimming pool, steps should be taken to eliminate their source.

COPPER AND IRON

The presence of copper and iron in pool water can lead to damage or discoloration of the pool surface, and corrosion of metal components in direct contact with the pool water. Any time metal objects such as poles, toys, and tools fall into the swimming pool, they can release iron and copper into the pool water. These "local" deposits of metal could cause a discoloration of the pool surface in that area. Also, some common algaecides used in swimming pools contain moderate amounts of copper, and when used in excess, can cause staining (usually blue or green) of the pool surface. In addition, some areas have relatively high concentrations of iron in the tap water. These high concentrations of iron can cause general rust spots to develop over large area of the pool surface.

A. TESTING OF COPPER AND IRON

The Copper And Iron Scales

Copper and iron are both measured in parts per million (ppm). The scale begins at zero ppm and has no upper limit. Generally the maximum level of copper and iron concerning swimming pools is on the order of 1.0 ppm.

Ideal Levels The recommended ideal levels of copper and iron in swimming pool water are both zero ppm, since the presence of these metals can cause problems as explained above. However, some pools are equipped with devices that introduce copper into the pool water in small amounts in an effort to reduce chlorine use and prevent certain types of algae buildup. In these cases, it is recommended that a copper concentration of approximately 0.2 ppm be maintained.

Time And Frequency Of Testing

Since the concentrations of copper and iron do not change rapidly under normal circumstances, testing for these metals once per month is generally sufficient, unless a copper ionizer is used as a source of sanitizer. In this case, follow the ionizer manufacturer's directions. However, if persistent general staining is observed, it is recommended to test for copper and iron as soon as possible. There is no specific time of day to test for these metals.

ALGAE Without proper chemical care, algae spores that enter the pool water from the air will multiply and become visible colonies. These colonies can take several forms and are identified by their colors. Of the many species of algae, only four are common in household swimming pools: green, yellow, pink and black.
A. TYPES OF ALGAE

Green Algae

Green algae are by far the most common type of fresh water algae. It can grow both on the pool surface, resembling a green, slimy stain, and also suspended in the pool water, causing the water to appear to have a green tint. In severe cases, the algae is concentrated enough so that it is impossible to see the pool bottom, or even the steps. This

can occur without significant warning during the summer months and may even happen within a 24-hour period. For this reason, it is always advisable to make certain that the chlorine concentration is well within the ideal range.

Yellow Algae

Yellow algae (also called mustard algae) are actually a type of green algae, but because of its different appearance and somewhat more difficult removal procedure, it is discussed separately here. Yellow algae almost always form on the pool surface, usually in shaded areas. It is yellow-brown in color, has a slimy texture, and can most often be brushed away with a few vigorous strokes of a standard pool brush.

Pink Algae

Pink algae are a relatively uncommon type of algae that is pink or red in color, and usually forms around pipefittings and light fixtures on the pool surface.

Black Algae

Black algae is a very common type of algae, and is the most difficult to remove once it has formed. A colony of black algae always forms on the pool surface, and usually is first visible when it is about the size of a small fingernail, but can grow rapidly and eventually become larger than a dinner plate. The spores settle in porous surfaces, such as rough plaster (mostly caused by calcium buildup), and begins to anchor itself to the surface. It is able to dig a root into the porous surface and from there can develop an extensive root network beneath the pool surface, usually between the plaster and the concrete. Once the root has been formed, the algae become visible, but at this time it is already too late. Destruction of the visible portion is by no means a

guarantee that the entire colony is destroyed.

B. METHODS OF ALGAE PREVENTION

The proper maintenance of pool chemicals are the best way to ensure the prevention of most types of algae. Some green algae, and virtually all yellow algae are immune to chlorine, so in these cases it is almost impossible to guarantee the prevention of all algae. However, there are algaecides available to the consumer that uses both chlorine and copper to collectively destroy these chlorine-immune algae. Ensuring that the pool surface is as smooth as possible can most easily prevent black algae. Maintaining a proper water hardness level, and ensuring that any damage to the pool surface is repaired as soon as possible are the best ways of keeping a smooth pool surface.

C. METHODS OF ALGAE DESTRUCTION

Once algae has become visible to the naked eye, it will require a great deal more time and expense to kill it than it would have to have prevented its formation. For this reason, the prevention of algae is stressed. There are information sheets available at most local Pool retail showrooms concerning the destruction of each type of algae mentioned above. With the exception of black algae, the destruction of algae means the total eradication of the colony from the swimming pool, and the pool is to be maintained as usual from that point on. With black algae, as mentioned above, the visible portion may have been removed, but a root still exists until at least a liquid chlorine bath can be performed, requiring the pool to be drained and scrubbed with liquid chlorine.

POOL SAFETY

The use and care of a swimming pool should be a safe and enjoy-

able experience for everyone. Since there are a number of items in and around a swimming pool, including the pool itself, which can be a potential hazard, familiarization of the safety aspects of these items is mandatory. Please refer to the warning labels on any product for use in or near the swimming pool, and follow any directions for the

safe and clean disposal of these items. Please refer to your equipment owner's manuals for all operating and safety precautions.

A. CHEMICALS

The chemicals used in a swimming pool pose a definite hazard to occupants and equipment. A few simple guidelines should be followed to ensure the safety of everyone. In this context, a "chemical" includes, but is not limited to, chlorine, acid, soda ash, any algaecide, diatomaceous earth, silica sand, and any cleaning agent.

· Never mix any two chemicals together, either away from or in the pool water.

· Never add water to a chemical . . . always add the chemical to water.

· Never handle a chemical without the use of protective gloves and a form of nose-mouth protection. This can be a disposable fabric mask or a respirator.

· Never add two different chemicals to the pool water at the same time . . . always allow at least 4 hours between applications unless otherwise directed by the chemical manufacturer.

· Never allow anyone to use the pool within 4 hours after the addition of chemicals.

· Never store any chemicals inside the house, in direct sunlight, or near the pool area.

· Always keep all pool chemicals out of the reach of children.

· Never store two different chemicals adjacent to one another. Leak-

age of one could cause them to mix and a chemical reaction could result.

· Avoid contact of any chemical with the skin or mucous membranes, such as those in the mouth, eyes, and nose. If this occurs, flush the area with water and consult a physician immediately. Be sure to have the container of the chemical nearby to inform the physician of the agent involved.

· Be aware of the addition of any pool chemicals by another person, to avoid interaction or overdose.

Filtration Equipment

YOUR FIRST 14 DAYS

From the moment construction of your swimming pool is complete and it is filled with water, the chemicals must be kept at their ideal levels. Most important is the chlorine concentration. Some type of chlorine (tablet, granular, or gas from a chlorine generator) must be added immediately to ensure the prevention of algae growth. In addition the total alkalinity and the pH must be tested to determine the need for acid or soda ash, and, if necessary, calcium should be added to prevent damage of the pool surface from soft water. In plaster pools, the water will be very cloudy for a week or more. During this time, it is necessary to brush the pool with a standard nylon pool brush at least three times per day, circulating the pool water with the filtration system 24 hours per day for the first 14 days. The filter will require cleaning almost every day to remove the extra plaster dust from the water, and it is possible that the pool will require large amounts of acid during this time as well. It is always best to make sure that the water requires acid (by testing the pH) before adding it. If there is an imbalance in both the pH and the total alkalinity, it is recommended to bring the total alkalinity to the ideal level first, then adjust the pH as needed. There will be a time when the porous fresh plaster will have absorbed quite a large amount of acid and the demand will decrease. It is unwise to get into a habit of adding acid, and forgetting to test the pH beforehand. The total alkalinity will also begin to rise with the presence of the additional plaster dust. It is recommended that the water be tested for all chemicals at your local Pool retail showroom at least two or three times per week during the first 3 weeks. Once the plaster dust has been removed from the pool water, it is then time to add conditioner to the pool. Since conditioner does not dissolve rapidly, it is necessary to allow the system to circulate for at least four days without cleaning the filters (as the conditioner usually dissolves in the filter). This is not practical while large amounts of

plaster dust are still present. After four days have passed from the time the conditioner was added, bring a water sample to a local Pool retail showroom to have the water thoroughly tested. At this time, all chemicals should be at their ideal levels, and your new swimming pool should be ready to enjoy.

WATER CIRCULATION

Properly adding chemicals to the pool water is just one step in the prevention of algae growth. Of equal importance is proper water circulation. Even if the chemical levels are well within ideal ranges where you take the test sample from, if the water is uncirculated, none of the chemicals will get evenly distributed throughout the pool water, thus there will be some areas of the pool with chemical levels far below ideal. Understanding how the water circulates throughout the pool, and what can be done to maximize the efficiency of the water's movement, is crucial in the prevention of algae growth. This section explains the swimming pool circulation system and it's operation.

Water turnover and filtration is the second half to maintaining healthy water in your swimming pool. The correct sizing of the equipment and filter greatly effect the amount of energy and time required to keep your pool clean and clear. The filtration system should be sized to turnover the entire volume of water in your pool two to three times daily. There are two different "sides" of the pool's circulation system: the suction and the pressure sides. The suction side refers to the water that is approaching the pump from the pool, whereas the pressure side refers to the water that is returning to the pool after it has passed through the pump. The suction side of the system has two main components: the skimmer and the main drain. Water flows from the pool through each of these openings to the pump, and from there, proceeds through the filter and returns to the pool.

A. SUCTION

Skimmer And Main Drain

The skimmer is located immediately adjacent to the pool water inside the pool deck. There is a rectangular opening in the pool tile which leads into the skimmer and which contains the skimmer weir, a plastic door, hinged at the bottom, which prevents debris from re-entering the pool once the pump is turned off. A plastic cover on the pool deck provides access to the skimmer approximately 18 inches from the pool water, directly above the rectangular opening described above. Once the cover is removed, the skimmer basket is visible. The skimmer basket traps large debris such as bugs and leaves before it enters the pipes leading to the pump.

Large debris such as this could become trapped in the pipes, causing restriction of water flow and possible starvation of the pump. Since the complete blockage of this basket could also lead to water flow restriction and improper circulation, it must be cleaned at least twice per week (sometimes more often), and also immediately following a wind storm where large amounts of debris have been blown into the pool. Beneath the basket is a unit called a float valve (For pools equipped with a Paramount In-Floor cleaning system with active main drain, the float valve may not be present. In this event, please refer to the section of the manual relating to the Paramount In-Floor cleaning system in your pool for more information). It is round and resembles a flying saucer. This float valve serves two functions. It regulates the flow between the main drain and the skimmer, and it also prevents air from entering the piping network in the event that the pool water lever were to fall below the level of the skimmer entrance.

On the bottom of the float valve there is a small teardrop-shaped flap attached to the valve with a single screw. This flap is responsible for the regulation of flow between the skimmer and the main drain. If the flap is closed, the main drain is the sole port through which the water flows out of the pool. If it is completely open, the skimmer transports most of the water out of the pool. Any position in between will result in a proportional amount of water flowing through the skimmer and the main drain. For example, if the flap were positioned so that it was about 3/4 closed, most of the water flowing out of the pool to the pump would flow through the main drain. On the other hand, if it were only 1/4 closed, the majority of the water flowing out of the pool would do so through the skimmer. For proper water circulation, it is best to position the flap so that it is about 2/3 closed.

This will allow for more flow through the main drain than through the skimmer, which will promote a "bottom-to-top" circulation throughout the pool. Most of the water in the pool will be pulled through the main drain at the bottom of the pool and returned to the pool at the top, where the main returns are located (see the section of this manual on "Returns"; for pools with a Paramount In-Floor system the circulation pattern is different, see the section regarding your system).

The float valve can be placed in the bottom of the skimmer in any orientation, as long as the flap is at the bottom. It should be noticed upon removal of the float valve that a black rubber O-ring is present in the bottom of the skimmer. This serves as a seal to ensure that all of the water flowing through the skimmer is flowing through the float valve, instead of around it. Inside the float valve is a small plastic float that prevents air from passing through the skimmer in the event that the pool water level drops below that of the skimmer entrance. If this occurs, the float drops down and seals against another black O-ring

within the float valve assembly. Beneath the float valve are two holes, each approximately 2 inches in diameter. The hole that is closest to the swimming pool is connected directly to the main drain at the bottom of the pool (in pools with a Paramount In-Floor system this is different, see the section regarding your pools system).

The other hole is connected to the pump. While the pump is running, the hole farthest from the pool will be pulling water into it, and a strong suction should be felt, while no suction should be felt from the other hole. Once the float valve is in place and the flap is positioned correctly, the water will flow up through the pipe closer to the pool and will turn to flow down the pipe leading to the pump. If the float valve is not in place, the water will follow the path of least resistance and will only flow through the skimmer and into the pipe leading to the pump, and the main drain will not be functioning.

B. PRESSURE

The pressure side of the system refers to the water that has already passed through the pump and is returning to the pool. The pressure side of the system includes the filter, backwashing assembly, heater (if present), the main returns, and the aerator. In this section, the main returns and the aerator are discussed leaving the filter, backwashing assembly, and the heater for subsequent sections.

Main Returns

The main water returns (named "returns" because they return water to the pool) are generally located about 1 foot beneath the water surface and resemble eyes in appearance. They may have openings ranging from 1/2 inch up to 1 inch. In order to aim the orifice in a certain direction the outer ring of the return can be loosened by turning counter-clockwise. Once the desired direction is achieved, the

ring can then be tightened to hold the return in place. The returns should be aimed so that a circulation pattern exists on the surface of the pool. This usually means that all of the returns should be aimed either to the left or to the right, depending on the style of the particular pool. Usually, all of the returns should be aimed so that they are level with the water surface, as opposed to up or down. This may interfere with the operation of some suction-powered pool cleaners, however, and if this is the case, please refer to the section on "Suction-side pool cleaners".

Aerator

The aerator is a small fitting just above the water line approximately halfway along the poolside. The aerator serves a single purpose: to cool the water in the event that it gets too warm for either swimmer comfort of chemical efficiency. Above 90 degrees F., chlorine becomes too active to remain in the water, and quickly dissipates. If the water temperature rises above 90 degrees F, it is recommended to turn the aerator on by opening the valve which controls it (see the labels on your specific pool valves to determine which is for the aerator). Water will flow from the aerator fitting and should spray approximately 2/3 of the way across the pool. If the spray does not carry this far, begin to close the valve that flows to the main returns until the water flowing from the aerator reaches the desired spot. Be careful not to close the other valves completely, as a possible over-pressure situation may result, causing damage to the system or even personal injury. Watch the pressure gauge at the top of the filter to insure that the pressure does not rise above the maximum operating pressure of that particular filter.

THE PUMP The pump is essentially the heart of the swimming pool's circulation system. It pulls water from the pool through the skimmer

and main drain, pushes it through the filter, and returns it to the pool through the main returns. The pump itself consists of three components: The motor, impeller, and hair and lint trap. The motor is electric, uses either 110 or 220 volts, and turns at 3,450 rpm. It is air cooled, and because of this is not perfectly sealed from the environment, so caution should be taken to keep excess water from entering the motor through the cooling vents located on the underside of the housing. Connected to the end of the shaft of the motor is the impeller.

As it turns, it pulls water in through the hair and lint trap at the end of the pump and pushes it out the top of the pump through a pipe leading to the filter. The impeller contains small openings and is very susceptible to becoming clogged with debris. If the pressure on the gauge at the top of the filter is reading lower than the recommended levels, and if the amount of water flowing back to the pool has decreased, it is possible that the impeller is either clogged or damaged.

This can be determined by separating the assembly at the impeller housing and checking the impeller visually.

A special hair and lint trap is located at the end of the pump assembly to prevent debris from entering the impeller assembly. Inside the hair and lint trap is a basket that should be checked and emptied at least twice per week. If the basket were clogged, the flow of water into the pump would be restricted and the pump would begin to pump air instead of water. This is known as a "loss of prime". At this point, the motor would begin to turn faster, and would eventually burn out. If this basket were not present, the impeller could become clogged, which would prevent it from pumping large quantities of water, or it could become damaged.

A. RUNNING THE PUMP

The entire operation of the swimming pool is dictated by the operation of the pump. The cleaning system cannot, in general, operate without the main pump, and the pool water cannot be filtered without the main pump operating. It is crucial, therefore, to be aware of the proper schedule for the operation of the main pump.

When To Run The Pump

There are two factors which determine the time of day when the pump should be operating: chemical demand and energy cost. Since ultraviolet light from the sun removes chlorine from the water, it is apparent that the highest chlorine demand would be during the daytime. Since most methods of chlorine addition require the pump to be operating to furnish the pool with the proper amount of chlorine, this would lead to the conclusion that it is better to run the pump during the day, rather than at night.

However, due to the higher cost of electrical power during the daylight hours, these two factors must be weighed in order to determine the schedule that best meets the needs of each pool, and its owner. The ideal case would be to run the pump from sunrise to sunset, and this schedule would be best for those situations where the cost of electricity does not vary throughout the day. In other cases, however, it may be necessary to run the pump during the night to avoid high utility costs. It should be noted that the amount of chlorine that is added to the pool must be enough so that the chlorine level remains at or above 3.0 ppm for the majority of the daylight hours, especially in the afternoon.

How Long To Run The Pump

The two main factors in determining the length of time that the pump should be run during each cycle are the chemical demand and filtration. During the summer months, the chemical demand is at its peak, and since the bathing load is generally higher during this time, the amount of debris in the pool is higher also. This requires that the water be filtered more thoroughly to remove the excess debris. A "rule of thumb" exists which can be used to determine the length of each pumping cycle. For every 10 degrees F of outside air temperature, run the pump 1 hour. For example, if the average maximum air temperature for a month was 100 F, then the pump should be operating for at least 10 hours per day for that month.

Since the temperature cannot be accurately predicted each month, this rule should be followed conservatively. It is recommended that the pump run 12 hours per day during the hottest summer months, and 4-5 hours per day during the winter months, and to varying degrees during the spring and fall. The daily cycle can be divided up into multiple cycles, but each cycle should be no shorter than 4 hours, since this is the minimum time it takes for all of the water in the pool to pass through the filter at least once, and it is also the recommended time between the addition of chemicals and the next water test/or pool use.

CARTRIDGE FILTER

Cartridge filters use polyester elements that are filled with very small pores. These pores allow water to pass through but trap dirt and debris, as well as microscopic particles, down to 20 microns (1/50 of a millimeter) in diameter. As the pores become clogged, the water has no place to go, so the pressure in the filter tank begins to rise, which shows up on the pressure gauge at the top of the filter. If a rise oc-

curs in the pressure, this usually means that the filter needs to be cleaned. This is done by disassembling the filter tank (Usually a clamp is present around the tank that holds it together.) and removing the filter element. Remove the plug at the bottom of the filter tank and rinse the inside out before removing the filter element or much of the debris trapped in the tank will pass back into the return line to the pool and be broadcast back into the pool. Once removed spray the filter element with very high pressure water and/or soak the element in a mixture of a filter cleaner and water.

Once the element is clean, it can be placed back into the tank and the clamp refastened. Then the pump can be restarted, making sure that the pressure rises from zero to the normal operating pressure soon after restart. As the pressure is rising, open the manual air relief valve to release the air that was introduced into the tank during the cleaning process. The filter element should be cleaned every week, or when the pressure on the gauge reaches a value 5-10 psi higher than the normal operating pressure, whichever comes first. Once or twice a year, it should be soaked in a mixture of filter cleaner (available at a Pool retail showroom near you) and water.

REGAINING PRIME If the pressure does not rise within 1 minute, shut the pump off and force water into the system through the skimmer by placing a garden hose into the hole at the bottom of the skimmer which is farthest from the pool and restarting the pump. The water from the garden hose should be enough to flood the pump and restart the system. Be sure to open the manual air relief valve after the pump has regained its prime to release the excess air from the filter.

SAND FILTER

Sand filters use a large amount of #20 silica sand as a filter for the pool water. They are composed of a one-piece fiberglass tank and are filled approximately 2/3 with sand. Special pipes and fittings inside the tank direct the water from the top of the filter to the bottom, allowing it to filter through the sand as it moves down. Sand filters can trap microscopic particles down to about 15 microns in size, and the pressure in the filter tank increases as the filter becomes clogged with debris. A process known as backwashing accomplishes cleaning of the filter. As the name implies, forcing the water through it backwards, and removing the debris and the water by placing it outside the pool area using a flexible backwash hose cleans the filter.

Backwashing

Before backwashing, it is important that the pump be turned off to avoid damage to the backwash valve mechanism. For filters with a side-mounted, vertical backwash valve, rotate the handle to unlock the valve, push the handle down as far as it will go, and rotate the handle once again to lock the valve in the backwash position. Make sure that the backwash hose is extended to the desired area, and turn on the pump. A large quantity of water and debris will flow out of the hose. Continue until the water which is flowing out of the hose is clear and wait an additional 30 seconds to ensure that the filter is properly cleaned. Turn the pump off and return the valve to the normal filter mode by carrying out the above steps except in reverse order. Once the valve is returned to the filter position, open the air release valve to release trapped air in top of lid or tank tops.
Turn the pump on and monitor the pressure gauge for proper operation of the system. If the pump fails to fill with water, or the pressure fails to build to the normal operating value, follow the steps in the "REGAINING PRIME" section below. For filters with a top-or side-

mounted rotating backwash valve, the process is similar, but instead of pushing the handle down to backwash and up to filter, the handle of the rotating valve is pushed down and then rotated to the backwash and filter positions, respectively. Once all of the trapped air is released through the air release valve and only water flows out, close this valve.

Due to the presence of minerals such as calcium in the pool water, which can harden and solidify the sand, it is recommended that the sand be completely changed every 5-7 years. #20 silica sand is available at any Pool retail showroom.
REGAINING PRIME If the pressure does not rise within 1 minute, shut the pump off and force water into the system through the skimmer by placing a garden hose into the hole at the bottom of the skimmer which is farthest from the pool and restarting the pump. The water from the garden hose should be enough to flood the pump and restart the system. Be sure to open the manual air relief valve after the pump has regained its prime to release the excess air from the filter.

DIATOMACEOUS EARTH FILTER

Diatomaceous earth (D.E.) filters utilize two components to filter pool water. Ribbed polyester grids (usually eight) are assembled within the tank connected together with a network of piping called a manifold. The grids themselves are far too porous to be an effective filter for pool water, but they are coated with a substance called diatomaceous earth (also called D.E. or just earth). D.E. is made from a number of sources, including crushed seashells and microscopic algae skeletons (diatoms). It resembles flour in appearance and once it is introduced onto the filter grids, it is capable of trapping particles as small as 5 microns, which is smaller than algae itself, making D.E. fil-

ters the most efficient filters available from swimming pools. As the filter becomes clogged with dirt and debris, the pressure in the tank begins to rise and the filter is then cleaned by backwashing.

Backwashing

Before backwashing, it is important that the pump be turned off to avoid damage to the backwash valve mechanism. For filters with a side-mounted, vertical backwash valve, rotate the handle to unlock the valve, pull the handle up as far as it will go, and rotate the handle once again to lock the valve in the backwash position. Make sure that the backwash hose is extended to the desired area, and turn on the pump. A large quantity of water and debris will flow out of the hose. Continue until the water which is flowing out of the hose is clear and wait an additional 30 seconds to ensure that the filter is properly cleaned.

Turn the pump off and return the valve to the normal filter mode by carrying out the above steps except in reverse order. Once the valve is returned to the filter position, open the air release valve to release trapped air in top of lid or tank tops. Turn the pump on and monitor the pressure gauge for proper operation of the system. If the pump fails to fill with water, or the pressure fails to build to the normal operating value, follow the steps in the "REGAINING PRIME" section below. For filters with a top-or side-mounted rotating backwash valve, the process is similar, but instead of pulling the handle up to backwash and pushing it down to filter, the handle of the rotating valve is pushed down and then rotated to the backwash and filter positions, respectively. Once all of the trapped air is released through the air release valve and only water flows out, close this valve.

After the backwash process is complete, additional D.E. must be added to the filter to replace what was removed with the water and debris. A convenient unit of measure for D.E. is a one-pound coffee can. Add one one-pound coffee can for every 5 square feet of filter area (found on the label on the outside of the filter tank) to a large (5 gal.) bucket of water and slowly pour the mixture into the skimmer (next to the pool) while the pump is running (in normal filter mode . . . not backwash). If you have a Paramount In-Floor cleaning system with a booster pump make sure it is off before D.E. is added to the skimmer.

Do not add dry D.E. to the skimmer as this will result in the D.E. piling up in the skimmer and also to the uneven coating of the grids. Once the new D.E. is added, normal filtering can be resumed. In addition to backwashing, it is recommended that the filter be disassembled and thoroughly cleaned by soaking the grids in a mixture of filter cleaner and water at least twice per year. This will remove excess D.E. that wasn't removed during normal backwashing.

REGAINING PRIME If the pressure does not rise within 1 minute, shut the pump off and force water into the system through the skimmer by placing a garden hose into the hole at the bottom of the skimmer which is farthest from the pool and restarting the pump. The water from the garden hose should be enough to flood the pump and restart the system. Be sure to open the manual air relief valve after the pump has regained its prime to release the excess air from the filter.

VALVES

As mentioned earlier, each swimming pool has a different arrangement of the equipment. Because of this, each one also has a differ-

ent number of valves, and their locations vary from pool to pool. Paramount recommends you label each valve in order to remember the intended use for that valve. Please refer to the equipment printout on your particular pool for this information. Be aware, however, that the 2-way and 3-way swing valves installed on most pools have the ability to be completely closed and if every valve is in the closed position, an overpressure situation will result, and damage and personal injury may occur. To avoid this, extra care should be taken to ensure that at least one valve on the pipes leading from the filter to the pool (on the pressure or return side) must be open at all times to give the water a place to go. Never close all valves while the system is in operation. All 2- and 3-way valves and round gate valves can be moved while the pump is operating.

BRUSHING THE POOL

Even though most modern swimming pools are equipped with an automatic cleaning system, there is no substitute for a thorough brushing of the walls and bottom of the pool. Most automatic cleaners can't scrub the floor to remove small debris and algae spores from the pores in the pool surface, and this must be done to ensure a stain and algae free pool surface. It is recommended that the pool be brushed with a standard 18-inch nylon bristle pool brush (found at any Pool retail showroom) at least twice per week. The entire process usually only takes 10 minutes and is well worth the time and effort. Be sure to brush the pool while the pump is operating, and to cover the entire pool from the tile line to the main drain. Sweep slowly and push the brush toward the main drain so that the debris will be pulled into the drain and then into the filter, where it will be removed from the water. If large amounts of debris were removed during this process, it is advisable to clean the filter afterward.

VACUUMING THE POOL

If the amount of debris in the pool is too great to be removed by either the automatic cleaning system or by brushing, the pool should be vacuumed to remove the debris before it becomes attached to the pool surface and requires special methods to remove. A manual vacuum system is available at any Pool retail showroom that will operate in any swimming pool. It consists of three major components: a vacuum head, a flexible vacuum hose, and a long telescopic pole. The pole that is used for brushing can also be used for vacuuming as both the brush and the vacuum head are connected to the pole with a quick disconnect attachment. The process of vacuuming the pool manually can be accomplished by following these steps.

First, make sure that the pump is operating and that the filter has recently been cleaned. In fact, it is recommended that the filter be cleaned immediately before and after vacuuming the pool. Attach the vacuum head to the telescopic pole, and attach either end of the vacuum hose to the top of the vacuum head. Keeping the opposite end of the hose and the pole accessible, lower the vacuum head into the pool. Before the vacuum hose can be attached to the suction line in the skimmer, it must be filled with water to prevent a large amount of air entering the pump and causing a loss of prime. This can be accomplished by either placing the free end of the vacuum hose over one of the main return lines, allowing water to flow into the hose and push out the air, or by inserting a garden hose into the vacuum hose and using the water from the garden hose to push air out of the vacuum hose.

As the hose is filling with water, the vacuum head should be lifted from the bottom of the pool about 1 foot to assist in the escape of

the trapped air. Once the bubbles have stopped flowing from the vacuum head, bring the free end of the vacuum hose to the skimmer, keeping the end of the hose beneath the water at all times so that no more air is allowed to enter the hose. Remove the lid from the skimmer, and also remove the skimmer basket and float valve. Cover the free end of the vacuum hose with the palm of your hand and quickly lift the hose over the pool deck and into the skimmer through the opening at the top. Once the end of the hose is underwater, remove your hand and insert the hose into the suction hole in the bottom of the skimmer (the hole farthest from the pool)(If you have a Paramount In-Floor system with a booster pump make sure the booster pump is off or the vacuumed debris will be returned to the pool via the floor returns). The suction will hold the hose into the hole and will form a good seal. If the hole is too large for the hose to seal properly, an adapter is available at any Pool retail showroom. Once the connection has been made, slowly move the vacuum over the pool surface in a similar fashion as brushing, except with vacuuming, it is not necessary to push the vacuum toward the main drain. It is necessary to vacuum the entire pool, from the tile line to the drain, but care should be taken to keep the vacuum head underwater at all times to prevent air from entering the system.

When the pool has been sufficiently cleaned, pull the vacuum hose out of the suction hole in the skimmer and wash the hose and head with fresh water to remove chemicals that could decrease the life of the equipment, and store them in a shaded area. Once again, it is recommended that the filter be cleaned immediately after vacuuming to remove the excess debris and increase the efficiency of the filter system. Replace the float valve, skimmer basket, and skimmer cover.

SKIMMING THE POOL

While vacuuming and brushing remove dirt and debris from the bottom of the pool, they do not remove the debris such as grass, leaves, and bugs which float on the water surface. The skimmer built into the pool deck usually removes this debris, but it can accumulate in large amounts and it may take the built-in skimmer an appreciable time to remove it. By using a hand skimmer, the debris can be quickly removed before it has the opportunity to become saturated with water and sink to the bottom. While there are no specific guidelines as to when the pool should be manually skimmed, it is recommended that it be done either before or after brushing. A manual skimmer can be used in conjunction with the same telescopic pole used for brushing and vacuuming, and can be found at any Pool retail showroom.

ATTACHED SPA

In the case where a spa is attached to the swimming pool and the water is allowed to overflow into the pool, both the pool and the spa share the same filter and pump systems, and they are connected to each other within the piping network. The spa will contain its own main drain, and may also have its own skimmer. In this case, the skimmer and main drain operate exactly the same as in the swimming pool, and the suction line in the skimmer meets that of the pool immediately adjacent to the hair and lint trap attached to the pump. A 3-way swing valve will be present at this junction to regulate the flow between the spa and the pool suction lines. For normal operation, the pool suction line should be considerably more open than that of the spa to ensure that the spa does not drain.

Since the volume of water in the spa is small compared to that of the pool, very little suction is needed for proper circulation of the spa. If a

separate skimmer is present for the spa, and the skimmer contains a float valve, set the flap in the same position as that in the pool skimmer, and adjust the 3-way valve near the pump so that the vast majority of the water is coming from the pool skimmer (i.e. adjust the 3-way valve so that the spa suction line is almost closed). On the pressure side of the system, there will be separate valves present to direct water flow to the therapy jets in the spa. To operate the therapy jets, simply open the swing valve that is labeled "therapy jets" and if needed for more flow, partially close the valve labeled "return". This will direct more water into the spa's therapy jets and less into the pool's main returns. Be aware that the water in the spa will overflow into the pool, and if the spa is heated, some heat may be lost to the pool.