To obtain service for your TUBBY™ system, contact the Dealer/Service Centre listed below, or:

Lectranator Systems, Inc.
2770 - 24 Avenue N.E.
Calgary, Alberta, Canada
T1Y 6V7 (403) 291-9845

If warranty service is being requested, you must provide a copy of your registered warranty card as proof of purchase. Warranty service cannot be performed without this documentation.

TUBBY™ DEALER

Appendix

Chlorine Generating Device for Residential Spas

Tubby™

By Lectranator Systems Inc.

Installation / Operation Manual

MODEL ST1 REGISTRATION NUMBER 27899 PEST CONTROL PRODUCTS ACT.
Maximum output equivalent to 15 grams of free available chlorine per day.
One Tubby™ Model ST1 unit can treat a maximum of 2200 Litres of Spa water.
Controls Bacteria in Spa Water.

PLEASE RETAIN OWNER'S MANUAL FOR FUTURE REFERENCE

LECTRANATOR

Tubby™ Spa Sanitizing System

ULC UL US LISTED CSA

IMPORTANT
READ THE LABEL AND THE INSTALLATION/OPERATION MANUAL BEFORE USING
Lectranator Systems Inc. 2770 - 24 Ave. N.E. Calgary, AB. T1Y 6V7

TABLE OF CONTENTS

Model: ST1

LECTRANATOR

3-Year Limited Warranty
Residential Use Only

The purchaser ("Customer") has purchased a "TUBBY™" Spa Sanitizing System ("Unit") for use in Customer's residential (not commercial) spa. Unit manufacturer, LECTRANATOR SYSTEMS INC. 2770 - 24 Avenue N.E. Calgary, Alberta, Canada T1Y 6V7 ("Manufacturer"), hereby provides a limited warranty to Customer as follows:

THREE (3) YEARS FROM THE DATE OF SALE, TO THE ORIGINAL PURCHASER, ON DEFECTS IN MATERIALS AND WORKMANSHIP FOR THE TUBBY™ POWER SUPPLY AND CELL. CUSTOMER MUST USE TUBBY™ SPA STARTER BLEND AND TUBBY™ POWER POUCHES™ EXCLUSIVELY WITH THE TUBBY™ ELECTROLYTIC GENERATOR, IN ORDER TO VALIDATE THIS WARRANTY. FAILURE TO USE THESE PRODUCTS SHALL RENDER THIS WARRANTY NULL AND VOID. CUSTOMER SHALL BE RESPONSIBLE FOR ANY TRAVEL CHARGES IMPOSED BY WARRANTY CENTER OR SERVICING AGENT FOR TRAVEL. IN ADDITION, MANUFACTURER'S LIMITED WARRANTY IS FURTHER SUBJECT TO THE FOLLOWING CONDITIONS AND EXCLUSIONS:

1. **This limited warranty is for the replacement of defective parts. Manufacturer reserves the right to replace defective parts with new or refurbished parts at it's sole discretion. All warranty replacement parts will carry a 90 day warranty from date of installation, or the balance of the original warranty, which ever is greater.**
2. **This limited warranty is applicable only if the Unit is installed by an Authorized TUBBY™ Dealer or its designee, a licensed electrician or by Customer in accordance with the installation procedures outlined in the accompanying Installation Manual.**
3. **Spa water must be tested regularly in order to properly maintain its chemical balance. Excessive chlorination is known to cause corrosion in spa metals. Failure of Customer to properly monitor the spa water's balance can create a situation which could negatively affect the performance of the Unit and thus void this limited warranty. Failure to comply with guidelines set forth in the Owner's Manual will void the warranty. Customer releases and holds Manufacturer harmless from any and all claims stemming from their failure to comply with these set guidelines.**
4. **Deterioration, discoloration or brittleness of spa surfaces, including but not limited to plaster tile, and acrylic, can be caused separately by, or in combination with, age, the environment, an imbalance in spa water chemistry, improper installation, sunlight and other factors. Customer hereby disclaims all claims, and releases Manufacturer from all claims for damages to any plaster, tile or acrylic surfaces in Customer's spa by reason of the use and/or operation of the Unit. Customer represents and agrees that any claims which it may assert against Manufacturer shall be limited to those which may be asserted under the foregoing limited warranty.**
5. **Under no circumstances shall Manufacturer be liable for any loss or damage, whether direct, consequential or incidental, arising out of the use or inability to use the Unit in Customer's spa. In addition, each spa has its own individual sanitizer requirements. This limited warranty specifically states that this product will NOT supply 100% of the sanitizer requirements for any specific residential spa. (Refer to Owner's Manual.)**
6. **This limited warranty does not apply to any injury, loss, damage, defect, or malfunction of the Unit or failure to function resulting from any failure to operate or maintain the Unit in accordance with the directions contained in the Owner's Manual or operating instructions provided by the Manufacturer; or any injury, loss, damage, defect, or malfunction, or failure to function resulting from any accident, acts of God, alterations in the Unit by anyone other than Manufacturer, or misuse, unreasonable use, tampering, abuse, acts, omissions, failure or negligence by anyone other than Manufacturer including but not limited to such damages or injuries to parts resulting from improper installation, or damage, defect or malfunction resulting from defects in, failure or malfunction of, or negligence, abuse, or misuse with respect to equipment other than the Unit, or any damage or loss of any nature whatsoever and personal injury caused due to the presence of a foreign object in or about the spa.**
7. **This limited warranty is valid and enforceable only on Units assembled, manufactured, purchased and installed in North America.**
8. **This limited warranty is applicable only if the Unit is purchased from an authorized TUBBY™ Dealer. If Customer is uncertain as to whether the seller of the Unit is an authorized TUBBY™ Dealer, Customer should call (866) 517-7584 immediately after purchase for verification.**
9. **This limited warranty shall apply only to Customer as an original purchaser of the Unit from an authorized TUBBY™ Dealer and shall not apply to any subsequent purchaser, assignee or other recipient of the Unit from Customer.**
10. **No dealer, distributor or other similar person has any authority to make any warranties or misrepresentations concerning Manufacturer's products, its Unit or to extend this warranty beyond the express terms contained herein. Manufacturer assumes no responsibility for any warranties beyond the expressed terms contained in this limited warranty. Customer releases and holds Manufacturer harmless from any claims stemming from any unauthorized representations.**
11. **This limited warranty shall be void if Customer modifies the Unit in any respect including but not limited to the use of parts other than genuine TUBBY™ parts.**
12. **The foregoing limited warranty gives Customer specific legal rights which may vary by geographic area and accordingly, some of the listed conditions and exclusions may not apply to Customers living in certain states/provinces.**
13. **These warranties set forth herein are in lieu of any other warranties, expressed or implied, including the warranties of merchantability or fitness. Any such implied warranty imposed by law is limited in duration to one (1) year from date of purchase.**
14. **Customer represents and agrees that any claims which it may assert against Manufacturer shall be limited to those which may be asserted under the foregoing limited warranty.**
15. **Any dispute between Customer and Manufacturer will be settled by binding arbitration, conducted in Calgary, Alberta, Canada.**

LECTRANATOR SYSTEMS INC. 2770 - 24 Avenue N.E. Calgary, Alberta, Canada T1Y 6V7

IMPORTANT SAFETY INSTRUCTIONS

110V Models Only

1. **WARNING - Risk of Electrical Shock. Connect only to a grounding type receptacle protected by a ground-fault-circuit-interrupter (GFCI). Contact a qualified electrician if you cannot verify that the receptacle is protected by a GFCI. The conductors on the load side of the GFCI shall not occupy conduit boxes or enclosures containing other conductors unless the additional conductors are also protected by a GFCI.**

2. **The GFCI must be tested before each use. With the TUBBY™ unit operating push the test button on the GFCI. The TUBBY™ unit should stop operating. Push the reset button. The TUBBY™ unit should now start to operate normally. If the GFCI fails to operate in this manner, there is a ground current flowing indicating the possibility of an electrical shock. Disconnect the power until the fault has been identified and corrected.**

3. **WARNING - To reduce the risk of electric shock, replace damaged cords immediately.**

4. **WARNING - To reduce the risk of electric shock, do not use extension cords to connect unit to electrical supply; provide a properly located outlet.**

5. **Do not bury cord. Locate cord to minimize abuse from lawn mowers, hedge trimmers and other equipment.**

6. **Warning - Operating Tubby™ Model ST1 without water flow through the cell can cause a build up of flammable gases which can result in FIRE or EXPLOSION.**

General Use

1. **WARNING - To reduce the risk of injury do not permit children to use this product unless they are closely supervised at all times. Children should not use spas or hot tubs without permanent adult supervision.**

2. **WARNING - Risk of Accidental Drowning . Extreme caution must be exercised to prevent unauthorized access by children. To avoid accidents, ensure that children cannot use a spa or hot tub.**

3. **DANGER - To reduce the risk of injury, do not remove the suction grates. Never operate a spa or hot tub if the suction grates are broken or missing. Never replace a suction grate with one rated less than the flow rate marked on the equipment assembly.**

4. **DANGER - Risk of Electrical Shock. Do not permit any electrical appliance such as a light, telephone, radio or television within 1.5m (5 feet) of spa or pool.**

5. **To avoid injury exercise care when entering or exiting the spa or hot tub.**

WHEN CALLING FOR SERVICE - Please have the following information ready:

1. **Power Supply Model:**_____
2. **Chlorine Cell Serial Number:**_____
   (Located on top of cell, stamped in plastic)
3. **Installation Date: MM:**_____**DD:**_____**YY:**_____
4. **Warranty Registration Number:**_____

IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS

EQUIPMENT RELATED, INSTALLATION AND GENERAL USE:
Installation of all TUBBY™ models

When installing and using the TUBBY™ unit, basic safety precautions must always be followed, including the following:

1. Follow all aspects of the local and National Electrical Codes when installing the TUBBY™ unit.

2. During installation, mount the TUBBY™ unit to ensure the least amount of direct exposure to rain, garden sprinkler water, direct sunlight or any corrosive environment.

3. WARNING - Risk of electrical shock. Plug the unit into an approved G.F.C.I. electrical outlet (110VAC ONLY). It may also be connected directly onto the spa pack with an optional "patch cord" (Part # 50-302).

4. WARNING - Do not use spas or hot tubs unless all suction grates are installed to prevent body and hair entrapment.

5. DANGER - To reduce the risk of drowning from hair and body entrapment, install suction fittings with a marked flow rate that equals or exceeds the flow rate on the equipment assembly.

6. WARNING - Install blower no less than 30cm (1 foot) above the maximum water level to prevent water from contacting electrical equipment.

7. CAUTION - Maintain water chemistry in accordance with values set out on page 5.

8. All field-installed metal components such as rails, ladders, drains, or other similar hardware within 3m (10 feet) of the spa or hot tub shall be bonded to the equipment grounding bus with copper conductors not smaller than No. 8 AWG in the U.S.A. and No. 6 AWG in Canada.

WARRANTY ACTIVATION REPORT
Detach & Mail within 14 days of purchase.

Owner's Name		Phone: Home	Business: Email:
Street Address	City	State/Prov	Zip Postal Code
Dealer (Source)		Phone:	Fax:
Street Address	City	State/Prov	Zip Postal Code
My TUBBY™ Serial Number is as Follows...		Date Purchased:	
Control Panel Serial #			
Cell Model ☐ In Wall ☐ Over the Wall		Serial #	
Spa Volume: Gallons	Liters		
Age of Spa: New ☐ Existing ☐		If Existing: How many years ?	
How often is your spa used? Daily	Weekly	Monthly	Rarely

Specifications

TUBBY MODEL ST1

INPUT : 105 - 125 VAC, 50/60 Hz, 0.5 amp

OUTPUT: 5.0 VDC, 300 mA (40°C/104°F)

Tubby Model C1 Cell: Maximum output equivalent to 15 grams of free available chlorine per 24 hours @ max. dial setting of 100%

NOTE: The TUBBY™ unit is designed to provide a chlorine/bromine residual whenever the spa IS NOT in use. With an average residential spa, this "non-use" time represents 95% to 99% of each day. Supplemental sanitizer/oxidizer should be added before and/or after EACH spa use, to maintain 3-5 ppm of free available chlorine/bromine. For use in residential spas only.

Automatic Self Cleaning Feature

Reverse Polarity Function:

The Reverse Polarity Function is designed to automatically clean the cell blades, maximizing the cell's ability to manufacture chlorine or bromine. This feature is only enabled when the AC power is on and the L.E.D. light displays a solid GREEN color. The unit reverses polarity after the first hour of run time; then every three hours from that point on.

TUBBY™ Power Supply Functions Con't

Use Of Sodium Bromide ***Once a bromine spa - always a bromine spa.***

SODIUM BROMIDE (OPTIONAL) - 60 PPM

Where Cyanuric acid is not available or where its use is restricted, bromine can be used as an alternative sanitizer to chlorine.
The TUBBY™ unit will convert sodium bromide to bromine in the same way that it converts sodium chloride to chlorine.
NOTE: Bromine spas do not require the addition of Cyanuric acid. Typical chlorine stabilizer provides no U.V. protection for bromine residuals. DO NOT MAINTAIN OR ADD CYANURIC ACID TO A BROMINE SPA!

To produce hypobromous acid (bromine sanitizer), we recommend adding 66 grams (2.4 oz.) of sodium bromide for every 2.2 kg (5 lbs.) of TUBBY™ Spa Starter Blend added to the spa. Always use a registered or scheduled source of sodium bromide.

REMEMBER: For the TUBBY™ System to produce bromine, the spa water must contain the recommended level of products as previously specified. (When used, sodium bromide is added in addition to the normal amount of TUBBY™ Spa Starter Blend required.)

Equipment startup Sequence

Before operating the TUBBY™ System, perform the following steps to ensure proper installation and operation:

A. Turn ON all circuit breakers to the spa equipment. Turn on jet pump. Add required type(s) and amount of salt to spa. Broadcast over the surface and allow salt to COMPLETELY dissolve (15 - 20 minutes). Place the cell in the spa (bottom of footwell). Plug the Power Supply into a 110VAC GFCI protected outlet and set the feed rate dial to 100%. The following indicators should display: A series of green flashes for 5 seconds, followed by a solid green light. If this sequence does not occur please refer to the Trouble Shooting Guide starting on page 12 for further assistance.

NOTE: Be sure to test the chlorine/bromine level for the next few days and properly adjust the chlorine/bromine output dial as outlined on page 4 of this manual.

DO NOT EXCEED RECOMMENDED CHLORINE OR BROMINE LEVELS!

Make the required adjustment and allow the spa to react to this change for a minimum of 2 days. After 2 days, retest the spa water and make any further "small" adjustments as required, until the TUBBY™ unit maintains an adequate Free Available Chlorine or Free Available Bromine residual (during the "non-use" times).

Troubleshooting

PROBLEM	CAUSE	SOLUTION
1. Insufficient sanitizer production.		
	A. The test kit reagents or test strips are old or expired.	A. Retest with new reagents or test strips.
	B. The unit is set too low in relation to the sanitizer demand.	B. Increase the feed rate on the output dial.
	C. Sanitizer loss due to intense sunlight exposure.	C. Check the stabilizer level and add Cyanuric Acid if needed. (Refer to the Cyanuric Acid Needed for 75 PPM section, page 6.) If on Bromine, replenish bromine residual.
	D. The body of water being sanitized leaks.	D. Repair the leak and rebalance the water being sanitized. (Refer to the Spa Water Preparation section, page 5.)
	E. Low salt.	E. Check the residual salt level and add if necessary. (Refer to the Salt Requirements Needed for 2000 ppm section, page 6)
2. Scale build-up within the cell.		
	A. The water being sanitized contains high pH, alkalinity and calcium hardness.	A. Calculate Langelier's Index to ensure balanced water. (See page 5). Adjust the water chemistry and mix 1 part muriatic acid to 4 parts water. Allow the cell to soak in this solution for no longer than 15 minutes. Repeat if necessary. Rinse with fresh water and re-install. Dilute spa water with fresh water if necessary.
3. DC Plug is burned.		
	A. The cell cord plug is not securely pushed onto the power supply allowing moisture to seep into the plug.	A. Ensure that the cell cord plug is pressed completely on the power supply.
	B. Completely failed cell.	B. Replace the cell.
4. Premature cell failure.		
	A. Abnormally high cell usage due to an insufficient C.Y.A. level.	A. Check the stabilizer level and add cyanuric acid if needed. (Refer to the Cyanuric Acid Needed for 75 PPM)
	B. Debris in Cell.	B. Inspect cell monthly and clean if required.
5. White flakes in the water.		
	A. This occurs when excessive calcium hardness is present in the water being sanitized. This should cease after a few days.	A. Monitor the pH and adjust if necessary. (Refer to the Spa Water Preparation section, page 5.)
6. No solid green "OK" light.		
	A. Incoming 110 VAC power not present.	A. Ensure that the TUBBY™ circuit breaker is set to "ON" and functional.
7. Rapid Green Flash - (Two flashes per second)		
	A. The cell is scaled.	A. Clean cell and re-install.
	B. The cell DC cord is disconnected .	B. Reconnect the DC cord properly.
	C. Low salt.	C. Check the residual salt level and adjust if necessary. (Refer to the salt requirements needed for 2,000 ppm section, page 6).
	D. The unit is not reversing polarity.	D. Return the Power Supply to your retailer for service or replacement.
	E. Possible cell failure.	E. Return Power Supply and Cell to your retailer for testing/servicing.
	F. Very cold spa water.	F. Raise temperature to normal operating range (Max 104°F/40°C).

HEALTH, GENERAL AND HYPERTHERMIA

General: WARNINGS - To reduce the risk of injury:

1. **People using medications and/or having an adverse medical history should consult a physician before using a spa or hot tub.**
2. **People with infectious diseases should not use a spa or hot tub.**
3. **The maximum spa water usage temperature is 40°C (104°F). Duration in spa water at 40°C (104°F) should not exceed 15 minutes. Lower water temperatures are recommended for young children and when spa use exceeds 10 minutes.**
4. **Water temperatures in excess of 38°C (100°F) may be dangerous to your health.**
5. **Pregnant or possibly pregnant women should consult a physician before using a spa or hot tub.**
6. **Since excessive water temperatures have a high potential for causing fetal damage during the 1st trimester of pregnancy, pregnant or possibly pregnant women should limit the spa water temperatures to 38°C (100°F).**
7. **Before entering a spa or hot tub, the user should measure the water temperature with an accurate thermometer since the tolerance of water temperature regulating devices vary.**
8. **The use of alcohol, drugs, or medication before or during spa or hot tub use may lead to unconsciousness with the possibility of drowning.**
9. **Obese persons and persons with a history of heart disease, low or high blood pressure, circulatory system problems, or diabetes should consult a physician before using a spa/hot tub.**
10. **Persons using medication should consult a physician before using a spa or hot tub since some medication may induce drowsiness while other medication may affect heart rate, blood pressure, and circulation.**
11. **Do not use a spa or hot tub immediately following strenuous exercise.**
12. **Prolonged immersion in a spa or hot tub may be dangerous to your health.**

Hyperthermia

WARNING - The use of alcohol or drugs can greatly increase the risk of fatal hyperthermia in hot tubs and spas.

Consult your spa/hot tub manufacturer's manual for the proper adjustment of water temperature. Prolonged immersion in hot water may induce hyperthermia. Hyperthermia occurs when the internal temperature of the body reaches several degrees above the normal body temperature of 37°C (98.6°F). Hyperthermia symptoms include drowsiness, lethargy, and an increase of internal body temperature.

The effects of hyperthermia include:

1. **unawareness of impending hazard**
2. **failure to perceive heat**
3. **failure to perceive the need to exit the spa/hot tub**
4. **physical inability to exit spa**
5. **fetal damage in pregnant women**
6. **unconsciousness and danger of drowning**

SAVE THESE INSTRUCTIONS

System Sizing for Spas (Continued)

NOTE: The TUBBY™ unit is designed to provide a chlorine/bromine residual whenever the spa IS NOT in use. With an average residential spa, this "non-use" time represents 95% to 99% of each day. Supplemental sanitizer/oxidizer should be added before and/or after EACH spa use, to maintain 3-5 ppm of free available chlorine/bromine. For use in residential spas only.

2. Sanitizer Production/System Sizing/Rule of Thumb

Sanitizer *demand* varies beyond precise prediction. If you desire a higher or lower sanitizer residual in your spa, the following "rule of thumb" will assist you in properly selecting the correct TUBBY™ feed rate dial setting.

A Tubby™ power supply with cell , operated at maximum output (100%), at 1800-2000 ppm salt residual will produce 15 grams of free available chlorine in 24 hours of continuous operation. This amount of chlorine could satisfy up to 2,200L (600 U.S. gallons) of spa water, depending on the 8 demand variables for sanitizer.

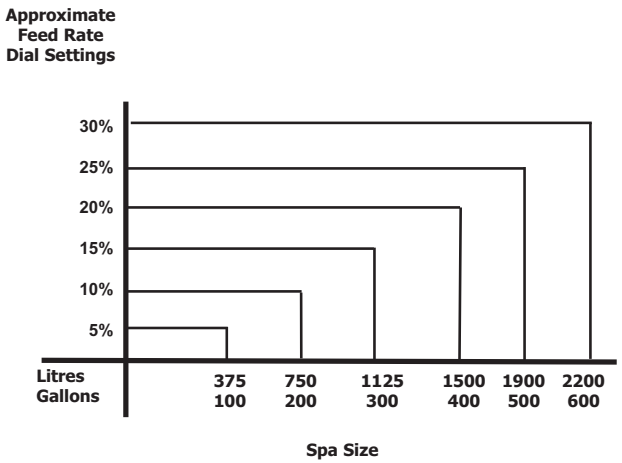
NOTE: Residual salt levels should be maintained above 1500 ppm and below 2500 ppm. Do not exceed 2500 ppm salt residual if you object to salty tasting water!

Normal System Sizing Guide

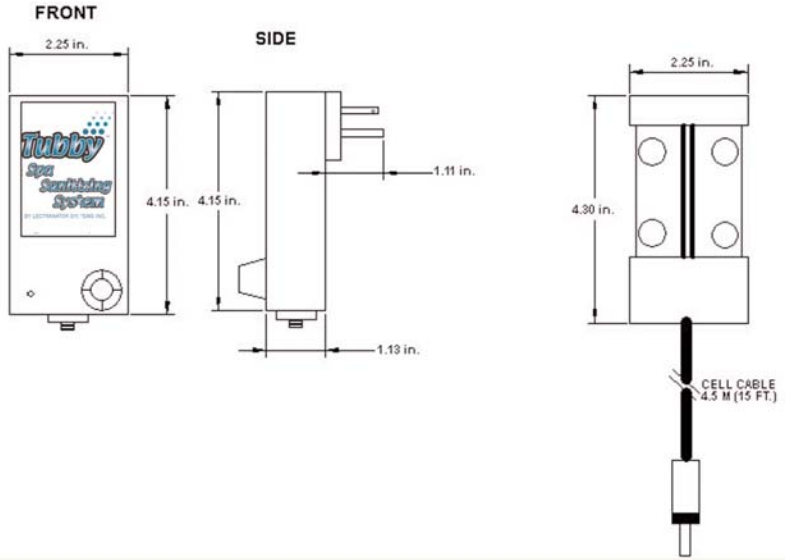
The sizing criteria below reflects *"normal"* conditions based on field experience and proper operation. Sanitizing "demand" varies from one spa to another. The chart below provides approximate feed rate dial settings required to maintain adequate chlorine (3.0 - 5.0 ppm) or bromine residuals (3.0 - 5.0 ppm) during "non-use" periods, based on spa volume.

NOTE: Establishing the exact feed rate dial setting is required. To maintain 3.0-5.0 ppm chlorine or bromine residual, during "Non-Use Spa Time" will require trial and error adjustments. Once set, this setting should be "marked" on the power supply as this will become the permanent setting for your particular spa.

For proper sanitation, spa must be completely drained periodically. The number of days between COMPLETE SPA DRAINAGE is equal to the volume of spa water in litres, divided by 10 times the maximum number of daily spa users. Refill spa with water and repeat the startup procedure.



Dimensions - Power Supply & Cell



TUBBY™ Power Supply Functions

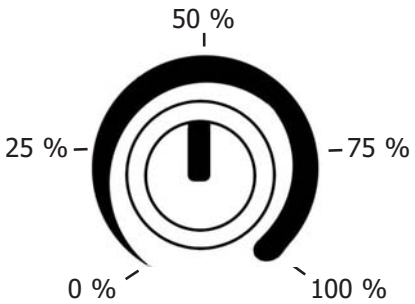
A. WHEN POWER IS FIRST TURNED ON:
The light will flash GREEN slowly (1 flash per second) for approximately 5 seconds while the TUBBY™ unit self-tests.

B. OK:
If your TUBBY™ unit is operating properly, this indicator will display solid GREEN. This indicates AC power is being delivered to the Power Supply and/or the unit is producing sanitizer and your spa is being sanitized by Hypochlorous Acid (chlorine) or Hypobromous Acid (bromine). NOTE: While sanitizer is being produced, bubbles can be seen coming from the cell blades!

C. CHECK SYSTEM:
The light will flash GREEN rapidly (2 flashes per second) to indicate a component problem or failure. For further explanation of this indicator, please refer to the Trouble Shooting Guide beginning on page 12.

Output Control
The Output Control Dial is a percentage setting that regulates the amount of ouput the system requires to maintain the chlorine/bromine residuals as indicated on page 4 of this manual. The output is regulated according to the setting of this dial. Remember the unit operates with convection. It operates independently from your filter pump run time.

NOTE: Any interruption of power, will cause the current memory cycle to reset itself when power is restored.



System Sizing for Spas

System Sizing

Use these three formulas to calculate the volume of water in the spa:

Rectangular: Length(M) x Width(M) x Average Depth(M) x1000 = Total Litres
Length(Ft) x Width(Ft) x Average Depth(Ft) x7.5 = Total U.S. Gallons

Round: 3.14 x Radius (M) x Radius (M) x Average Depth (M) x 1000 = Total Litres
3.14 x Radius (Ft) x Radius (Ft) x Average Depth (Ft) x 7.5 = Total U.S. Gallons

Free Form: Average Length (M) x Average Width (M) x Average Depth (M) x 1000 = Total Litres
Average Length (Ft) x Average Width (Ft) x Average Depth (Ft) x 7.5 = Total U.S. Gal.

TUBBY™ System Production Capacity

IMPORTANT CONCEPTS

1 . Sanitizer Demand

The rate at which sanitizer is <u>consumed</u> in any spa depends on the relationship of <u>eight major variables</u>. Since these variables can vary widely from spa to spa and season to season, precise prediction of the sanitizer *<u>demand</u>*** for any one spa is difficult. At the end of this section, rules of thumb are provided for TUBBY™ System Sizing.**

THE VARIABLES ARE:

I. <u>Volume and surface area of the spa being sanitized</u>.

II. <u>Average water temperature maintained</u>: As the temperature of the water increases, the sanitizer *<u>demand</u>*** will also increase. As the temperature of the water decreases, the sanitizer ***<u>demand</u>*** will also decrease. When this happens, the output dial should be decreased to compensate for this lower ***<u>demand</u>*** (which will also protect your equipment from excessive levels of sanitizer).**

III. <u>Cyanuric acid level maintained</u>: This chemical, when added to your outdoor spa water, significantly inhibits sanitizer depletion from exposure to sunlight. Cyanuric acid also inhibits corrosion if your spa is equipped with any metal components. Minimum levels or better <u>must</u> be maintained to ensure that the sanitizer being produced is protected from UV breakdown.

IV. <u>Bather load</u>: As the bather load increases, the sanitizer *<u>demand</u>*** will also increase.**

V. <u>Amount of direct sunlight / UV exposure</u>: Spas exposed to larger amounts of direct sunlight are more vulnerable to increased sanitizer loss and algae growth. Indoor or screened spas have less sanitizer demand.

VI. <u>Exposure to vegetation and airborne debris</u>: Dense landscaping near the spa, along with increased nitrate levels (urine, bird droppings, fertilizer, well water, etc.) greatly contribute to increased sanitizer demand.

VII. <u>Chemical dilution</u>: Virtually all spa chemicals experience dilution through rainfall, adding of fresh make-up water due to evaporation, splash-out, filter backwashing, leaks, etc. When fresh water is added, sanitizer *<u>demand</u>*** increases for a brief period.**

VIII. <u>Main filter pump runtime and your spa's circulation patterns</u>: Waterfalls/Fountains and other water features operated by the filter pump can directly affect sanitizer *<u>demand</u>***. The main filter pump runtime and/or output dial may need to be increased to satisfy this higher ***<u>demand.</u>***

Salt Requirements Needed for 2000 PPM

KILOGRAMS OF TUBBY™ SPA STARTER BLEND REQUIRED FOR 2000 PPM RESIDUAL

Salt Level Before Addition	Tub Volume in Liters					
	375	750	1125	1500	1900	2200
0 ppm	.72	1.4	2.2	2.9	3.7	4.3
300 ppm	.66	1.3	2.0	2.6	3.3	3.8
600 ppm	.58	1.2	1.7	2.3	2.9	3.4
900 ppm	.50	1.0	1.5	2.0	2.5	2.9
1200 ppm	.44	.85	1.3	1.7	2.2	2.5
1600 ppm	.34	.66	1.1	1.4	1.8	2.1
1900 ppm	.27	.53	.79	1.0	1.3	1.5

POUNDS OF TUBBY™ SPA STARTER BLEND REQUIRED FOR 2000 PPM RESIDUAL

Salt Level Before Addition	Tub Volume in USG					
	100	200	300	400	500	600
0 ppm	1.6	3.3	5.0	6.6	8.3	9.9
300 ppm	1.5	3.0	4.5	6.0	7.5	9.0
600 ppm	1.3	2.6	4.0	5.3	6.6	7.9
900 ppm	1.1	2.3	3.5	4.6	5.8	6.9
1200 ppm	1.0	2.0	3.0	4.0	5.0	6.0
1600 ppm	.80	1.6	2.3	3.1	3.9	4.7
1900 ppm	.60	1.2	1.8	2.4	3.0	3.6

NOTE: Turn device off before adding sodium chloride/bromide and other chemicals, and wait until complete dissolution before turning it on.

Cyanuric Acid needed for 75 PPM

Cyanuric Acid / Stabilizer/Conditioner (Required with uncovered outdoor spas only)

Cyanuric acid, CYA, (also known as stabilizer or conditioner) prevents rapid breakdown of chlorine by direct sunlight. Maintain CYA concentrations between 30-100 ppm by diluting with fresh water. Regulations may exist regarding use of Cyanuric acid in spas; please consult your spa professional. Use the chart below to determine the amount of Cyanuric acid needed. Test water with a test kit that includes CYA testing, then use the chart below to determine the amount to add. Note: Indoor or bromine spas do not require the addition of CYA.

GRAMS OF CYANURIC ACID NEEDED FOR 75 PPM RESIDUAL

CYA level Before Addition	Tub Volume in Liters					
	375	750	1125	1500	1900	2200
0 ppm	28.0	56.0	84.0	112	142	164
10 ppm	24.0	49.0	73.0	98.0	124	144
25 ppm	19.0	37.0	56.0	75.0	95	110
40 ppm	13.0	26.0	39.0	52.0	69.9	76.3
50 ppm	9.5	19.0	28.0	38.0	48.1	55.7
60 ppm	5.5	11.0	17.0	24.0	30.4	35.2

OUNCES OF CYANURIC ACID NEEDED FOR 75 PPM RESIDUAL

CYA Level Before Addition	Tub Volume in USG					
	100	200	300	400	500	600
0 ppm	1.0	2.0	3.0	4.0	5.0	6.0
10 ppm	.87	1.7	2.6	3.5	4.4	5.3
25 ppm	.66	1.3	2.0	2.6	3.3	3.9
40 ppm	.47	.95	1.4	1.9	2.4	2.9
50 ppm	.33	.66	1.0	1.3	1.6	2.0
60 ppm	.20	.40	.60	.80	1.0	1.2

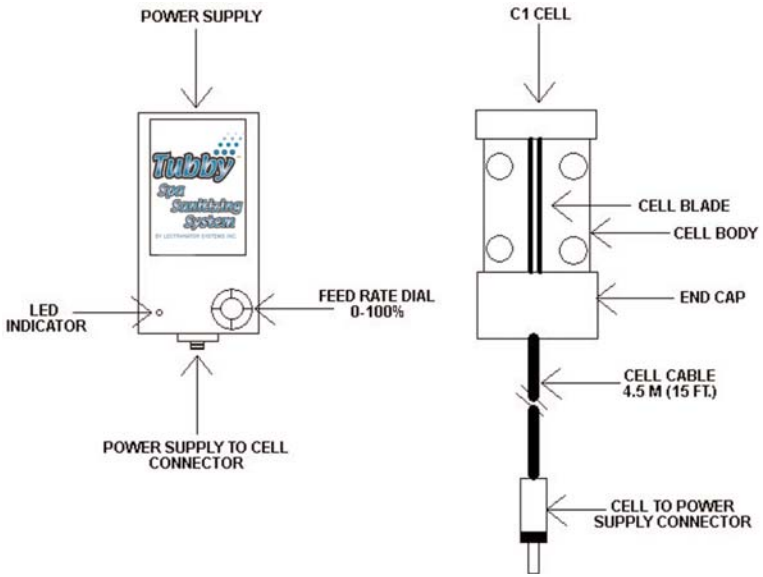
Power Supply and Cell Installation

Power Supply
The Power Supply should be plugged into a 110VAC GFCI protected outlet and preferably away from direct exposure to sunlight. The Cell is equipped with a 4.5m (15 ft.) DC cord.

The unit comes complete with one of two cell types.

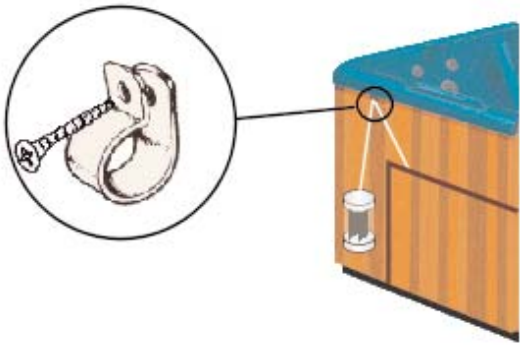
- **For existing spas, the TUBBY™ unit will be provided with an enclosed see-through cell (Diagram 1), for simple over the wall installation. The cell should be placed into the footwell of the spa.**
- **Where TUBBY™ unit is a factory installed option, the cell will be fitted into a standard spa fitting and installed directly into the wall of the spa. The in wall model cell includes an "o" ring seal and removable lock screw to allow for future servicing. (Diagram 2)**

Diagram 1



UNIT WITH CELL ATTACHED FOR "OVER THE WALL" RETROFIT INSTALLATION.

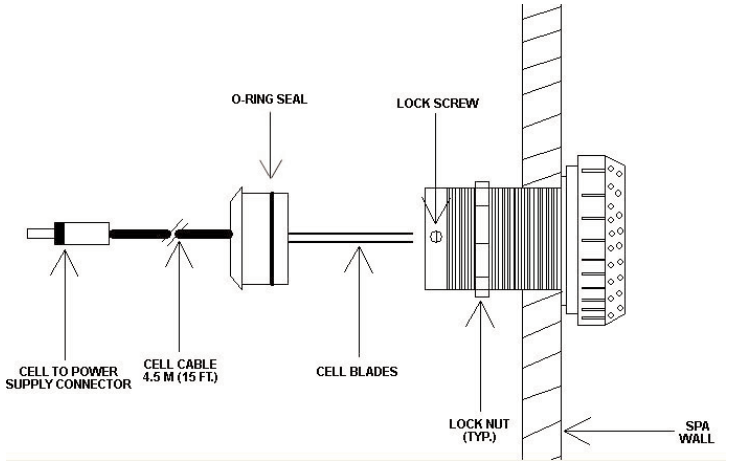
Power Supply and Cell Installation (Continued)



INSTALLING THE "P" CLIP:
Position the DC cable into the "P" clip. Using the stainless steel screw provided, fasten the "P" clip to the top of the spa skirt, just below the acrylic lip. Before tightening the screw and locking the cable into place, adjust the length of the DC cable so that the cell remains approximately 1" above the floor or ground when hanging freely. The cell can now be put into and taken out of the spa without damage.

NOTE: The Tubby™ over the wall cell should be removed whenever the spa is in use. After installing the "P" clip provided, simply hang the cell outside the spa as indicated in the figure above, during spa use.

Diagram 2



UNIT WITH "IN WALL" FACTORY INSTALLED CELL.

Spa Water Preparation & Monitoring

STEP 1 - Proper Water Balance Requirements:

Proper TUBBY™ System operation is dependent on proper spa water conditions. Manually balance the SPA water chemistry to meet all suggested ranges of water balance factors listed below before startup of the TUBBY™ unit. From that point forward your TUBBY™ System will assist you in keeping your water chemistry factors in balance.
BEFORE STARTUP, MAKE SURE THE SPA WATER MEETS THE FOLLOWING REQUIREMENTS: ALL WATER BALANCE FACTORS SHOULD FALL WITHIN LANGELIER'S SATURATION INDEX. WE RECOMMEND A VISIT TO YOUR LOCAL SPA PROFESSIONAL.

TUBBY™ System Required Ranges

STEP 2 - Daily Checks:

1) Free Available Chlorine = 3.0 - 5.0 ppm OR
2) Free Available Bromine = 3.0 - 5.0 ppm
3) Calcium Hardness 150 - 200 ppm
4) Total Alkalinity 80 - 120 ppm
5) Cyanuric Acid 30 - 100 ppm (Outdoor)
6) Salt Residual 1800 - 2200 ppm
7) Langelier's Index (water balance)+0.3 to -0.3
8) pH 7.2 - 7.8 NOTE: (Check expiry date of the test kit as test results may be inaccurate if used after that date.)

STEP 3 - Monthly Checks: CAUTION: Excessive Free Available Chlorine(>5.0 ppm) or Free Available Bromine (> 5.0 ppm) causes corrosion of any metal components in contact with spa/hot tub water. Staining and premature failure of heaters, filters, and other metal components will be the result. Do not exceed recommended sanitizer ranges. NOTE: Standard (DPD) pool water test kits do not read chlorine/bromine levels above approximately 8.0 ppm. Test reagents, at high sanitizer levels, return to a clear liquid. AVOID HIGH SANITIZER LEVELS!

STEP 4 - Salt Requirements: It is important that a suggested salt level of 1800-2200 ppm be maintained at all times. Low salt levels will activate a rapid green flash CHECK SYSTEM light and may stop sanitizer generation. Salt levels can be determined by using the TUBBY™ Salt Test Strips included with your starter kit. The amount of TUBBY™ Spa Starter Blend required depends on the size of the spa/hot tub. Use the chart on the next page to determine the amount of salt to add, in pounds or kilograms, for a new spa/hot tub startup. Also test your make-up water for its level of salt and compare it with the charts on the next page. Before adding TUBBY™ Spa Starter Blend to a spa/hot tub for the first time, turn your TUBBY™ unit OFF, then pour TUBBY™ Spa Starter Blend around the perimeter of the spa.

NOTE: Homeowners with water softening/treatment equipment, which utilize salt, may already have substantial levels of salt in their drinking water. So before adding this water to your spa, test the level of salt, then determine the amount of TUBBY™ Spa Starter Blend still needed to be added to bring the level up to the suggested 2000 ppm startup level. Before adding any make-up water to your spa, you should pre-test the water for pH, and total alkalinity and adjust these levels before they become too excessive. Your starter kit includes 4-in-1 TUBBY™ Test Strips for this purpose.

NOTE: Maintaining constantly high levels of salt and bromine above the recommended range can contribute to corrosion of the pool equipment. Salt levels exceeding the recommended concentration can be reduced by diluting the spa water with fresh water. NOTE: Heavy uses of the spa (excessive contamination) may require longer recovery times (a return to a minimum of 3 ppm bromine). Recovery time may be reduced by adding a shock compound to the water. Follow instructions of the shock compound being used.

MANUAL CLEANING OF CELLS
In normal conditions the TUBBY™ unit should not require manual cleaning. If manual cleaning is required, check water chemistry for possible imbalances or call the factory for consultation, and use the following procedure:
STEP 1 - Remove the cell.
STEP 2 - Using a bucket, add 1 part muriatic acid to 4 parts of water. PUT WATER IN BUCKET FIRST! CAUTION: Always add acid to *water*, never water to acid.
STEP 3 - Submerge the cell in the solution.
STEP 4 - After 10 - 15 minutes of foaming, remove the cell. Rinse with fresh water.
STEP 5 - If cell blades still have white crusty scale deposits on them, repeat the process, not to exceed 15 minute intervals.

NOTE: DO NOT try to remove any scale from cell blades with any tools. This may scratch or damage the coating on the blades and will VOID WARRANTY. The electrolytic cell has a life expectancy of 2 to 4 years under typical conditions of use. When replacing the cell, only use replacement cells having a label that clearly states that it is a replacement cell for the chlorine generating device TUBBY™ Model ST1, Registration Number: 27899, Pest Control Products Act.