



MASTER SPAS®

OWNER'S MANUAL

2001 MODEL YEAR

THE LEGEND SERIES

THE CENTURY SERIES

THE STANDARD SERIES

The ultimate relaxation machine...

RECORD OF OWNERSHIP

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

DATE PURCHASED _____

MODEL _____ SERIAL # _____

DEALER NAME _____

DEALER ADDRESS _____

DEALER PHONE # _____

SERVICE TECH REPRESENTATIVE _____

COMMENTS _____

Manufactured by:



MASTER SPAS®

6927 Lincoln Parkway, Fort Wayne, IN 46804

219-436-9100

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SAVE THESE INSTRUCTIONS

Included with your new spa is a safety sign. The sign is for you and your guest's protection and is suitable for outdoor use in wet locations. The sign should be placed in a location visible to all users of the spa.

Please take time to point out the physical location of the safety sign and the importance of the safety precautions displayed on the safety sign to all of your guests. Remember your safety and the safety of anyone who enjoys the use of your spa is our utmost concern.

The sign should be mounted with screws or another type of permanent fastener. Additional or replacement signs can be obtained from your dealer or direct from the factory.

INTRODUCTION

It's time to relax! You now have your very own portable spa by Master Spas, Inc. By fully understanding the operation of each of the features of your new Master Spa you will be assured of many years of hassle-free, hot water therapy and fun.

Your safety is of paramount importance to the MasterSpas family. We urge you to read and become thoroughly familiar with all safety aspects addressed in this manual.

Through reading and totally understanding the important information in your owner's manual; you will realize that you now own THE ULTIMATE RELAXATION MACHINE!

IMPORTANT SAFETY INSTRUCTIONS

When installing and using this electrical equipment, basic safety precautions should be observed including the following:

READ AND FOLLOW ALL INSTRUCTIONS

1. **WARNING.** To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.
2. **DANGER – RISK OF CHILD DROWNING.** Extreme caution must be exercised to prevent unauthorized access by children. To avoid accidents, insure that children cannot use a spa or hot tub unless they are closely supervised at all times.
3. A pressure wire connector is provided on the surface of the control box inside the spa to permit connection of a minimum No. 8 AWG solid copper bonding wire between this point and any metal equipment, metal enclosures of electrical equipment, metal water pipe or conduit within 5 feet (1.5M) of the unit.
4. **DANGER – RISK OF ELECTRIC SHOCK.** Install spa at least five (5) feet (1.5M) from all metal surfaces. A spa may be installed within five (5) feet (1.5M) of metal surfaces if, in accordance with the National Electrical Code, each metal surface is permanently connected by a No. 6 AWG (8.4mm) solid copper conductor attached to the wire connector on the terminal box. A grounding plug is provided for this purpose.
5. **DANGER – RISK OF INJURY.** The suction fittings in this spa are sized to match the specific water flow created by the pump. Should the need arise to replace the suction fitting or the pump be sure that the flow rates are compatible.

***NOTE:** Never operate the spa if the suction fittings are broken or missing. Never replace a suction fitting with one rated less than the flow rate marked on the original suction fitting.

6. **DANGER –** To reduce the risk of injury to persons, do not remove suction grate. Suction through drains and skimmers is powerful when the jets in the spa are in use. Damaged covers can be hazardous to small children and adults with long hair. Should any part of the body be drawn into these fittings, turn off the spa immediately. As a precaution, long hair should not be allowed to float in the spa.
7. Install spa so that water can be easily drained out of compartment containing electrical components so as not to damage equipment. Also, when installing spa, allow enough room to access for servicing.
8. **WARNING – TO REDUCE THE RISK OF INJURY:**
 - a. Always enter and exit a spa slowly.
 - b. Do not use the spa alone.
 - c. Before entering the spa, always measure the water temperature with an accurate thermometer. Tolerance of water temperature regulating devices can vary as much as plus/minus 5° F (3° C).
 - d. Persons suffering from obesity or with a medical history of heart disease, diabetes, high or low blood pressure or circulatory system problems should consult with their physician before using the spa.

- e. Since excessive water temperature has a high potential for causing fetal damage during early months of pregnancy, pregnant or possibly pregnant women should limit spa water temperatures to 100° F (38° C).
- f. Excessive water temperature can be dangerous. The water in the spa should never exceed 104° F (40° C). Water temperatures between 100° and 104° F are considered safe for a healthy adult. Lower water temperatures are recommended for extended use (exceeding 10 minutes) and for young children. Long exposures at higher temperatures can result in hyperthermia.

HYPERTHERMIA

Hyperthermia occurs when the internal temperature of the body reaches a level several degrees above the normal body temperature of 98.6° F.

THE SYMPTOMS OF HYPERTHERMIA INCLUDE:

- Dizziness
- Fainting
- Drowsiness
- Lethargy
- Increase in Internal Body Temperature

THE EFFECTS OF HYPERTHERMIA INCLUDE:

- Unawareness of Impending Hazard
- Failure to Perceive Heat
- Failure to Recognize the Need to Exit Spa
- Physical Inability to Exit Spa
- Fetal Damage in Pregnant Women
- Unconsciousness Resulting in a Danger of Drowning

- g. Children's body temperature can increase more rapidly than adults in the same water with elevated temperatures (above 99° F). Children should spend less time in water above body temperature than adults.
- h. The use of a spa while under the influence of alcohol, drugs and/or medication may lead to unconsciousness with the possibility of drowning.

***NOTE:** Persons on medication should consult with their physician before entering the spa since some medication may induce drowsiness while other medication may affect heart rate, blood pressure and circulation.

10. People with infections, sores or the like should not use the spa. Warm and hot water temperatures may allow the growth of infectious bacteria if not properly disinfected.
11. **DANGER – RISK OF ELECTRIC SHOCK.** Do not permit any electric appliance, such as a light, telephone, radio or television, within five (5) feet of the spa. Never operate any electrical appliances from inside the spa or while wet.
12. **WARNING – RISK OF SUFFOCATION.** If this spa is equipped with a gas heater, it is intended for outdoor use only, unless proper ventilation can be provided for an indoor installation.
13. **SAVE THESE INSTRUCTIONS.**

ELECTRICAL INSTALLATION REQUIREMENTS

HAVE YOUR ELECTRICIAN READ THE FOLLOWING INFORMATION BEFORE INSTALLATION BEGINS

Electrical connections made improperly, or the use of wire gauge sizes for incurring power which are too small, may continually blow fuses in the electrical equipment box, may damage the internal electrical controls and components, may be unsafe and in any case will void your warranty.

It is the responsibility of the spa owner to ensure that electrical connections are made by a qualified electrician in accordance with the National Electric Code and any local and state electrical codes in force at the time of installation. These connections must be made in accordance with the wiring diagrams found inside the control box. This equipment has been designed to operate on 60 HZ alternating current only, 240 volts are required. Make sure that power is not applied while performing any electrical installation. A copper bonding lug has been provided on the electrical equipment pack to allow connection to local ground points. The ground wire must be at least 6 AWG copper wire and must be connected securely to a grounded metal structure such as a cold water pipe.

All MasterSpas equipment packs are wired for 240 VAC only.

The only electrical supply for your spa must include a 50 AMP switch or circuit breaker to open all non-grounded supply conductors to comply with section 422-20 of the National Electrical Code. The disconnect must be readily accessible to the spa occupants, but installed at least five feet from the spa.

A Ground-Fault Circuit Interrupter (GFCI) must be used to comply with section 680-42 of the National Electrical Code. A ground fault is a current leak from any one of the supply conductors to ground. A GFCI is designed to automatically shut off power to a piece of equipment when a fault current is detected.

Power hook-up to the spa must be 240 volt AWG-3 – 6 copper wire. Route the cable into the equipment for final hook-up to terminals inside the control panel.

SITE PREPARATION/GENERAL GUIDELINES

Portable spa installation is simple when properly planned. To that end it is important that you read the following information carefully and consult with your MasterSpas dealer.

- 1) Access - The actual dimensions of your new spa will determine the amount of space that is needed in moving the spa from curbside to its final installation area. Be sure to measure side yard dimensions, gates or doors and vertical obstructions such as roof overhangs and overhead cables. Any other space limiting obstacles such as trees or shrubs must be evaluated.

If the spa is being installed indoors, dimension limitations such as stairs, ceilings and walls must be taken into consideration. Please have your MasterSpas dealer or delivery service review site or installation plans prior to delivery.

- 2) Surface/Pad Requirements - When your new spa is filled with water and bathers, it may weigh as much as several tons. It is imperative that the base beneath the spa can support the actual weight. The spa must be on a uniformly firm and continuous surface. The recommended foundation is a concrete pad with a minimum thickness of four (4) inches with steel reinforcement bars crossed throughout the pad.

IMPORTANT

When installing your spa indoors or on a wood deck or balcony, the same load requirements must be met. Total load may be as much as 75 pounds per square foot. Your MasterSpas dealer should be consulted or you should speak with a qualified contractor or your local building department. Be sure to locate your spa so that equipment remains above grade and is not subject to flooding.

The equipment side of the spa must be accessible in the event that future service is needed. Periodical maintenance checks require entry into the equipment bay. When possible, it is wise planning for the future to leave access to all sides of the spa in the event your spas plumbing requires maintenance. Your spa warranty does not cover the cost of providing access for service.

GENERAL CONSIDERATIONS FOR OUTDOOR INSTALLATION

Again, proper planning will increase your total enjoyment factor with your new spa. Listed below are some additional items to consider when planning your installation.

- How spa will complement landscaping and vice versa
- View from inside spa and view of spa from inside of home
- Exposure to sunlight and shading from trees
- Privacy
- Getting to spa from house and return
- Proximity to dressing rooms and bathrooms
- Storage for spa chemicals
- Local building codes (if applicable)
- Power cable (see electrical requirements)

GENERAL CONSIDERATIONS FOR INDOOR INSTALLATION

Installing your spa indoors creates an entirely different set of considerations. Here again, with proper planning, no matter what room your spa goes in, it will be your favorite room.

- Work with your MasterSpas dealer and contractor to insure all local building, electrical and plumbing codes are met
- Plan for a floor drain to drain off excess water or for draining and cleaning your spa
- A ventilation fan may be necessary due to high humidity created by your spa
- Finished material in your spa room should also be capable of withstanding increased humidity

INITIAL START-UP PROCEDURE

Now that all electrical connections to your new Master Spa are complete, start-up procedures may begin. This is the fun part!

CAUTION - DO NOT APPLY POWER TO OR OPERATE THE SPA WHEN THE SPA IS PARTIALLY FILLED OR THERE IS NO WATER IN THE SPA!

- 1) Be sure that the circuit breaker in you breaker panel is off.
- 2) Be sure all jets in the spa are fully open by turning the jet face counter-clockwise. The large Power Master Jets are opened by turning the jet face clockwise.
- 3) **LOCATE AND OPEN ALL VALVES.** *NOTE: There are two valves per pump.* Pump locations vary depending on model of spa.
- 4) Be sure drain fitting is fully closed.
- 5) Fill your new Master Spa with water. Fill to waterline, which is approximately three inches above bottom of filter/skimmer opening (*See "Filter Cartridge Diagram," Insert 4*).
- 6) Bleed air from system by briefly opening the external drain fitting then close. Turn breaker switches on. You may then press any of the spa function switches. After power has been applied for one minute your spa will automatically move into its pre-set filter cycle. (See operation section for further information.)

GLOSSARY OF SPA TERMINOLOGY

1. **NECK JETS**
2. **SHOULDER JETS**
3. **THERAPY JETS**
4. **MASTER BLASTER FOOT THERAPY JET**

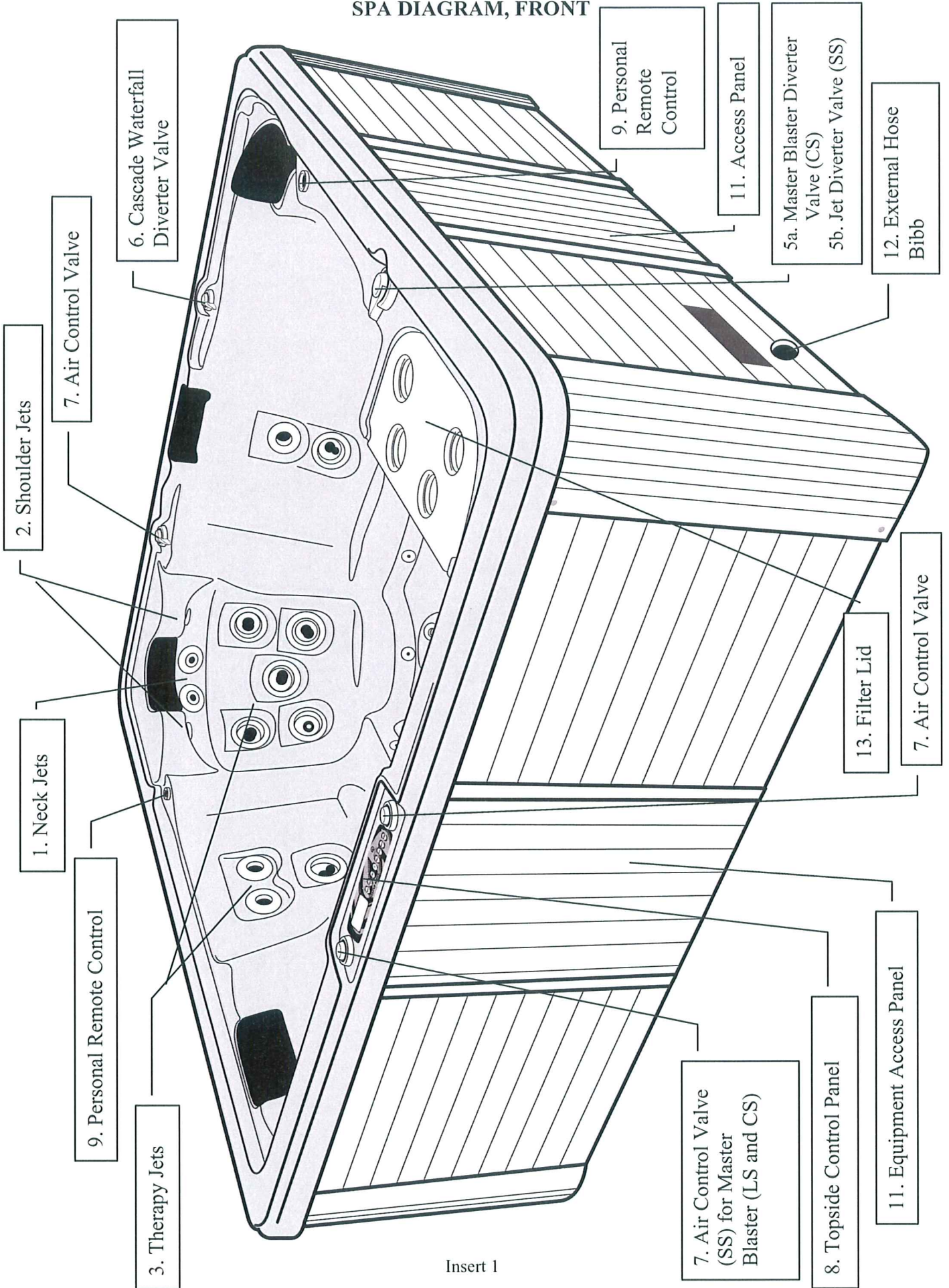
Your new Master Spa features a variety of jet styles. All jets, regardless of style return the water to the spa. Air is mixed with the water by using the air controls creating a gentle to most vigorous massage. Water flow is adjusted by simply turning the outer face of the jet. Your Master Spa will have a combination of pulsating, rotating, dual pulsating and directional adjustable jets. The LS and CS Series' feature the Master Blaster Foot Therapy System, which produces over 220 gallons per minute of soothing jet action.

- 5a. **MASTER BLASTER DIVERTER VALVE** – Located on the topside of the spa, this valve physically diverts the flow of water from one zone of the spa to another. To use the Master Blaster Jet, the Master Blaster Diverter Valve must be turned to the Master Blaster setting. Be sure to open the Master Blaster Air Control (7) for maximum velocity (*CS Models only*). NOTE: LS Model uses a fourth dedicated pump.
- 5b. **JET DIVERTER VALVE** – Located on the topside of the spa, this valve physically diverts the flow of water from one jet zone of the spa to another jet zone (*SS Model only*).
6. **CASCADE WATERFALL DIVERTER VALVE** – Located on the topside of the spa, this valve diverts water from the top jet in the cascade waterfall seat to provide soothing over the shoulder therapy. This feature is available in the LS Series only. A similar top mount valve operates the skimmer waterfall.
7. **AIR CONTROL VALVES** – These are located around the top of your spa. You may increase or decrease the velocity of your jets by opening or closing the air control valves. Typically, one dial controls the air to water ratio and mix to one group of jets. When not in use the air controls should be kept in the closed position, as air bubbles tend to cool the water.
8. **TOPSIDE CONTROL PANEL** – You may safely control all functions from inside or outside your spa using the Topside Control Panel. This Panel is used to control the water temperature, pumps, the spa light, automatic filtration cycles and other advanced functions. The digital display will give you a constant temperature readout and will notify you in case of certain malfunctions. Several user programmable functions are also available.
9. **PERSONAL REMOTE CONTROL** – The LS Series and CS Series spas have additional remotes which allow the user to control the jet therapy while remaining in his/her seat. By pressing the control one time, you will activate low speed. Press the pad again for high speed and again to turn it off.
10. **EQUIPMENT ACCESS PANEL** – Located behind the door below the Topside Control Panel, this area houses the major components responsible for the spas operation. Those components include the pumps, heater, control panel box and ozonator (if applicable).
11. **ACCESS PANELS** – These are located on all four sides of the spa within the cabinetry. All of the panels are removable should service be required.
12. **EXTERNAL HOSE BIB** – This device simply pulls away from your spa cabinet and is connected to a dedicated drain line used for draining your spa. By attaching a garden hose and opening the drain-fitting valve, you are able to quickly drain your spa.
13. **FILTER LID** – Your filter lid will serve to prevent major objects from entering your filter area and possibly damaging your filter elements which are located under the filter lid. These filter elements are designed to remove small debris and oils from your spa water.
14. **WEIR GATE** – The weir gate is the horizontal door located in front of the filter that traps debris and contains it in the filter area.

-
15. **SPA LIGHT** – Your spa light is designed for safety and is located in the interior wall of your spa. The on/off switch is located on the topside of the control panel. Colored lenses may be installed over the clear lens and simply snap into place.
 16. **SERIAL NUMBER AND WARNING LABELS** – The serial number given to your spa will be located within the Filter bay and will be needed when communicating with your dealer or our service technicians. The serial number is also located on the U.L. plate attached to the outside of the Equipment Access Panel.
 17. **EQUIPMENT CONTROL SYSTEM** – This Control bay houses the wiring electrical components necessary to operate the control system.
 18. **SPA HEATER** – This element is a 5.5 kW-220v electric heater, thermostatically controlled and equipped with a high-limit temperature safety shut-off switch. The high-limit switch cannot be reset until the temperature within the heater assembly drops several degrees below the shut-off temperature of 112° F. Should the high-limit switch trip repeatedly, contact your dealer or qualified service representative to diagnose the problem.
 19. **SLICE VALVES** – These valves are used by service personnel to shut off water to the heater, main pump system and secondary pump system.

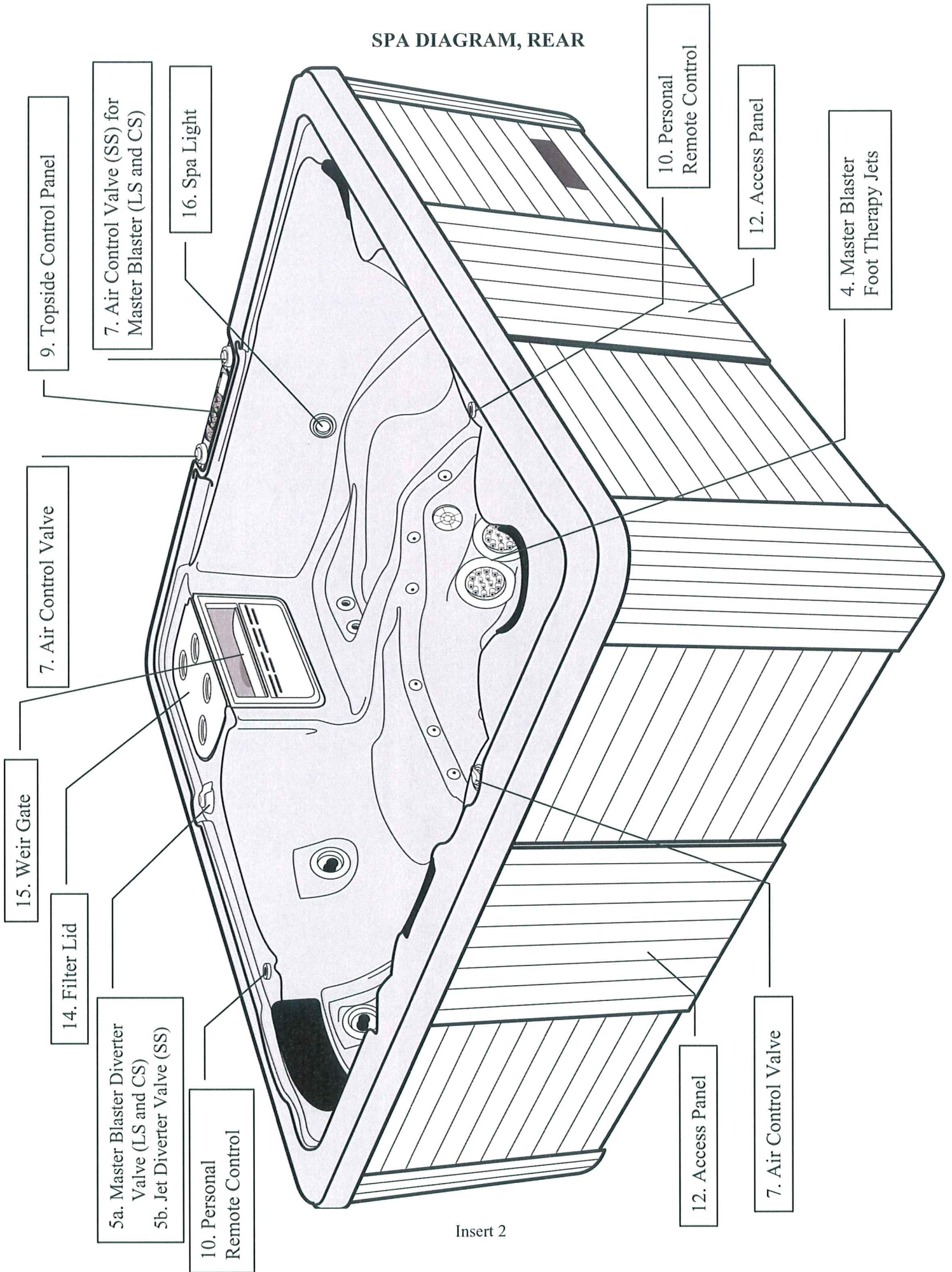
*NOTE – Slice valves must be completely open during normal operations.
 20. **MAIN PUMP** – This produces water flow through the main jets in the spa. The first pump may be operated on two speeds. Low speed will produce efficient water circulation during filtration and gentle jet action. High speed should be used for maximum jet action. The main pump is controlled by the “*Therapy I*” button on the Topside Control Panel or by using the Personal Remote Control next to the reverse molded neck therapy seat (LS and CS Series only).
 21. **SECONDARY PUMP** – This produces water flow through the other jet system in the spa (LS and CS Series only). The second pump operates similar to the main pump and is controlled by the “*Therapy II*” button on the Topside Control Panel or by using the Personal Remote Control next to the Aqua Pressure Seat (LS Series only).
 22. **CIRCULATION PUMP** – This produces water flow through the heater in the spa and provides the water flow necessary to actuate the ozone generator. This fractional HP pump runs silently for 24 hours of efficient filtration and heating. This is a standard feature on the LS Series and optional on the CS Series.
 23. **PUMP UNION** – These are used by service personnel to easily service the pumps.
 24. **HEATER UNION** – These are used by service personnel to easily service the heater.
 25. **OZONATOR** – Your ozonator will operate in conjunction with your filtration system and circulation pump. It will deactivate when any other control function is manually activated and will reactivate after one hour of inactivity. This is a standard feature on the LS Series.
 26. **SPA LIGHT** – Bulb replacement access may be found within the Equipment Control bay area. (See LIGHT BULB REPLACEMENT for additional information)

SPA DIAGRAM, FRONT

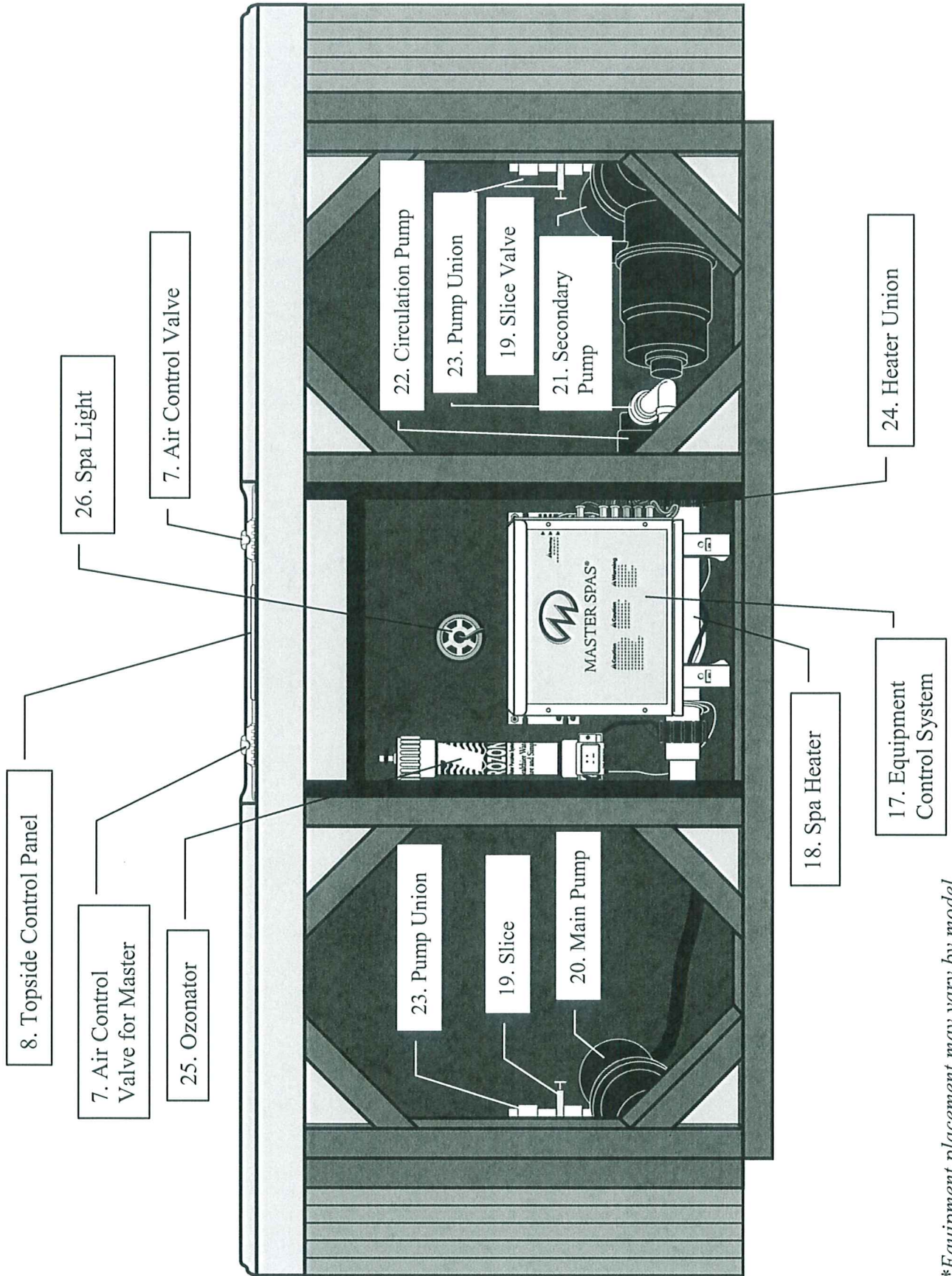


Insert 1

SPA DIAGRAM, REAR

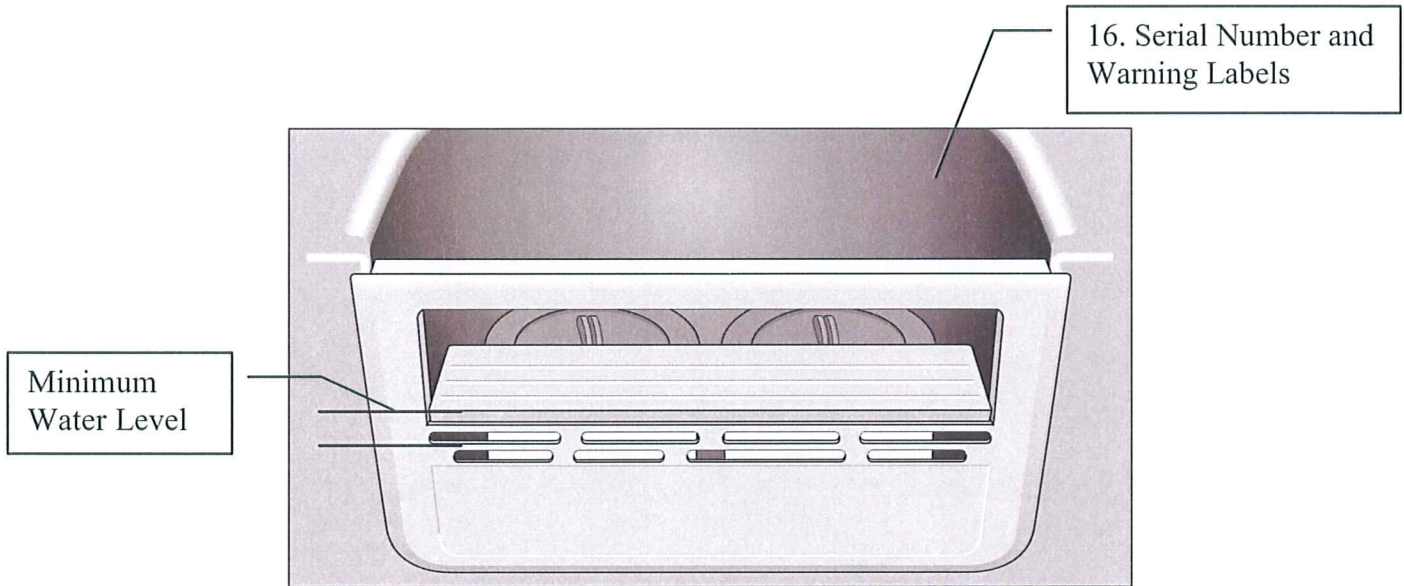


FRONT PANEL CUTAWAY



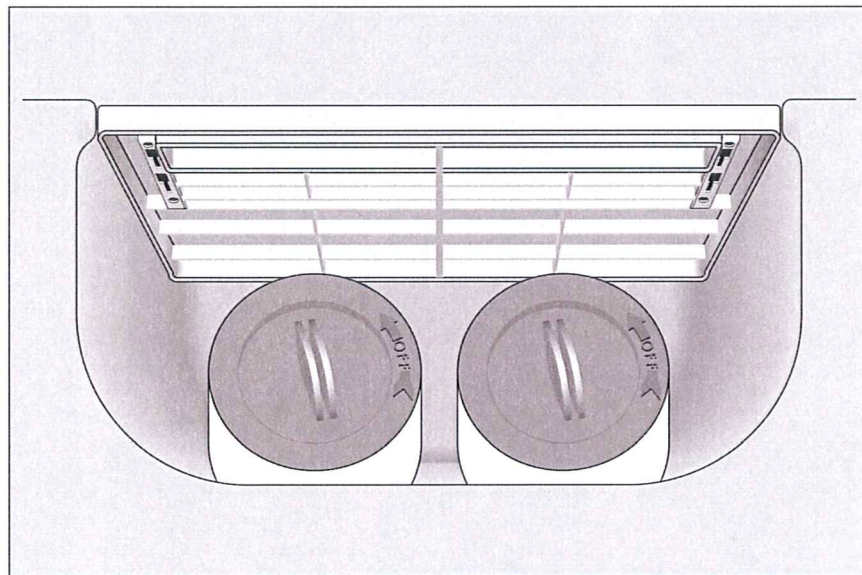
**Equipment placement may vary by model.*

FILTER CARTRIDGE DIAGRAM



FILTER, FLOATING WEIR STYLE CARTRIDGE

The filter elements are located under the filter lid. The filters remove dirt, oil and fine particles from your spa's water. The floating weir gate traps surface oils and debris containing them in the filter area.



To service and clean your filter elements, turn counter-clockwise 6-8 revolutions. To reinstall, turn clockwise 6-8 revolutions. For more complete instruction, see *"To Clean Your Filter Elements,"* p. 19.

THE LEGEND SERIES

(LS 1050, LS 850, LS 800, LS 750, LS 700, LS 650)

Your spa's Topside Control Panel consists of two main parts. The control pads operate individual functions and allow for several programming modes. The scrolling Liquid Crystal Display (LCD) displays prompting or convenience messages along with diagnostic messages.



PROGRAMMING THE SCROLLING MESSAGE CENTER

Your Topside Control Panel is virtually a scrolling message center and is the most advanced in the industry and can virtually walk you through customizing your spa to your exact needs.

When your spa is first powered up, it will automatically default into the programming mode. If, within five (5) seconds, you do not proceed with the spa programming, the spa will automatically exit the programming sequence and revert to the pre-set factory default settings.

To **initiate** the programming sequence at any time, press the "Program" pad and then press the "Mode" pad. By continually pressing the "Program" pad, you can scroll through the programmable features. To **exit** the programming sequence at any time, press the "Mode" pad.

PROGRAM PAD

This pad is used to initiate the time setting, filter programming, and other programmable features.



MODE/ENTER PAD

This control pad switches the spa operation between the Economy and Standard modes. In the Economy mode, the spa will only heat during the secondary filter mode. In the Standard mode, the spa will automatically heat to and maintain the set temperature. This pad is also used in helping to initiate and/or exit any programming sequence at any time.



LIQUID CRYSTAL DISPLAY

The Liquid Crystal Display or LCD continuously shows the operating status of the spa, as well as the various monitoring functions, self-diagnostics and programming information.

SETTING THE TIME

Upon power initiation, or after pressing the "Program" pad and then pressing the "Mode" pad, the top line of the LCD will read **SET CLOCK**. Press the "Up" or "Down" pads to engage the clock, press them again to start the time-setting cycle, and press either pad a third time to stop the time-setting cycle. After pressing either pad once, the time will advance or decrease automatically in one-minute increments. (The time will change one minute every second for the first 10 seconds, and then start advancing or decreasing very rapidly.)



After reaching the correct time, press the "Up" or "Down" pad again to set the time or make further adjustments. The pre-set factory default is 11:59 am. Pressing the "Program" pad will set the time and exit the time-setting mode. You will then be prompted to set the filter start time.

FILTER START TIME

After setting the time of day, the top line of the LCD will read **SET FILTER TIME**. Press the “Up” or “Down” pads to engage the clock and press them again to set the time that the first filter cycle will start. When your desired filter cycle start time is set in the LCD display, press the “Program” pad to continue. The pre-set factory default is 12:00 pm to 1:00 pm repeating every 12 hours unless the number of filter cycles per day has been changed. During a filter cycle, the bottom line of the LCD will read **SPA FILTERING – JETS1 ACTIVATED**. During the filter cycle, “Therapy I” will automatically activate at low speed.



FILTER CYCLE DURATION

After setting the filter cycle start time, the top line of the LCD will read **CYCLE DURATION**. Press the “Up” or “Down” pads to toggle from 0 to 60 to 90 to 120 to 150 to 180 minutes. The first 5 minutes of the filter cycle will be at high speed and the remaining time at low speed. When your desired filter cycle length appears in the LCD, press the “Program” pad to select it. The pre-set factory default is 60 minutes.



NUMBER OF FILTER CYCLES

After setting the length of the filter cycle, you will be prompted to set the number of filter cycles. The top line of the LCD will read **SET # OF CYCLES**. Press the “Up” or “Down” pad to toggle from 1 to 2 to 3 to 4 cycles per day. When your desired number of cycles appears on the LCD, press the “Program” pad to select it. The pre-set factory default is 2 cycles per day.



CAUTION: Long and/or numerous filter cycles could cause overheating of the spa – especially in hot climates.

PUMP RUN TIME

After setting the number of filter cycles, the top line of the LCD will read **PUMP RUN TIME**. Press the “Up” or “Down” pads to toggle from 30 to 45 to 60 minutes. When your desired number of minutes appears on the LCD, press the “Program” pad to select it. This sets the length of time the pump will run when a “Therapy” pad is pressed. For example, if you choose 45 minutes, each time you press a “Therapy” pad, the pump will run for 45 minutes before shutting down automatically. The pre-set factory setting is 30 minutes.



TEMPERATURE CONTROLS

Your spa will maintain the water temperature for whatever it is programmed. It has been factory set at 100°F. When either the “Up” or “Down” pads are touched once, the bottom line of the LCD will read **SET TEMP XXX° F** thereby changing the set temperature of the spa. When the spa is in a heating mode, the top line of the LCD will read the current temperature and the bottom line will read **SPA HEATING TO XXX° F**.



THERAPY CONTROLS

The Legend Series is equipped with four pumps. Three of them control your Power Master jet system while the fourth is exclusively for maintaining heat and crystal clear filtration. Two of your jet pumps operate on either low or high speed and controls its own bank of jets.



The “Therapy I”, “Therapy II”, and “Therapy III” control pads operate the pumps. When any “Therapy” control pad is pressed, the spa jet pump is energized, the respective yellow LED indicator light will be dimly illuminated and the pump speed will be indicated on the lower line of the LCD display. Each time a “Therapy” control pad is pressed, it will activate a 30-minute, programmable, automatic shut-off cycle. This auto shut-off cycle is a safety device and also allows for convenient filtration immediately after use of the spa.

The first time a "Therapy I" or "Therapy II" control pad is pressed, the respective pump will energize on low speed. When the same control pad is pressed again, the pump will energize on high speed. The third time the same control pad is pressed, the pump will turn off. "Therapy III" pump will energize on high speed only, powering the dual Master Blaster jets. The second time it is pressed the pump will shut off.

4Also, as a safety feature your spa is equipped with "Freeze Protection." Should the water temperature drop to 40° F, the pump will activate to protect the system from freezing. It is recommended that if you are going to be away from your spa for a long period of time during unusually cold weather that you contact your MasterSpas dealer for proper winterizing details or see the section "Winterizing Your Spa."

PERSONAL REMOTE CONTROLS

Your spa is equipped with two remotes, one for each pump. This allows you to control pump functions without moving to the opposite side of the spa.



SPA LIGHT

The spa light is controlled by the pad labeled "Light". Press this pad once to activate the interior light. Press this pad two times to deactivate this function. The light will automatically shut off after four (4) hours of operation. To reactivate, press the button again.



OZONE MANAGEMENT SYSTEM

Your Ozone Management System will operate in conjunction with the filtration cycle and circulation pump. It will deactivate when any other control function is operating. It will then reactivate after one hour of inactivity.

FIBER OPTIC LIGHT OPTION

For the deluxe 24 light system, press the "Light" control pad once to activate the fiber optic light and color wheel. Pressing the pad a second time will stop the color wheel on a color choice and a third time will turn the light off. For the 12 light system, press the "Light" control pad to activate the fiber optic system. Pressing the pad a second time will turn the light off. On this there is no option for stopping the color wheel. The light will automatically shut off after four (4) hours of operation. To reactivate, press the button again.



INSTRUCTIONS PERTAINING TO A RISK OF FIRE, ELECTRIC SHOCK, EXPOSURE TO EXCESSIVE UV RADIATION, OR INJURY TO PERSONS.

IMPORTANT SAFETY INSTRUCTION SAVE THESE INSTRUCTIONS

LIGHTED LAMP IS HOT!

WARNING – TO REDUCE THAT RISK OF FIRE, ELECTRIC SHOCK, EXPOSURE TO EXCESSIVE UV RADIATION, OR INJURY TO PERSONS.

- 1) Turn off /unplug and allow to cool before replacing bulb.
- 2) Bulb gets hot quickly.
- 3) Do not look directly at lighted bulb.
- 4) Use only with a 75 W or smaller bulb.
- 5) Handle lamp by reflector only. Do not touch bulb at any time. Use a soft cloth.
- 6) Do not operate the unit with missing or damaged guard, lamp containment barrier or UV filter.

LS SERIES PROMPTING OR CONVENIENCE MESSAGES

Because of the advanced programming features of your scrolling display, your spa will prompt you when you need to perform routine maintenance. For example:

CHECK WATER –

First line reads – CHECK WATER

Second line reads – CHECK WATER CHEMISTRY – PUSH MODE TO RESET

This message will turn on every seven (7) days.

RINSE FILTERS

First line reads – DIRTY FILTER

Second line reads – REMOVE FILTER AND RINSE WITH HOSE – PUSH MODE TO RESET

This message will turn on every thirty (30) days.

CLEAN FILTERS

First line reads – DIRTY FILTER

Second line reads – REMOVE FILTER AND CLEAN IN SOLUTION – PUSH MODE TO RESET

This message turns on every sixty (60) days.

CHANGE WATER –

First line reads – CHANGE WATER/N2

Second line reads – TURN POWER OFF – DRAIN AND REFILL SPA – PUSH MODE TO RESET

This message will turn on every ninety (90) days.

LS SERIES DIAGNOSTIC MESSAGES

LOW FLOW –

First line reads – LOW FLOW

Second line reads – CHECK WATER LEVEL – CLEAN FILTER

Action Required:

- 1) Check the water level to see if it is too low. If the water level is too low, fill the spa to one or two inches above the bottom of the tile line.
- 2) If you are using a Nature² filter cartridge or Frog sanitization system make sure that it is clean and not impeding the flow of the water. If the filter is dirty, clean it and reinstall.
- 3) A flow switch has malfunctioned. The spa will operate but the heater will not activate. Contact your local authorized MasterSpas dealer or authorized service center.

FLOW SENSOR –

First line reads – FLOW SENSOR

Second line reads – CALL FOR SERVICE

Action Required:

When FLOW SENSOR is displayed on the LCD, the flow switch has malfunctioned. Contact your local authorized MasterSpas dealer or authorized service center.

HIGH LIMIT SENSOR –

First line reads – HIGH LIMIT SENSOR
Second line reads – CALL FOR SERVICE

Action Required:

When HIGH LIMIT SENSOR is displayed on the LCD, the high limit sensor is non-functional. Contact your local authorized MasterSpas dealer or authorized service center.

TEMP SENSOR –

First line reads – TEMP SENSOR
Second line reads – CALL FOR SERVICE

Action Required:

When TEMP SENSOR is displayed on the LCD, the water temperature sensor is non-functional. Contact your local authorized MasterSpas dealer or authorized service center.

COOLING –

First line reads – COOLING

Action Required:

When COOLING and the water temperature are displayed on the LCD, the water temperature has reached 2° above the set temperature. The circulation pump and ozone generator will turn off to allow the water to cool back to the set temperature. This is a normal spa function. No corrective action is necessary.

NOTE: The circulation pump and ozone generator will be on while either jet pump is on and they will remain on for 30 minutes after the pump(s) turn off regardless of the water temperature.

NOTE: The MasterSpas Scrolling Message Center is equipped with a 30-day battery back up to preserve program settings during power outages. This battery back up will not provide power to heat or operate the spa.

ICE –

First line reads – ICE xxx° F
Second line reads – FREEZE PROTECTION – PUMPS ACTIVATED

Action Required:

When ICE and the water temperature are displayed on the LCD, the high limit sensor reads below 40° F at the heater element, and the system is at a freeze condition. It will then automatically activate the pump to circulate water. This is a normal spa function. No corrective action is necessary.

OVERHEAT –

First line reads – OVERHEAT xxx° F
Second line reads – REDUCE HEAT – CHECK WATER TEMPERATURE BEFORE ENTERING

Action Required:

When OVERHEAT along with the water temperature of the spa is displayed on the LCD, the spa is in a high limit condition. In such a condition – DO NOT ENTER THE WATER. If this happens, remove the spa cover and allow the water to cool below 106° F, then push any pad on the upper control and the system will reset. If the problem recurs, turn off all power to the spa and contact your local authorized MasterSpas dealer or authorized service center.

THE CENTURY SERIES

(CS 850, CS 800, CS 750, CS 700, CS 650)

Your spa's Topside Control Panel consists of two main parts. The control pads operate individual functions and allow for several programming modes. The Liquid Crystal Display (LCD) displays constant temperature and will monitor various functions.



AUTOMATIC OPERATION

The Century Series has been designed so that by simply connecting the spa to its power source, the spa will automatically maintain a temperature of 100° F (37.7° C) and all user controls will be completely functional. The spa will automatically turn the main pump on low speed to filter and circulate the water for four (4) hours, twice per day.

TEMPERATURE CONTROLS

Your spa will maintain the water temperature for whatever it is programmed. It has been factory set at 100°F. When either of these pads are touched once, the LCD will display the desired temperature setting, indicated by an "up" arrow on the display. Each time either of pads are touched again, the set temperature will increase or decrease depending on which pad is pressed. After three (3) seconds, the LCD will automatically display the actual spa temperature.



THERAPY CONTROLS

The Century Series is equipped with two dual speed pumps. Both pumps operate on either high or low speed and in any combination. You will notice that each pump operates its own bank of Power Master Jets. Pressing the "Therapy I" and "Therapy II" control pads once will turn the corresponding pump on low speed. Press again for high speed and once more to turn it off. You may operate your spas jet pumps in any combination you desire.



As a safety feature, your system has been designed to shut off after a specified time period. This will occur after the spa has been running for 30 minutes on high speed or after 60 minutes on low speed. To reactivate the pump(s) simply press the "Therapy" pads again.

Also, as a safety feature your spa is equipped with "Freeze Protection." Should the water temperature drop to 40° F, the pump will activate to protect the system from freezing. It is recommended that if you are going to be away from your spa for a long period of time during unusually cold weather that you contact your MasterSpas dealer for proper winterizing details or see the section "Winterizing Your Spa."

PERSONAL REMOTE CONTROL

Your spa is equipped with one remote to operate "Therapy I". This allows you to control pump functions without moving from your seat.



FILTRATION

Your Master Spa is designed to automatically filter twice each day through low speed on the main therapy pump. The first cycle will begin one minute after the spa is energized. The second daily cycle will begin twelve (12) hours later. The length of each cycle period is preset at two (2) hours. It may be reset for zero, one, two, four or six hour increments via the Topside Control Panel.

To program the filter cycle:

- ⇒ Press the “Up” or “Down” pad
- ⇒ Press the “Therapy I” pad
- ⇒ Press “Up” or “Down” to desired filtration cycle time
- ⇒ Press “Therapy I” to exit
- ⇒ The LCD will revert to current temperature



SPA LIGHT

The spa light is controlled by the pad labeled “Light”. Press the pad once for on and again for off. The light will automatically shut off after two (2) hours of operation. To reactivate, press the button again.



OZONE MANAGEMENT SYSTEM (OPTIONAL)

Your Ozone Management System will operate whenever the spa is in its normal filtration cycle.

LCD ERROR INDICATOR

Your LCD Topside Control Panel will readout the following if any problems are detected:

1. **OH** – “Overheat Protection” (Spa is deactivated)
TRANSLATION: If for any reason the spa water reaches 112° F (44° C), the system will completely shut down. **DO NOT ENTER THE WATER.** If overheating occurs repeatedly, turn off all power to the spa and contact your dealer or qualified service organization.

***NOTE:** Overheating may occur if you set the main pump to operate for a long period of time, particularly during hot weather. If this happens, remove the spa cover and allow the water to cool below 104° F (40° C). Press any button on the Topside Control Panel to reset the system.
2. **FLO** – “Flow/pressure switch”
TRANSLATION:
Constant – The pressure switch has malfunctioned. Contact your dealer or qualified service organization.
Flashing – The pressure through the heater is inadequate. Check the spa water level, the filter for dirt or scale, and the skimmer basket and suction fittings for any obstructions.
3. **COOL** – “Temperature set back”
TRANSLATION: If the spa water is more than 20° F (6° C) cooler than the temperature set point, the heater will automatically activate to provide freeze protection. This is a normal spa function; no corrective action is necessary.
4. **ICE** – “Freeze Protection”
TRANSLATION: If a freeze condition is detected, both pumps are automatically activated. This is a normal spa function; no corrective action is necessary.
5. **SN 1** – “Open sensor 1”
TRANSLATION: The high-limit temperature sensor is non-functional. Contact your dealer or qualified service organization for repair.
6. **SN 3** – “Open sensor 3”
TRANSLATION: The main temperature sensor is non-functional. Contact your dealer or qualified service organization for repair.

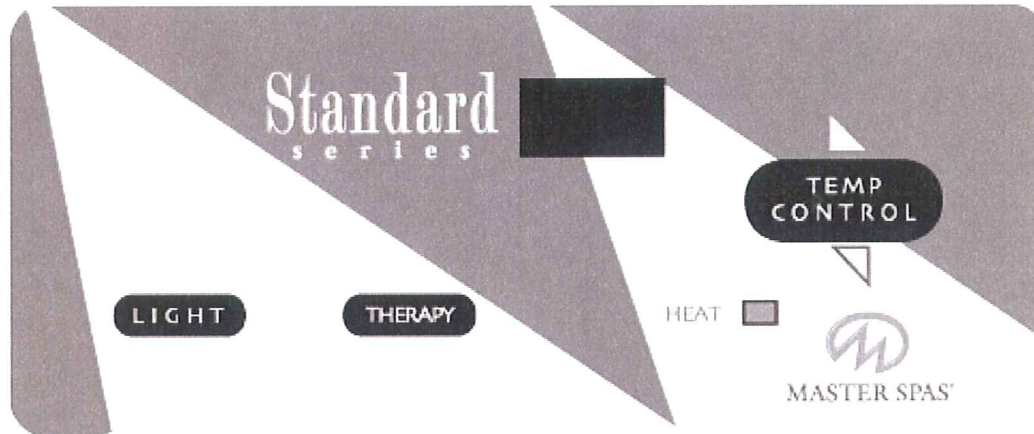
WARNING – THERE IS A SHOCK HAZARD AND THERE ARE NO USER SERVICEABLE PARTS.

Do not attempt service of this control. Contact your dealer or service organization for assistance. Follow all owner’s manual power connection instructions. Installation must be performed by a licensed electrician, and all grounding connections must be properly installed.

THE STANDARD SERIES

(SS 650S, SS 570)

Your spa's Topside Control Panel consists of two main parts. The control pads operate individual functions and allow for several programming modes. The Liquid Crystal Display (LCD) displays constant temperature and will monitor various functions.



AUTOMATIC OPERATION

The Standard Series has been designed so that by simply connecting the spa to its power source, the spa will automatically maintain a temperature of 100° F (37.7° C) and all user controls will be completely functional. The spa will automatically turn the main pump on low speed to filter and circulate the water for four (4) hours, twice per day.

TEMPERATURE CONTROLS



Your spa will maintain the water temperature for whatever it is programmed. It has been factory set at 100°F. Temperature adjustment is controlled by pushing the "Temp Control" button. The display shows the actual water temperature unless the pad is pressed. When the pad is pressed, the display will show the set temperature. Pressing the pad a second time will cause the set temperature to increase or decrease depending on what direction was last chosen. Each successive press will change the set temperature in the same direction.

If the opposite direction is desired, release the pad and let the display revert to the actual water temperature again. Press the pad to display the set temperature, and again to make the temperature change in the desired direction.

THERAPY CONTROLS



The Standard Series is equipped with a dual speed pump which operates on either high or low speed. Pressing the "Therapy" pad once will turn the pump on low speed. Press again for high speed and once more for off.

As a safety feature, your system has been designed to shut off after a specified time period. This will occur after the spa has been running for 30 minutes on high speed or after 60 minutes on low speed. To reactivate the pump simply press the "Therapy" pad again.

Also, as a safety feature your spa is equipped with "Freeze Protection." Should the water temperature drop to 40° F, the pump will activate to protect the system from freezing. It is recommended that if you are going to be away from your spa for a long period of time during unusually cold weather that you contact your MasterSpas dealer for proper winterizing details or see the section "Winterizing Your Spa."

FILTRATION

Your Master Spa is designed to automatically filter twice each day through low speed on the main therapy pump. The first cycle will begin one minute after the spa is energized. The second daily cycle will begin twelve (12) hours later. The length of each cycle period is preset at three (3) hours. It may be reset for one, two, three, five or seven hour increments via the Topside Control Panel.

To program the filter cycle:

- Press the “Temp Control” pad
- ⇒ Press the “Therapy” pad
- ⇒ Press “Temp Control” to desired filtration cycle time
- ⇒ Press “Therapy” to exit
- ⇒ The LCD will revert to current temperature



SPA LIGHT



The spa light is controlled by the pad labeled “Light”. Press the pad once for on and again for off. The light will automatically shut off after two (2) hours of operation. To reactivate, press the button again.

OZONE MANAGEMENT SYSTEM (OPTIONAL)

Your Ozone Management System will operate whenever the spa is in its normal filtration cycle.

LCD ERROR INDICATOR

Your LCD Topside Control Panel will readout the following if any problems are detected:

1. **OH** – “Overheat Protection” (Spa is deactivated)
TRANSLATION: If for any reason the spa water reaches 112° F (44° C), the system will completely shut down. **DO NOT ENTER THE WATER.** If overheating occurs repeatedly, turn off all power to the spa and contact your dealer or qualified service organization.
***NOTE:** Overheating may occur if you set the main pump to operate for a long period of time, particularly during hot weather. If this happens, remove the spa cover and allow the water to cool below 104° F (40° C). Press any button on the Topside Control Panel to reset the system.
2. **FLO** – “Flow/pressure switch”
TRANSLATION:
Constant – The pressure switch has malfunctioned. Contact your dealer or qualified service organization.
Flashing – The pressure through the heater is inadequate. Check the spa water level, the filter for dirt or scale, and the skimmer basket and suction fittings for any obstructions.
3. **COOL** – “Temperature set back”
TRANSLATION: If the spa water is more than 20° F (6° C) cooler than the temperature set point, the heater will automatically activate to provide freeze protection. This is a normal spa function; no corrective action is necessary.
4. **ICE** – “Freeze Protection”
TRANSLATION: If a freeze condition is detected, both pumps are automatically activated. This is a normal spa function; no corrective action is necessary.
5. **SN 1** – “Open sensor 1”
TRANSLATION: The high-limit temperature sensor is non-functional. Contact your dealer or qualified service organization for repair.
6. **SN 3** – “Open sensor 3”
TRANSLATION: The main temperature sensor is non-functional. Contact your dealer or qualified service organization for repair.

WARNING – THERE IS A SHOCK HAZARD AND THERE ARE NO USER SERVICEABLE PARTS.

Do not attempt service of this control. Contact your dealer or service organization for assistance. Follow all owner’s manual power connection instructions. Installation must be performed by a licensed electrician, and all grounding connections must be properly installed.

MAINTENANCE RECOMMENDATIONS

Your spa requires periodic draining and cleaning to ensure a safe, healthy environment. It is recommended that you clean your spa every 60-90 days. Heavy bather load will require cleaning a more often.

TO DRAIN YOUR SPA

- Turn off power at breaker box.
- Pull out the drain valve located on the exterior wall of the cabinet.
- Turn the black knob counter-clockwise.
- Attach a garden hose and turn the valve counter-clockwise to open and drain.

TO CLEAN YOUR SPA SURFACE

- With a soft cloth, wipe down the spa surface with a non-abrasive cleaner such as “409,” “Fantastik” or equivalent. Do not use paper towels.
- If your spa has developed an oily or chalky residue at the waterline it may require special treatment. Consult your dealer.

TO REFILL YOUR SPA

- Be sure to close the drain valve located on the exterior cabinet wall.
- Be sure all valves are fully opened located next to the pump(s).
- Fill the spa with water. Be sure water level is above skimmer opening.
- Refer to “*Initial Start-Up Procedure*” section with any questions.

TO CLEAN YOUR FILTER ELEMENTS

The filter in your spa is one of the most important components of your spa. It not only is essential for clean water, but also for extending the life of the spa equipment. Your filter elements must be cleaned regularly (once a month on average) with normal spa use. With heavy use, they will need to be cleaned more often.

- Turn spa off.
- Remove filter element(s) by turning counter-clockwise 6-8 revolutions.
- With a garden hose, spray each element under pressure. Periodically, the elements need to be soaked in a filter cleaner compound. Check with your MasterSpas dealer for details on cleaning and/or filter replacement recommendations.
- Be sure to remove any debris from between filter pleats.
- Replace filter elements.
- Be sure water level is adequate.
- Turn spa on and refer to “*Initial Start-Up Procedure*” with any questions.

CARE OF YOUR SPA PILLOWS

- Your spa pillows need to be rinsed periodically to remove any chemical residue. This should help to eliminate pillows becoming stiff and discolored.
- If spa is not to be used for a period of time pillows should be removed. Pillow life will be extended

CARE OF YOUR SPA COVER

Always cover your spa when not in use. This will greatly reduce energy consumption and will cause spa water to heat more rapidly. Water loss and chemical usage will also be reduced.

- Do not allow spa to sit uncovered in direct sunlight. This may cause damage to exposed surfaces of spa.
- Periodically hose off both sides of spa cover for maximum life of cover.

NOTE: IF YOUR SPA IS GOING TO BE LEFT EMPTY FOR PROLONGED PERIODS, DO NOT REPLACE COVER DIRECTLY ON SURFACE OF SPA. PLACE 2"-3" BLOCKS BETWEEN COVER AND SPA. THIS ALLOWS FOR ADEQUATE VENTILATION OF COVER AND SPA.

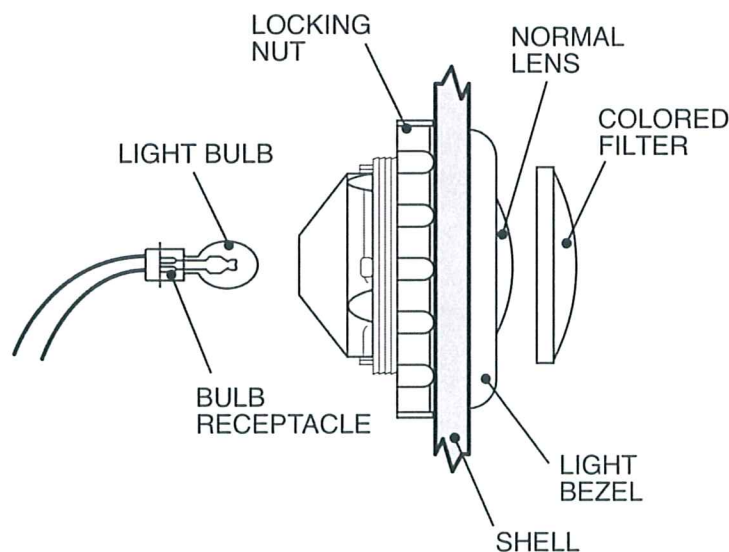
CARE OF YOUR SPA CABINET

Your quality spa cabinet is produced from hand-crafted cedar. It has been factory treated with a stain/sealer to maintain its appearance and to preserve its life. Several times a year (especially if located outdoors) it is recommended that your cabinet be re-treated. Your local dealer or service center can recommend the appropriate product based on your cabinet finish. Periodically, remove dust, dirt and grime with clean water.

If your spa has the DuraMaster Polymer Skirt option it just needs to be hosed off periodically. No other maintenance is required.

LIGHT BULB REPLACEMENT

Replacing a light bulb in your spa is not difficult. Access to the light fixture is through your equipment door and behind the electrical panel box. Simply twist (turn counter clockwise) the holding fixture and remove. The bulb will then pull loose. Replace with new 12 volt bulb (available through your dealer). Reverse process for fixture replacement.



WINTERIZING YOUR SPA

Many people find they enjoy using their spa more in the winter than any other time. Your spa is designed to be used year round in any type of climate.

However, if you decide you don't want to use your spa in the winter, you must drain it and follow the winterizing steps listed below:

NOTE: FAILURE TO WINTERIZE YOUR SPA COULD CAUSE FREEZE DAMAGE TO YOUR PLUMBING WHICH WILL VOID YOUR WARRANTY. FOLLOW THESE STEPS CAREFULLY.

- 1) Drain your spa completely using the drain valve (see *"To Drain Your Spa"*) or use an inexpensive submersible pump that you can buy from your dealer or your local hardware store.
- 2) Use a shop vac to get all standing water out of your unit.
- 3) Remove access panels from equipment area.
- 4) Loosen all pump unions
- 5) Remove square winterizing plug from the face of the pump.
- 6) Using your shop vac in a blowing mode, insert the hose into the nozzle of each jet and blow the trapped water from the lines into the interior of the spa.
- 7) After this is completed, use the shop vac to remove any standing water in the spa and in the equipment area.
- 8) Clean the spa with a soft cloth and a non-abrasive cleaner (409, Fantastik, Glass Plus, etc.).
- 9) Replace access panels.
- 10) Cover spa to prevent water from entering the spa.

CHEMICAL MAINTENANCE

GUIDELINES

There are certain variables to proper chemical application in spas. This information, as it states, is to be used as a general guideline. Your spa dealer or service center will assist you with properly detailed recommendations and instructions.

NOTE: IT IS IMPERATIVE THAT pH, TOTAL ALKALINITY AND CALCIUM HARDNESS LEVELS BE PROPERLY MAINTAINED. FAILURE TO MAINTAIN PROPER LEVELS WILL DAMAGE YOUR SPAS EQUIPMENT AND MAY VOID YOUR WARRANTY.

SAFETY CONSIDERATIONS

- ⇒ Always follow the manufacturer's instructions with any chemical application.
- ⇒ If you are to dilute a chemical, always add the chemical to the water, never the water to the chemical.
- ⇒ DO NOT EVER MIX TWO CHEMICALS TOGETHER.
- ⇒ Avoid contact with skin.
- ⇒ Always add chemicals with pump in operation. Leave pump running for 30 minutes.

NOTE: USING A GOOD CHEMICAL TEST KIT RECOMMENDED BY YOUR DEALER IS ESSENTIAL FOR PROPER WATER CARE. ALSO, CHANGING YOUR WATER ON A REGULAR BASIS IS A VERY INEXPENSIVE CHEMICAL TREATMENT.

ADDITIONAL INFORMATION / RECOMMENDATIONS

CHEMICAL ADDITIVE BENCHMARKS

◆ Sanitizer	2.0 - 3.0 PPM free available Chlorine or 4.0 - 6.0 PPM Bromine
◆ pH	7.4 - 7.6
◆ Shock Treatment	Weekly/consult your dealer
◆ Total Alkalinity	120 - 150 PPM
◆ Calcium Hardness	180 - 250 PPM

SANITATION

Sanitation is the process of killing bacteria, algae and other organisms that will multiply in water. Several methods of sanitation are available - Organic Bromine or Chlorine. Consult your dealer. Always be sure to read and understand chemical instructions.

pH CONTROL

- ▶ pH is the measure of the relative acid/base content of the water.
- ▶ If the pH indicator is below 7.4, your water is too acidic and may corrode your spa equipment and/or cause irritation to bathers.
- ▶ If the pH indicator is above 7.6, the water is too basic and may result in cloudiness and a scale formation in the spa. High pH also reduces the effectiveness of chlorine as a sanitizer.
- ▶ Proper pH control is essential.

SHOCK TREATMENT

Consult your dealer.

TOTAL ALKALINITY

“TA” is the amount of carbonate, bicarbonate and hydroxyl ions in the water. Increasing TA increases water pH and acts as a buffer against pH changes. High TA promotes high pH and makes the water resistant to adjustment. Low TA makes the pH unstable and difficult to keep in ideal range.

Consult your dealer for methods to measure and control TA.

CALCIUM HARDNESS, STAIN AND SCALE

Calcium hardness can be very important. Water that is too hard (dissolved calcium over 250 PPM) can promote scale formation, making deposits in the spa and reducing your heaters efficiency. Water that is too low in calcium hardness may also be harmful. Soft water (under 180 PPM) will more rapidly dissolve metals, shortening the life of your spas heater or other metal components.

Staining and scaling are common problems. Hot water causes calcium to deposit more rapidly. Some local water conditions may require the use of a stain and scale remover. Please consult your dealer.

NOTE: IF YOU HAVE READ THROUGH YOUR SPA CARE MAINTENANCE SECTION TO THIS POINT, “GO TO THE HEAD OF THE CLASS!” YOU ARE GOING TO ENJOY MANY HAPPY, PROBLEM-FREE YEARS OF ENJOYMENT IN YOUR MASTER SPA.

TROUBLE SHOOTING / PROBLEM SOLVING

<u>SYMPTOM</u>	<u>SOLUTION</u>
SYSTEM NOT OPERATING-	<ul style="list-style-type: none">a) Check circuit breaker in panel box.b) Check GFCI. If GFCI has been tripped, reset. If it trips repeatedly, locate cause of problem or consult your dealer.c) Check for correct wiring.
HEATER NOT WORKING-	<ul style="list-style-type: none">a) Be sure temperature is set to the desired temperature.b) Be sure adequate time has been allowed for heating.c) Refer to heater control instructions.
“OH” IS DISPLAYED ON READOUT SUBSEQUENTLY TRIPPING HIGH LIMIT-	<ul style="list-style-type: none">a) Be sure filter is clean.b) Be sure water level is adequate.c) Be sure shut off valves are fully open.d) Contact dealer or service center.
PUMP SURGES OR NO WATER IS COMING FROM JETS-	<ul style="list-style-type: none">a) Water level may be low or possible air lock in plumbing. If so, loosen the union on suction side of pump and allow air to bleed out of the pipe while pump is running. When water flows—tighten union.
LOW FLOW RATE FROM JETS OR “FLOW SENSOR”-	<ul style="list-style-type: none">a) Be sure pump(s) are on high speed.b) Be sure valves in equipment compartment are fully open.c) Remove filter cartridge. If flow then improves, clean or replace cartridge(s).d) Be sure jets are open.e) Check suction for any blockage.

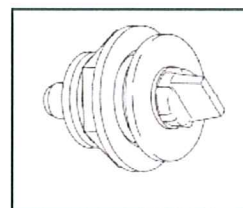
NOTICE:

WHEN FILLING A NEW MASTER SPA, OR REFILLING A MASTER SPA AFTER DRAINING, IT IS POSSIBLE FOR AIR TO BE ENTRAPPED IN ONE OR ALL OF THE SPA PUMPS.

IF THIS SHOULD OCCUR, THERE IS AN AIR BLEED VALVE LOCATED IN THE FILTER AREA OF THE SPA.

TO REMOVE ENTRAPPED AIR FROM PUMPS:

- 1) REMOVE THE BLACK FILTER LID
- 2) LOCATE THE AIR BLEED VALVE (SHOWN)
- 3) OPEN VALVE BY TURNING HANDLE COUNTER -CLOCKWISE A FEW TURNS
- 4) TURN ALL PUMPS ON
- 5) LEAVE VALVE OPEN UNTIL ALL PUMPS ARE OPERATING AND WATER IS SQUIRTING FROM VALVE
- 6) CLOSE VALVE BY TURNING THE HANDLE CLOCKWISE



MASTER SPAS, INC.
6927 Lincoln Parkway
Fort Wayne, IN 46804

(219) 436-9100

www.masterspas.com
lauter@masterspas.com