

INSTALLATION & OPERATION MANUAL

resilience[®]
E Series



PREFACE

Welcome to the Resilience family! You are now the proud owner of *Resilience E* - the very first "all in one" salt system. Resilience E's unique design simplifies its installation and maintenance leaving you more time to enjoy your pool rather than maintain it.

This unique salt system uses a very low concentration of salt (less than the concentration of a human teardrop) and converts it into free chlorine that destroys algae and bacteria in the pool. Once the algae and bacteria are destroyed, the chlorine reverts back into salt. This purification cycle continues eliminating the need to add extra sanitizing chemicals.

Before installation or operation, please take the time to read this entire manual, compare package contents with the parts list, and gather tools required. Improper installation and operation in a manner not specified in this installation manual may void the warranty and create unnecessary hazards. This manual contains step-by-step instructions to help ensure that your installation meets the recommended standards. Spending the time to understand your system and its functions will assure successful, trouble-free operation. If you are unsure about any of the information in this manual, please contact your installer/dealer. When working around your pool, please take care to avoid hazards such as electrical wires and chemicals.

CAUTION! Safety comes first!

IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS

All electrical work must be performed by a licensed electrician and conform to all national, state, and local codes. Improper use or installation can badly harm the unit and its surroundings. When installing and using electrical equipment, basic safety precautions should always be followed, including the following:

- **DANGER** Disconnect all AC power before installation.
- Device can be connected / disconnected to / from power supply by plug or circuit breaker.
- **WARNING** – to reduce the risk of injury, do not permit children to use this product, unless they are closely supervised at all times.
- The unit must be mounted at a minimum horizontal distance of 5 ft (1.5m) (or more, if local codes require so) from the inside walls of the swimming pool.
- **WARNING – risk of electric shock!** Connect only to a grounding type circuit protected by a ground-fault circuit-interrupter (GFCI) outlet. The installer should provide this GFCI requirement. The GFCI should be rated for minimum 6 Amps and tested on a regular basis by pushing the test button. If the GFCI fails to operate correctly, there is ground current flowing indicating the possibility of electric shock. Do not use this unit. Disconnect unit and have a qualified professional fix the problem before operating again.
- A wire connector is provided to this unit to connect a minimum No. 8 AWG (8.4mm²) solid copper conductor between this unit and any metal equipment, metal enclosures of electrical equipment, metal water pipe, or conduit within 5 feet (1.5 m) of the unit.
- **DANGER - Risk of electric shock!** Install at least 5 feet (1.5 m) from all metal surfaces. As an alternative, this unit may be installed within 5 feet of metal surfaces, if each metal surface is permanently connected by a minimum No. 8 AWG (8.4mm²) solid copper conductor to the wire connector on the terminal box that is provided for this purpose.
- **WARNING!** To reduce the risk of electric shock, DO NOT turn on or operate the unit if the cell housing is damaged or improperly assembled!
- **WARNING!** To reduce the risk of electric shock, replace a damaged cord immediately. **WARNING - RISK OF ELECTRIC SHOCK!**
- **WARNING!** To reduce the risk of electric shock, do not use an extension cord to connect the unit to electric power supply; provide a properly located outlet. Do not bury cord!
- Wiring of the unit must be performed according to the wiring instructions detailed in this manual.
- Ensure that equipment and materials used in or around the pool and spa are compatible with salt-based sanitation systems. Certain materials may be susceptible to salt and chlorine damage.
- If acid is stored in the machine room, make sure it is properly vented to avoid damage from acid vapors.

- Under no circumstances should the machine room be used to store equipment, furniture, sports gear or any other apparatus that is not related to the pool including spare acid containers. The machine room must be aired and vented prior to working in it.
- Device is suitable for IP66 environment conditions.
- Device is suitable for voltage range of 100-240Vac, 50-60Hzm current rating 4A.
- Device should be installed at maximum operating temperature of 40°C, Pollution Degree 2, Installation Category 2, Altitude up to 2000m, Indoor/Outdoor, Wet locations
- **SAVE THESE INSTRUCTIONS.**

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PACKAGE CONTENTS

Please unpack your new salt system carefully. Do not use a knife or sharp instrument to remove contents. Enclosed in the box you should find the following:

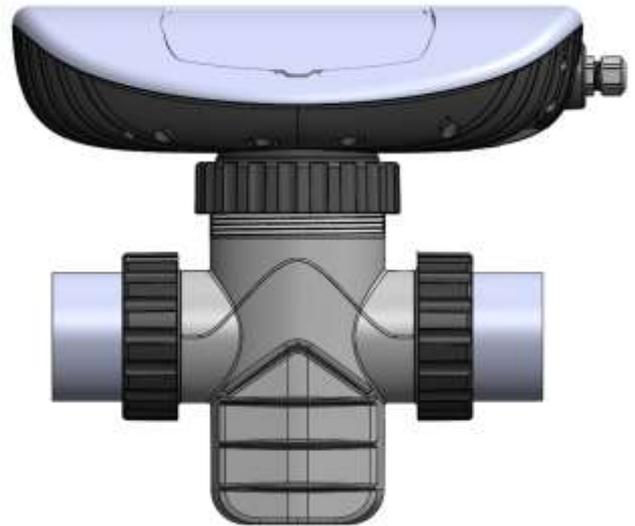
- Resilience E salt system preassembled
- Installation manual
- Warranty card
- Pipe cutting template
- 2 sets piping adaptor (63mm to 50mm)



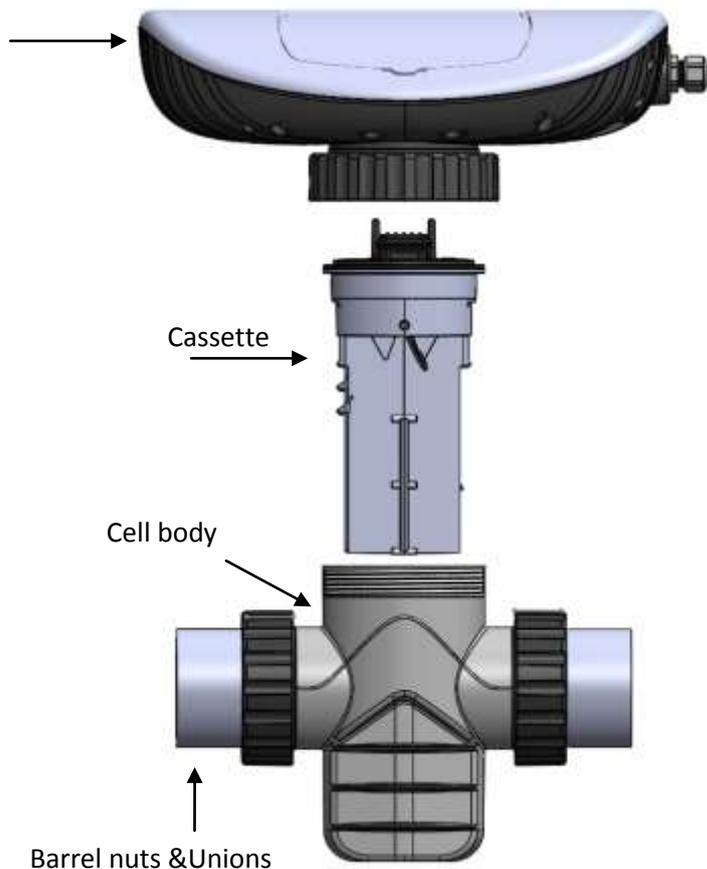
2 pipe adaptors
(63mm to 50mm)



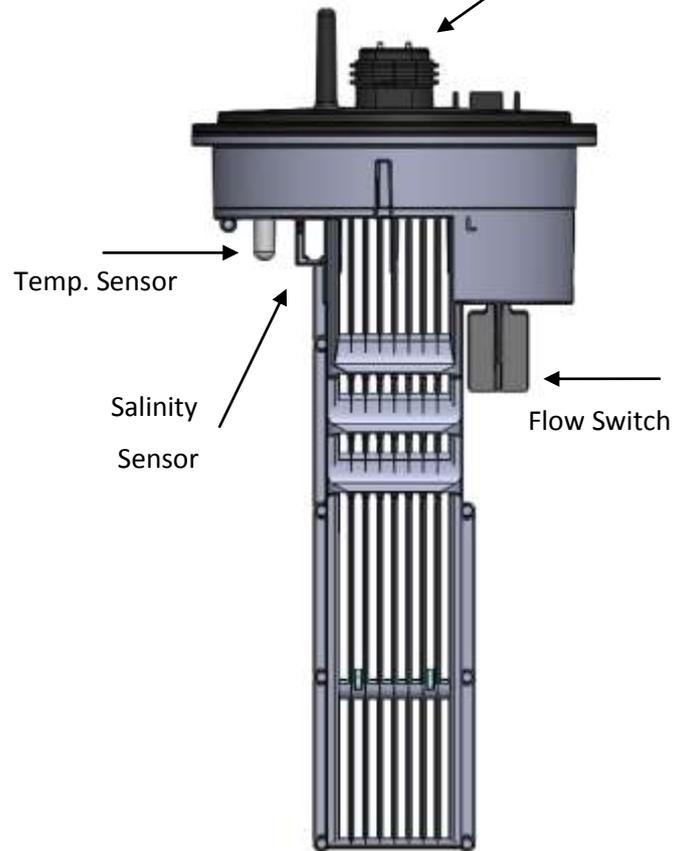
Pipe cutting template



Control box



Electrical cell connector



ADDITIONAL MATERIALS REQUIRED (NOT SUPPLIED IN PACKAGE)

Essential equipment:

- PVC solvent cement and priming fluid
- Hacksaw or pipe cutters and petroleum jelly
- Screwdrivers
- Permanent marker

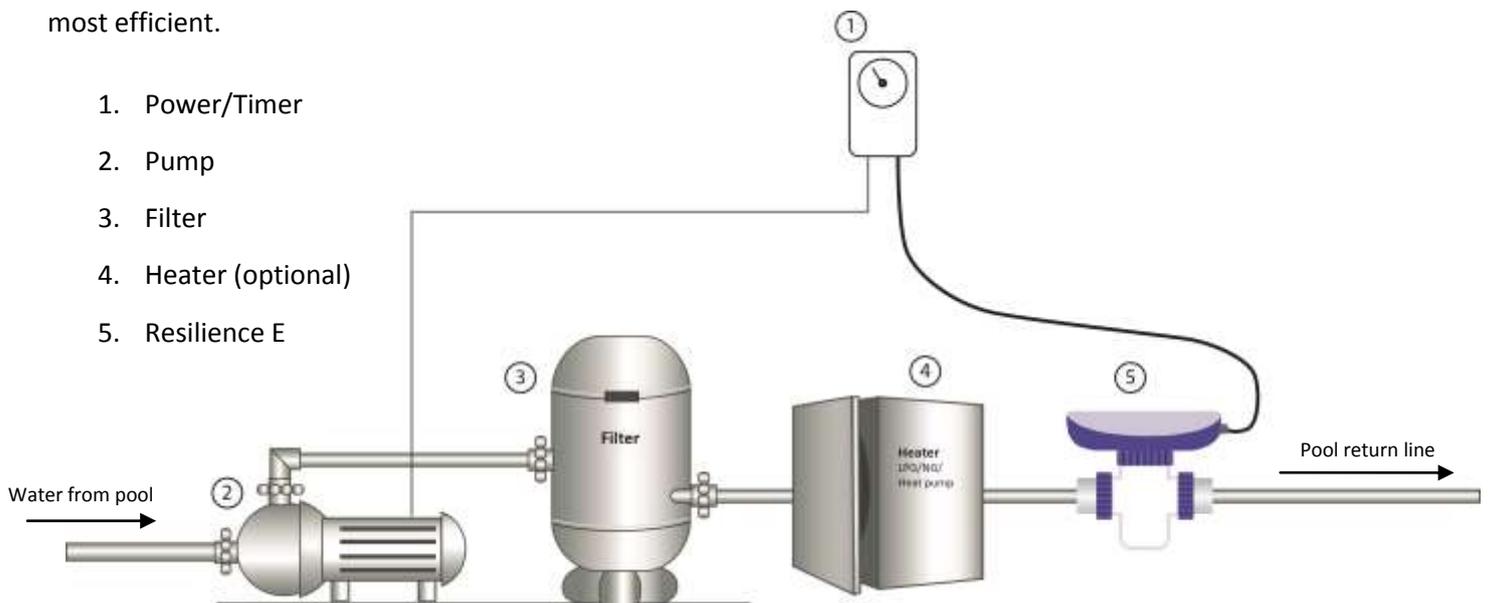
Optional equipment:

- Pipe adaptors (i.e. reducer couplings)

SYSTEM OVERVIEW

This installation manual is designed for the pool professional. It assumes the installer has a working knowledge of basic pool-service operations. It is based on actual field installations and the natural flow of progress found to be most efficient.

1. Power/Timer
2. Pump
3. Filter
4. Heater (optional)
5. Resilience E



SYSTEM INSTALLATION

Resilience E consists of 1 assembly that incorporates all of the following: Control box, Transparent cell containing a cassette. In the cassette are installed: Flow Sensor and temperature sensor. This unit is manufactured using the most advanced corrosion resistant materials that are available in the market. Installing them in an area that is sheltered from the sun and water will protect them from extreme weather conditions.

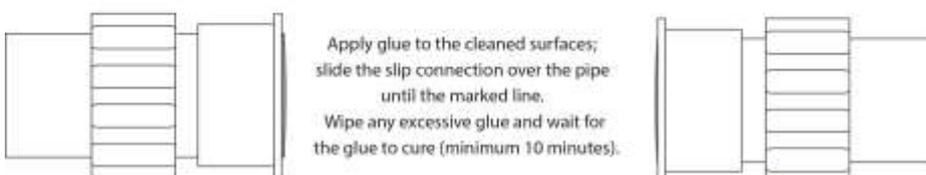
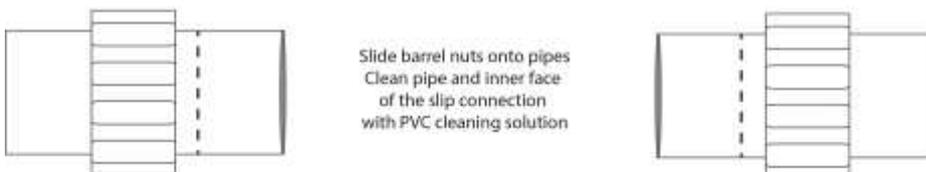
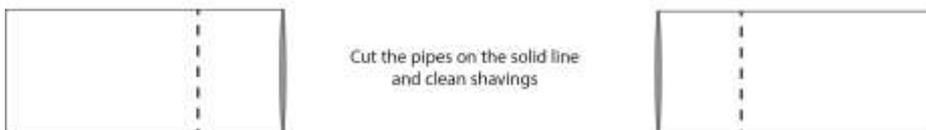
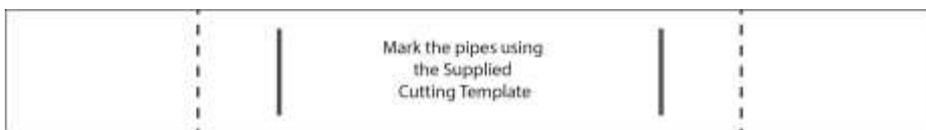
***Resilience E* MUST be installed downstream from the filter and heating devices (if installed) before any Tees in the return line.**

The unit can be installed with or against the direction of water flow, there is no significance to the direction of the unit only its position on the pipeline.

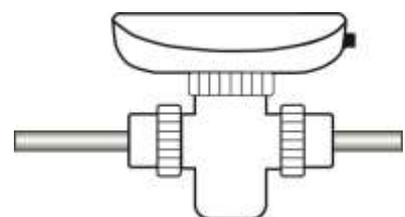
Make sure to install the system in such a place that will allow easy access to dismantle if needed.

CONNECTING TO PLUMBING

1. 30 cm of straight pipe length are required for the installation.
2. Using the cutting template supplied with the unit, mark the required distance of 19.5 cm on the pipe.
3. Cut the pipe using a hacksaw or pipe cutter and slip the barrel nuts onto the pipe. **Make sure the cut is parallel and straight!**
4. Clean pipe and inner face of slip connections with a PVC cleaning solution.
5. Apply glue to the cleaned surfaces; Slide the slip connections over the pipe.
6. Wipe any excess glue and wait for the glue to cure (minimum 10 minutes).
7. Place the system with the O-rings into the opening between the two ends of the pipe and tighten the unions.



This is what the unit should look like when installed on the pipe



CAUTION - Do not block the vents of the unit, located on the rear of the casing.

ELECTRICAL WIRING OF THE POWER SUPPLY



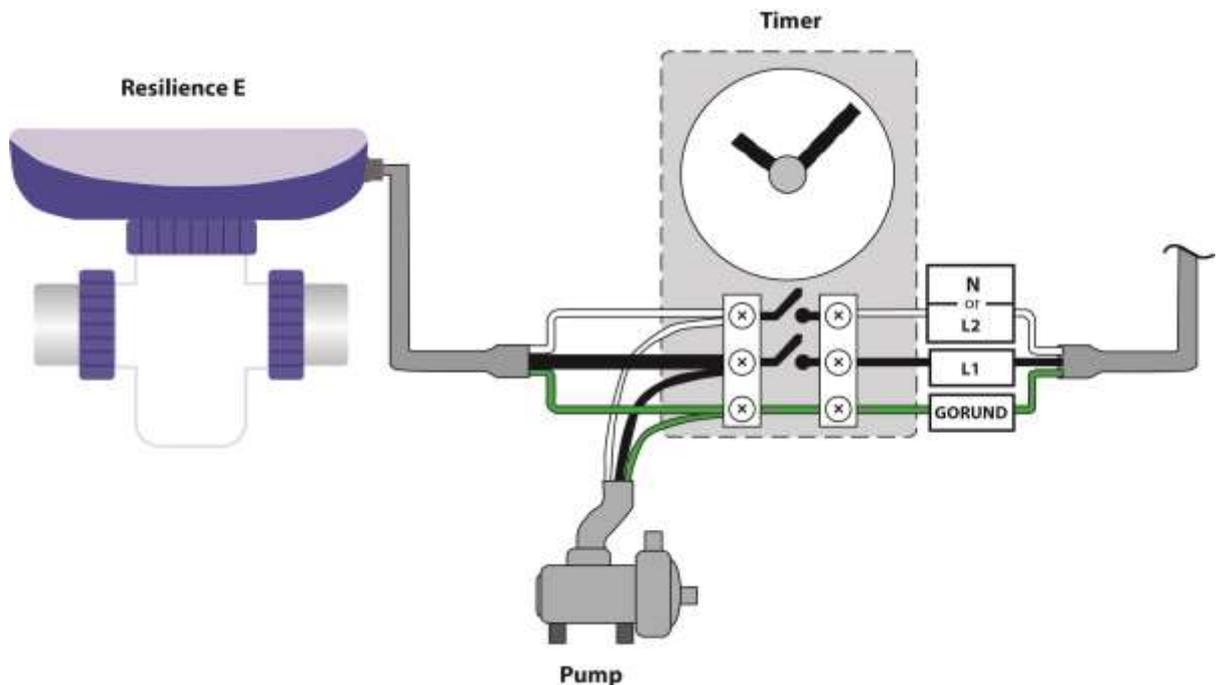
CAUTION! Disconnect the power supply to the main timer/main power source before hardwiring the input voltage cables to the timer and unit.

It is critical to wire the salt system in such a way that it can only operate when the circulating pump is operating (i.e. load side). See instructions below for details.

Plug the unit into a ground fault circuit interrupter (GFCI) safety outlet or an outlet protected by a ground fault circuit breaker (GFCB). Follow Local and National codes. The outlet must be wired parallel to the pump so both the unit and pump are working simultaneously.

Warning! All electrical work must be performed by a licensed electrician and conform to all national, state, and local codes. Improper use or installation can badly harm the unit and its surroundings. When installing and using electrical equipment, basic safety precautions should always be followed!

110V / 240V Wiring



STARTING UP

BEFORE ADDING THE SALT

1. **Balance the chemicals:** See the section titled "Understanding the chemistry" on page 20 for recommended water balance. Remove metals from the water using a phosphate-free metal remover and test the water to ensure that phosphate levels are lower than 100 ppb (parts per billion). This will ensure that the transition to the natural chlorine generator system is quick and reliable.
2. **New Pools:** wait 30 days or longer if specified by your pool builder, for plaster to cure before adding salt or operating the natural chlorine generator.
3. **Biguanide Pools:** if installing the system in a pool that has Biguanide sanitizers, all Biguanide must be removed prior to system startup.

ADDING THE SALT

1. Measure the pre-existing salinity of your pool. Previous chlorine use may cause the salinity reading to be higher due to residual salt in the chlorine.
2. Determine how much salt is needed from the Salinity Demand Table on the page 11. This table is based on a salt concentration of 3500 ppm (approximately $\frac{1}{3}$ %). More may be added for larger pools (e.g. 4000 ppm).
3. Keep the circulating pump on.
4. **Distribute the determined amount of salt evenly around the pool. To avoid clogging the filter or damaging the control box and pump, do not add salt through the skimmer or surge tank.** Brush the bottom to help dissolve the salt.
5. The readout on the chlorine generator may fluctuate until the salt is fully dissolved.
6. Turn the control box OFF.
7. Keep the pump on to circulate the water.
8. Distribute the required amount of salt evenly around the pool. It will take about 8 hours for the salt to disperse evenly in the water.
9. Once the salt has fully dissolved, adjust the chlorinator to the desired setting.

Calculating the size of the pool

| | Liters (dimensions in meters) | Gallons (dimensions in feet) |
|-------------|---|---|
| Rectangular | Length X Width X Average Depth X 1000 | Length X Width X Average Depth X 7.5 |
| Round | Diameter X Diameter X Average Depth X 785 | Diameter X Diameter X Average Depth X 5.9 |
| Oval | Length X Width X Average Depth X 893 | Length X Width x Average Depth X 6.7 |

What type of salt should I use?

| Good | Bad – do not use! |
|--|---|
| The best salt is an evaporated, granulated pool salt | Iodized salt |
| 99.9% pure salt | Salts with more than 1% anti caking agents (e.g. yellow prussiate of soda or sodium ferrocyanide) – because they contain iron and will yellow the fittings. These anti caking agents are commonly found in water softener salts |
| | Rock salt – because of the dirt mixed with the rock salt |
| | Calcium chloride- is not a salt. Use only sodium chloride |

Salinity demand table (in kg.)

Salt level before addition (in ppm)

| | | | | | | | | |
|---|-----|------|------|------|------|------|------|------|
| 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4500 |
|---|-----|------|------|------|------|------|------|------|

How much salt to add? (In kg.)

| | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| Your pool water volume – in thousands of liters | 10 | 40 | 35 | 30 | 25 | 20 | 15 | 10 | 5 | 0 |
| | 20 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 | 0 |
| | 30 | 120 | 105 | 90 | 75 | 60 | 45 | 30 | 15 | 0 |
| | 40 | 160 | 140 | 120 | 100 | 80 | 60 | 40 | 20 | 0 |
| | 50 | 200 | 175 | 150 | 125 | 100 | 75 | 50 | 25 | 0 |
| | 60 | 240 | 210 | 180 | 150 | 120 | 90 | 60 | 30 | 0 |
| | 70 | 280 | 245 | 210 | 175 | 140 | 105 | 70 | 35 | 0 |
| | 80 | 320 | 280 | 240 | 200 | 160 | 120 | 80 | 40 | 0 |
| | 90 | 360 | 315 | 270 | 225 | 180 | 135 | 90 | 45 | 0 |
| | 100 | 400 | 350 | 300 | 250 | 200 | 150 | 100 | 50 | 0 |
| | 110 | 440 | 385 | 330 | 275 | 220 | 165 | 110 | 55 | 0 |
| | 120 | 480 | 420 | 360 | 300 | 240 | 180 | 120 | 60 | 0 |
| | 130 | 520 | 455 | 390 | 325 | 260 | 195 | 130 | 65 | 0 |
| | 140 | 560 | 490 | 420 | 350 | 280 | 210 | 140 | 70 | 0 |
| | 150 | 600 | 525 | 450 | 375 | 300 | 225 | 150 | 75 | 0 |
| | 160 | 640 | 560 | 480 | 400 | 320 | 240 | 160 | 80 | 0 |
| | 170 | 680 | 595 | 510 | 425 | 340 | 255 | 170 | 85 | 0 |
| | 180 | 720 | 630 | 540 | 450 | 360 | 270 | 190 | 95 | 0 |
| | 190 | 760 | 665 | 570 | 475 | 380 | 285 | 190 | 95 | 0 |
| | 200 | 800 | 700 | 600 | 500 | 400 | 300 | 200 | 100 | 0 |

Identify the current salt concentration at the top of the chart (e.g 1000 ppm). Then find the size of your pool on the left (e.g. 100,000 liters). Run these figures down and across until they meet. That is the amount of Kilograms of salt that needs to be added to your pool.

Salinity demand table (in lbs.)

Current Salt concentration in pool (before addition) [ppm]

How much salt to add (pounds)

| 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4500 |
|---|-----|------|------|------|------|------|------|------|
|---|-----|------|------|------|------|------|------|------|

| | | | | | | | | | | |
|--------------------------------------|------|------|------|-----|-----|-----|-----|-----|----|----|
| Water volume in thousands of Gallons | 4 | 117 | 100 | 83 | 67 | 50 | 33 | 17 | 0 | OK |
| | 6 | 175 | 150 | 125 | 100 | 75 | 50 | 25 | 0 | OK |
| | 8 | 234 | 200 | 167 | 133 | 100 | 67 | 33 | 0 | OK |
| | 10 | 292 | 250 | 209 | 167 | 125 | 83 | 42 | 0 | OK |
| | 12 | 350 | 300 | 250 | 200 | 150 | 100 | 50 | 0 | OK |
| | 14 | 409 | 350 | 292 | 234 | 175 | 117 | 58 | 0 | OK |
| | 16 | 467 | 400 | 334 | 267 | 200 | 133 | 67 | 0 | OK |
| | 18 | 525 | 450 | 375 | 300 | 225 | 150 | 75 | 0 | OK |
| | 20 | 584 | 500 | 417 | 334 | 250 | 167 | 83 | 0 | OK |
| | 22 | 642 | 550 | 459 | 367 | 275 | 183 | 92 | 0 | OK |
| | 24 | 701 | 600 | 500 | 400 | 300 | 200 | 100 | 0 | OK |
| | 26 | 759 | 651 | 542 | 434 | 325 | 217 | 108 | 0 | OK |
| | 28 | 817 | 701 | 584 | 467 | 350 | 234 | 117 | 0 | OK |
| | 30 | 876 | 751 | 626 | 500 | 375 | 250 | 125 | 0 | OK |
| | 32 | 934 | 801 | 667 | 534 | 400 | 267 | 133 | 0 | OK |
| | 34 | 992 | 851 | 709 | 567 | 425 | 284 | 142 | 0 | OK |
| | 36 | 1051 | 901 | 751 | 600 | 450 | 300 | 150 | 0 | OK |
| | 38 | 1109 | 951 | 792 | 634 | 475 | 317 | 158 | 0 | OK |
| | 40 | 1168 | 1001 | 834 | 667 | 500 | 334 | 167 | 0 | OK |
| | 42 | 1226 | 1051 | 876 | 701 | 525 | 350 | 175 | 0 | OK |
| 44 | 1284 | 1101 | 917 | 734 | 550 | 367 | 183 | 0 | OK | |
| 46 | 1343 | 1151 | 959 | 767 | 575 | 384 | 192 | 0 | OK | |
| 48 | 1401 | 1201 | 1001 | 801 | 600 | 400 | 200 | 0 | OK | |
| 50 | 1460 | 1251 | 1043 | 834 | 626 | 417 | 209 | 0 | OK | |

Locate the current salt concentration at the top of the chart (e.g. 1000 ppm). Then locate the size of your pool on the left (e.g. 12 thousand gallons).

Run these figures down and across until they meet. That number is the number of lbs. of salt required for your pool.

OPERATING INSTRUCTIONS

FILTRATION

Proper filtration is critical for maintaining clean and healthy water. It is typically required in the pool industry that all the water of the pool pass through the filter at least one and a half (1½) times per day (at least eight hours in most pools). During very heavy use, the filter run time should be increased. If needed, the filter circulation pump and chlorine generator may run continuously.

 **Note: inadequate filtration reduces water clarity and causes the generator to work harder.**

Related chemistry

Other chemical levels must be monitored and adjusted because they can greatly reduce the effectiveness of the chlorine produced by the system. If you use a good quality pool test kit and follow the simple instructions outlined in this manual, your natural chlorine generator will help you maintain a sparkling-clean, trouble-free pool for many years with minimal effort. See the section titles "Understanding the chemistry", page 19 for more information.

BASIC OPERATION

Resilience E produces a pure form of chlorine to sanitize and oxidize your pool water. The Chlorine residual needs to be maintained at 1-3 ppm. The water may be tested using a standard kit or by your local pool store. To obtain the optimal residual buildup of chlorine, the best time to run your filter is in the early morning or after 4:00 PM when there is less UV to destroy the chlorine produced, leaving chlorine in the pool to oxidize the unwanted foreign matter.

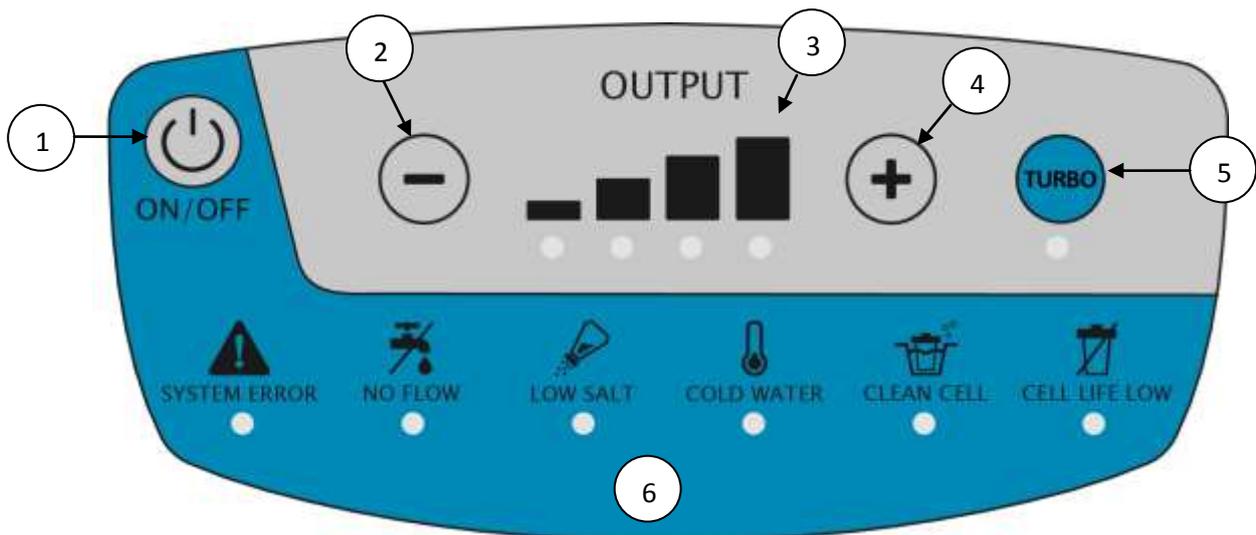
Modes:

ON – the unit is ON (verify the circulation pump is operating) – the unit is fully operational and produces chlorine.

OFF – the unit is OFF by manual shut down of the controller using the  button. All system functions are off.

 **WARNING:** the unit still receives power from the line.

CONTROLS



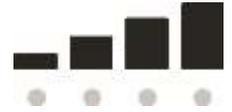
- 1 **ON/OFF button** - turns the unit ON or OFF.
- 2 **Decrease chlorine production** - press the  button to decrease chlorine production level.
- 3 **Chlorine output levels** - Indicated the system's chlorine output (i.e. 25%, 50%, 75% & 100% production rate).
- 4 **Increase chlorine production** - press the  button to increase chlorine production level.
- 5 **Turbo** - Enables the system to operate at full power for 24 hours.
- 6 **Warning messages** - Attention!! Please respond to each warning message as described on page 17.

INCREASE/DECREASE CHLORINE PRODUCTION

1. Press the  button until the required output level LED is blinking.

NOTE: The amount of chlorine production will increase/decrease gradually.

Production level is marked with a solid lit LED. Required level is marked with a blinking LED.



2. Press the  button until the required output level LED is blinking.



Note: Factors such as sunlight, bather load, debris, and chemical imbalance as well as water temperature increase chlorine demand.

TURBO MODE

Press the  button to automatically run the system at full power for 24 hours super chlorination. Once pressed, Turbo LED illuminates and the chlorine output will increase to 100%. After 24 hours of actual runtime (or pressing the  button again), the system will automatically revert back to the chlorine output it was previously set on. This feature is handy for temporarily increasing the sanitation level in the pool before and/or after a pool party, heavy rains etc'

WINTER / COLD WATER MODE

To protect the electrodes, the unit is programmed to automatically decrease chlorine production when it senses low temperatures.

In case of low water temperature below 18°C (64°F) the unit reduces its chlorine production to 50%. The LED below the 50% bar will be lit. The LED below the bar of the required level will be blink. "Cold Water" warning LED is illuminated.

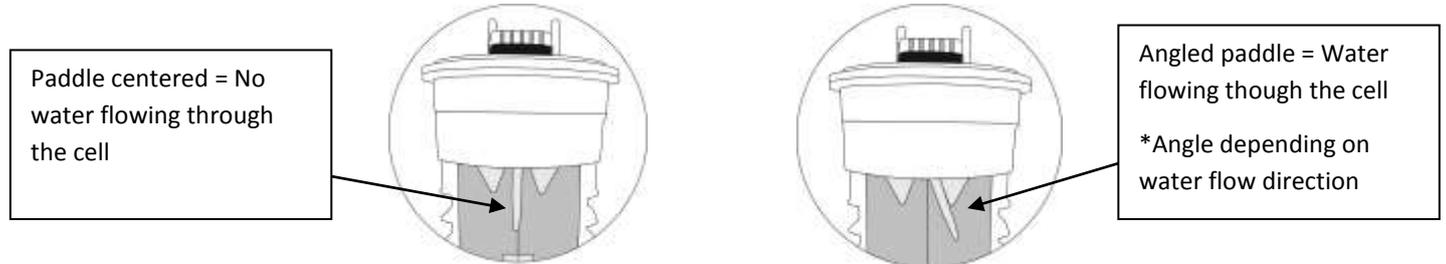
When water temperatures reach below 14°C (59°F) the unit reduces chlorine production to 25%. The LED below the 25% bar will be lit. The LED below the required level bar will be blinking. "Cold Water" warning LED is illuminated.

WARNING MESSAGES

"NO FLOW"



The "faucet" LED is illuminated. Verify that you have proper water flow without air bubbles in the cell pipeline. Verify that the flow sensor paddle is at an angle; hence, water is flowing through the cell. In case you have a variable speed pump installed, increase the flow until the LED is turned off.



"LOW SALT"



Salt may be needed to be added to the pool. First visually inspect the cell for lime-scale, as lime-scale build up on the blades may affect the low salinity readings. Clean blades if necessary (see instructions on page 18).

If cleaning does not solve the problem, manually check the salinity of the pool water with a stick. If needed, add salt according to the table on page 12.

"COLD WATER"



This warning indicates water temperatures are below 18°C (64°F). Unit reduces chlorine production to 50% or 25% in case the temperature further decreases below 14°C (59°F). No further action is necessary.

"CLEAN CELL"



This warning indicates that the Cell requires cleaning. Refer to page 18 of this manual to see how to clean the cassette.

"CELL LIFE LOW"



This LED is lit when cassette has reached the end of its expected life. It is time to purchase a replacement cassette for the unit.

"SYSTEM ERROR"



This LED is illuminated when the system is no able to produce chlorine. Please refer to the "Troubleshooting" chapter on page 23 of this manual to diagnose and solve the problem.

MAINTENANCE

Maintaining your *Resilience E* maximizes the performance and life of the unit and requires minimal work.



Pool water should be tested weekly, but MUST be tested at least once a month.

CELL MAINTENANCE

The clear cell body allows easy, regular inspection for lime-scale and calcium build up. Visually check the cell periodically, and clean it as necessary. Advanced self-cleaning technologies, including reverse polarization help the cell stay cleaner but bi-annual cleanings are required.

Cell cleaning



CAUTION – do not use metal or other hard objects to clean the cell.



DO NOT insert anything into the cell.

Both actions detailed above may scratch the precious coating on the plates and void the warranty.



Make sure the electrical connection on top of the cassette does not come in direct contact with water and/or acid!



Always add acid to water NOT water to acid.



Diluted muriatic acid solution = 1 part acid to 10 parts water.



Follow the instructions of the acid manufacturer.



1. Turn the unit OFF and disconnect it from all electric sources.
2. Close the valves before and after the unit
3. Allow water to drain from the unit by opening on of the side barrel unions.
4. Disconnect the control box from the cell body by unscrewing the large barrel nut located under the control box. Place the control box in a dry, safe place away from any water source.
5. Remove the cap, connected to the top part of the cassette and plug it on top of the electrical connection. Make sure it is tight.
6. Remove the cassette from the cell body. **Make sure the electrical connection on top of the cassette does not come in direct contact with water and acid!**
7. Once removed, look inside the cassette and inspect for lime-scale formations (light colored crusty or flaky deposits) on the plates and for any debris which has passed through the filter and caught on the plates. If no deposits are visible, reinstall. If deposits are visible, please complete the cell cleaning operation.

8. Remove the O'ring from the cassette
9. Mix undiluted white distilled vinegar, or a solution of diluted muriatic acid (one part muriatic acid to 10 parts water) in a clean plastic container. **ALWAYS ADD ACID TO WATER - NEVER ADD WATER TO ACID!**
10. Place the cassette in the container **make sure the electrical connection on top of the cassette do not come in direct contact with water and acid!**
11. Wait for foaming to stop (5-10 minutes when using muriatic acid; vinegar takes longer).
12. Safely dispose of the acid solution or vinegar by pouring it into your pool.
13. Carefully wash the cassette in tap or pool water and return the cassette's O'ring to its place.
14. Insert the cassette into the cell body. Notice that it can only fit in a particular direction so be gentle and flip the other way if necessary.
15. Remove the cap from the electrical connection and plug it back into the head of the cassette.
16. Place the control box back over the cell and tighten the barrel nut firmly.
17. Turn the unit ON
18. Make sure there are no leaks from the unit once it has restarted

WINTERIZING

Just like the pool plumbing, freezing may damage the unit. If severe or extended periods of freezing temperatures may occur, drain all water from the pump, filter, cell, supply and return lines before temperatures drop.

SPRING STARTUP

DO NOT turn on the system until the pools' water chemistry has been brought to the required levels.

UNDERSTANDING THE CHEMISTRY

The table shows the recommended balance levels followed by a more detailed explanation of the factors affecting the water chemistry. Maintaining these levels ensures maximum enjoyment of the pool. You should test your water periodically. If the water chemistry needs adjustment, your authorized dealer or most pool stores can supply you with the appropriate chemicals and procedures. We recommend either taking a copy of the Water Balance Table to the pool store, or notifying the pool store that you are using Magen eco-Energy's natural salt chlorine generator.

| Factors | Ideal levels |
|--|--|
| Salt | 3000 – 4500 ppm |
| Free Chlorine | 1 – 3 ppm |
| pH | 7.0 – 7.8 |
| Total alkalinity | 80 – 120 ppm (depending on the saturation index) |
| Stabilizer (a.k.a Cyanuric acid or conditioner) | 20-70 ppm |
| Phosphates | 0-100 ppb |
| Nitrates | 0 ppm |
| Metals | 0 ppm |
| Calcium Hardness | Determined by the pool you own (individual for each pool) |
| Total dissolved solids (TDS) | < 1200 |
| Saturation index | -0.3 to 0.3 (0 is ideal) |

Salt is the source of the Natural Chlorine. The ideal salt level to ensure maximum benefits using our system is 3500 ppm (parts per million). A lower concentration of salt may hinder the generator effectiveness. A concentration of salt above 5500 ppm may cause corrosion damage to the pool fixtures. See the "Adding salt" chapter, on page 11 for more information.

Free Chlorine vs. Combined Chlorine: The unpleasant smells and side effects often associated with chlorine are actually caused by combined chlorine (e.g. chloramines). Combined chlorine is a chlorine molecule that attacks a noxious particle in the water but is unable to destroy it. This chlorine particle remains attached to the noxious particle until one of the two is burned off; hence the term Combined Chlorine (a.k.a chloramines). To burn off the noxious particle and free up the chlorine again, pool owners have to periodically shock (with chlorine) the pool. In the natural chlorine generator the noxious particle is burned off within the generator cell and the combined chlorine is continuously converted back to free chlorine.

The free chlorine level in the pool should be maintained at 1 to 3 ppm. This level of free chlorine is comfortable to swim in with no unpleasant smells, and maintains proper sanitizing.

pH is a measure of the acidic or basic solution. A scale of 0 to 14 is used to measure pH. Pure water has a pH of seven (neutral), acid solution have a pH of less than seven, and basic (alkali) solutions have a pH of more than seven. The

recommended range is 7.2 to 7.6; chlorine is much more effective within this range and the water is most comfortable for bathers. **pH levels above 7.8 drastically reduce the effectiveness of the chlorine.**

To lower the pH, add muriatic acid or dry acid. Be sure to read and follow the respective manufacturer's instructions.

Total Alkalinity mitigates changes in pH. It is often referred to as the "big brother of pH". Keeping proper levels of total alkalinity helps reduce unwanted fluctuations in pH levels. Total alkalinity is also used to offset high or low levels of calcium hardness (see "saturation index" on page 22).

Add muriatic acid or dry acid to lower the total alkalinity and sodium bicarbonate to raise the total alkalinity. Be sure to read and follow the respective manufacturers' instructions.

Stabilizers (Cyanuric Acid or Conditioner) is necessary in most outdoor pools to maintain appropriate levels of chlorine. Chlorine stabilizer helps provide an appropriate residual chlorine level in the water. Without stabilizer, UV radiation from the sun will destroy most chlorine within 2 hours, but excessive amounts of stabilizer can decrease the effectiveness of chlorine. Chlorine stabilizers should be maintained at 60 ppm to offset the harmful effect of the sun while maintaining the effectiveness of the chlorine. Where pH/ORP automatic sensors are used, 40 ppm of stabilizer suffices.

Phosphates and Nitrates set very high demands on chlorine, most nitrates and phosphates often bring the chlorine level down to zero (0). You can have your water tested for nitrates and phosphates by a local professional. **Your pool should NOT contain Nitrates or Phosphates.** To reduce Phosphate levels, use a phosphate remover from your local pool professional. To reduce Nitrate levels, the pool must be partially or fully drained. Please check with your local professional prior to draining the pool.

Metals can cause loss of chlorine and can stain your pool. If a water test reveals the presence of metals, refer to your local pool professional for recommended methods of removal. Be sure to use a phosphate-free metal remover to avoid replacing a metal problem with a phosphate problem.

Calcium Hardness, like pH and alkalinity, affects the water tendency to be aggressive or scale forming. Lower levels of calcium hardness improve the chlorine generators' ability to stay clean and provide softer silkier water for the swimmers. Check with your local pool professional for proper calcium levels for your pool surface.

Total Dissolved Solids (TDS) is a measure of many types of dissolved materials, including salt. High effective TDS levels (e.g. 1500 ppm and up) cause cloudy water and significantly increase chlorine demand.

To obtain the effective TDS level in a pool using a salt system, subtract the salt level from the TDS reading (e.g. 5000 TDS – 4000 salt = 1000 effective TDS).

Saturation Index determines whether the pool water is balanced, aggressive, or scale forming by comprehensively taking into account all the relevant factors, including pH level, alkalinity level, calcium hardness, and temperature. These factors should be periodically tested, then included into the worksheet on the following page to verify the proper balance of the pool and make adjustments as necessary.

SATURATION INDEX

Test the water for pH, Alkalinity, Calcium hardness and temperature, and then follow the simple steps detailed below:

1. Write your pool pH level here _____ → pH: _____

2. Find your Alkalinity level in the chart below,

And write the corresponding Alkalinity factor here: _____ → Alkalinity Factor: _____

| | | | | | | | | | |
|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pool Alkalinity [ppm] | 5 | 25 | 50 | 75 | 100 | 150 | 200 | 300 | 400 |
| Factor | 0.7 | 1.4 | 1.7 | 1.9 | 2.0 | 2.2 | 2.3 | 2.5 | 2.6 |

3. Find your Calcium (CaCO₃) level in the chart below,

And write the corresponding Calcium factor here: _____ → Calcium Factor: _____

| | | | | | | | | | |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pool Calcium [ppm] | 5 | 25 | 50 | 75 | 100 | 150 | 200 | 300 | 400 |
| Factor | 0.3 | 1.0 | 1.3 | 1.5 | 1.6 | 1.8 | 1.9 | 2.1 | 2.2 |

4. Find your pool temperature in the chart below,

And write the corresponding temperature

Factor here: _____ → Temperature Factor: _____

| | | | | | | | | | | |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Pool Temp [F°] | 32 | 37 | 46 | 53 | 60 | 66 | 76 | 84 | 94 | 105 |
| Factor | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |

5. Add the results from steps 1 through 4 above and write

The result here: _____ → Total of above: _____

-12.2

6. Subtract 12.2 from step five and write the result

here: _____ → Saturation Index =

- If the saturation index above is between -0.3 and +0.3, the water is well balanced.
- If the index is higher than 0.3, the water will tend to cause scaling or get cloudy. The Alkalinity and pH should be reduced accordingly, but maintained within the recommended levels.
- If the index is less than -0.3, the water will tend to be aggressive towards the pool surface, equipment, and bathers. The Alkalinity and pH should be increased accordingly, but maintained within the recommended levels.

TROUBLESHOOTING

NOTE: Evaluating the possible causes for each problem from top to bottom (first to last) will void extra labor.

| Problem | Possible Causes | What to do |
|--|---|--|
| No power (control box does not turn on) | <ul style="list-style-type: none"> System is turned off | <ul style="list-style-type: none"> Turn the system on |
| | <ul style="list-style-type: none"> Circulation pump is off | <ul style="list-style-type: none"> Unit should be wired in such a way that it operates only when the circulation pump is on, verify that pump is in fact operating |
| | <ul style="list-style-type: none"> Power plug is disconnected | <ul style="list-style-type: none"> Connect the plug into socket |
| | <ul style="list-style-type: none"> Other malfunction in the unit | <ul style="list-style-type: none"> Contact customer support |
| Chlorine level is low | <ul style="list-style-type: none"> No power to the unit / power plug is disconnected | <ul style="list-style-type: none"> See "no power" above |
| | <ul style="list-style-type: none"> Pump operation time is too short | <ul style="list-style-type: none"> Increase pump run time! Make sure pump runs at least eight hours per day (1½ turnovers of all the pool water) |
| | <ul style="list-style-type: none"> Low stabilizer (cyanuric acid) | <ul style="list-style-type: none"> Check water chemistry; stabilizer should be 20-70 ppm. If low, add stabilizer (see "Understanding the Chemistry" chapter, page 20) |
| | <ul style="list-style-type: none"> High phosphate levels | <ul style="list-style-type: none"> Check phosphate levels at your local pool shop and reduce to below 100 ppb |
| | <ul style="list-style-type: none"> Chemical imbalance | <ul style="list-style-type: none"> Check other chemistry and balance chemicals (see "Understanding the Chemistry" chapter, page 20) |
| | <ul style="list-style-type: none"> Other malfunctions in control box | <ul style="list-style-type: none"> Contact customer support |
| Green Pool | <ul style="list-style-type: none"> Chlorine level is low | <ul style="list-style-type: none"> See "chlorine level low" above |
| | <ul style="list-style-type: none"> Chemical imbalance | <ul style="list-style-type: none"> Check other chemistry and balance chemicals (see "Understanding the Chemistry" chapter, page 20) |

| Problem | Possible Causes | What to do |
|--|--|--|
| Chlorine Output level does not reach 100% | <ul style="list-style-type: none"> • Output level set too low | <ul style="list-style-type: none"> • Press the "+" button to set the output level to a higher setting |
| | <ul style="list-style-type: none"> • Low pool water temperature | <ul style="list-style-type: none"> • In case Cold Water LED is on, refer to the Cold Water warning, page 17 |
| | <ul style="list-style-type: none"> • Not enough salt due to heavy rain, initial miscalculation etc' | <ul style="list-style-type: none"> • In case Low Salt LED is on, refer to the Low Salt warning, page 17 |
| | <ul style="list-style-type: none"> • Overheating protection | <ul style="list-style-type: none"> • In extreme condition, when the unit identifies overheating it will automatically reduce chlorine production to protect itself. |
| | <ul style="list-style-type: none"> • Worn cassette | <ul style="list-style-type: none"> • Clean cassette. Refer to the "maintenance" chapter of this manual, page 18 • If none of the above resolves the problem the cassette may be worn and requires replacing |
| Blinking LED in the Chlorine output bar | <ul style="list-style-type: none"> • Increasing or decreasing output levels | <ul style="list-style-type: none"> • This is perfectly normal, indicating the required set point. Solid LED signals current production level. |
| Scale build-up inside cassette | <ul style="list-style-type: none"> • Standard occurrence that needs cleaning | <ul style="list-style-type: none"> • Clean cassette as instructed in the maintenance chapter, page 18 |
| | <ul style="list-style-type: none"> • Chemical imbalance | <ul style="list-style-type: none"> • Balance chemicals (focus mostly on the Saturation index in the "Understanding the chemistry chapter, page 20) |
| Cloudy water | <ul style="list-style-type: none"> • May be due to chemical imbalance | <ul style="list-style-type: none"> • Make sure your filtration system is working properly (e.g clean filter and/or skimmer) • Make sure the circulation time is adequate – if not, increase pump run time • Balance all chemicals referenced in the "Understanding the Chemistry" chapter, page 20 • Shock the water to eliminate build-up of any organic matter |
| Colored water | <ul style="list-style-type: none"> • Metals in the fill water may have been oxidized • Algae may be trying to form | <ul style="list-style-type: none"> • Have a pool professional test the pool water. If high in metals use phosphate-free metal remover • Increase circulation time if needed and clean the filter |

| Problem | Possible Causes | What to do |
|---|---|--|
| Algae | <ul style="list-style-type: none"> • May be due to low chlorine levels or a chemical imbalance | <ul style="list-style-type: none"> • Have the water tested for chemical balance including pH, phosphates and nitrates • If chlorine level is low, increase output levels • Use nonmetallic (polyquat) algaecide as instructed on the bottle and brush the side of the pool often • Clean the filter and shock the pool with chlorine daily until the water clarity returns |
| No Flow LED is on  | <ul style="list-style-type: none"> • Insufficient water flow from pump to the cell | <ul style="list-style-type: none"> • This may happen if there is air in the lines or for a few minutes at initial startup • Clean filters and strainers • Check for closed valves, pump cavitation, faulty pump etc' |
| | <ul style="list-style-type: none"> • Obstruction build up in or around flow sensor paddle | <ul style="list-style-type: none"> • Dismantle cassette from cell body and remove debris to free the paddle |
| | <ul style="list-style-type: none"> • Low flow rate | <ul style="list-style-type: none"> • In case you have a variable frequency pump installed, increase the flow until the LED turns off • Make sure flow rate is above 22 GPM [5m³/h] |
| Low Salt LED is on  | <ul style="list-style-type: none"> • Not enough salt in water | <ul style="list-style-type: none"> • Manually check the salinity of the pool water with a stick. If needed, add salt according to the table on page 12 |
| | <ul style="list-style-type: none"> • Scale build-up inside cassette | <ul style="list-style-type: none"> • Visually inspect the cassette for lime-scale. Clean blades if necessary (see instructions on page 18) |
| Cell Life Low LED is on  | <ul style="list-style-type: none"> • Blades are worn | <ul style="list-style-type: none"> • No immediate action is required, pool water is safe to bath in • Cassette is nearing its working capacity limit. Purchase a replacement cassette for the unit and replace it when the system does not reach 100% chlorine output and Cell Life Low LED is on |

| Problem | Possible Causes | What to do |
|--|--|---|
| <p>System Error LED is on</p>  | <ul style="list-style-type: none"> • Salinity High, too much salt has been added | <ul style="list-style-type: none"> • Test the salt levels in pool, if high it is recommended to drain part of the pool water and refill with fresh water (please check with your local pool professional prior to draining the pool) |
| | <ul style="list-style-type: none"> • Low salt levels | <ul style="list-style-type: none"> • Manually check the salinity of the pool water with a stick. If needed, add salt according to the table on page 12 |
| | <ul style="list-style-type: none"> • Debris in cassette electrical connector | <ul style="list-style-type: none"> • Dismantle power pack from cassette and visually inspect the electric connector. In case debris has settled there, gently remove it and re-attach the power pack |
| | <ul style="list-style-type: none"> • Worn cell | <ul style="list-style-type: none"> • Visually inspect the cassette to see if blades are damaged. If damaged replace cassette |
| | <ul style="list-style-type: none"> • A more profound error occurred | <ul style="list-style-type: none"> • Call your pool professional or dealer for assistance |
| <p>SYSTEM ERROR LED is blinking</p>  | <ul style="list-style-type: none"> • Debris is stuck in the electrical connection on the cassette | <ul style="list-style-type: none"> • Remove the control box from the cassette. Clean the electrical connection from any debris stuck in it. Wipe with a dry cloth |
| | <ul style="list-style-type: none"> • Communication problem between the cassette and control box | <ul style="list-style-type: none"> • Please contact customer service |

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