

Cedar Tub Care Manual

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General Safety Instructions/Warnings

FOLLOW ALL WARNINGS CAREFULLY!!

- Do not permit electric appliances (such as a light, telephone, radio or television) within 5ft (1.5 M) of this hot tub.
- Children should not use hot tubs without adult supervision.
- Do not use hot tubs unless all suction guards are installed to prevent body and hair entrapment.
- Pregnant or people under medical care (such as but not limited to heart disease, diabetes, blood pressure, circulatory problems, obesity) should consult a physician before using a hot tub.
- People using medications and/or having an adverse medical history should consult a Physician before using a hot tub.
- People with infections or infectious diseases, sores or open wounds should not use a hot tub.
- To avoid injury, exercise care when entering or exiting the hot tub. Wet surfaces will be slippery.
- Do not use drugs or alcohol before or during the use of a hot tub to avoid unconsciousness and possible drowning.
- Water temperature in excess of 100°F (38°C) may be injurious to your health.
- Before entering the spa or hot tub measure the water temperature with an accurate thermometer.
- Never walk, climb, play or jump on the cover.
- When Tub is not in use, cover must be properly positioned and secured
- Prolonged immersion in a hot tub may be injurious to your health.

CAUTION: DO NOT OPERATE THE EQUIPMENT WHEN THERE IS LITTLE OR NO WATER IN THE HOT TUB.

PROLONGED IMMERSION IN HOT WATER MAY INDUCE HYPERTHERMIA READ THE FOLLOWING SYMPTOMS:

The causes, symptoms, and effects of hyperthermia may be described as follows. Hyperthermia occurs when the internal temperature of the body reaches a level several degrees above the normal body temperature of 37° C (98.6°). The symptoms of hyperthermia include drowsiness, lethargy, and an increase in the internal temperature of the body. The effects of hyperthermia include:

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

WARNING: THE USE OF ALCOHOL OR DRUGS CAN GREATLY INCREASE THE RISK OF FATAL HYPERTHERMIA IN HOT TUBS

SAVE THESE INSTRUCTIONS!

Cedar Tub Care

1. The Advantages of a Wooden Hot Tub vs. the Acrylic Spa

Although acrylic spas are by far more prevalent today than wooden hot tubs, it was the wooden hot tub that began the experience of social bathing in America. Whether to purchase an acrylic spa or a wooden hot tub depends mostly on personal preference and each individual situation. There are many reasons for choosing a wooden tub over a plastic spa.

Because they are assembled on site, they can be carried through any doorway, stairs or other narrow access. With a spa, you have a large one-piece which can be unwieldy or impossible to move into its final location.

The vertical walls and greater depth of the wooden tub surround the bather with more water than would be found in a spa, so there is a greater effect of buoyancy in the hot tub. In addition, there is typically much more legroom since you can stretch out under the bench, and taller bathers are more comfortably accommodated.

Because of a wooden hot tub's greater depth, a smaller diameter hot tub will seat the same number of people as a larger spa. For example, a 5' (152 cm) round hot tub will seat as many people as a 7' (213 cm) square spa. And a smaller surface area means less heating expense.

And, of course, there's the rustic look of a traditional wooden hot tub. From an aesthetic point of view, nothing matches the appearance of a wooden tub.

2. Levelling

The tub should be placed on a leveled base. We recommend using 18 in x 18 in (400mm x 400mm) concrete patio blocks for this. The area should first be dug down to clay in such a way that there is a slight slope. Place 4 mil (100 micron) polyethylene plastic over the clay. Then, using 1 inch (2.5 cm) plastic conduit, arrange for any water to be able to drain out of the pit. Now fill the dug-out area with a small aggregate gravel fill. Compact and level the gravel before positioning the patio blocks.

We prefer this method to pouring a cement base. Should the ground settle unevenly and the base becomes tilted, the patio blocks can be re-leveled. This is not the case for a poured concrete base.

3. Filling & Draining Procedure

3.1 Initial Filling Procedure

If your tub has a skimmer, it will be equipped with a shut-off valve that can be closed. This (closing) allows the level of the water to be low without air being sucked into the pump through the skimmer. The pump and heater can be turned on once 5 inches (13 cm) of water are in the tub. Do not allow the heater to be on, if the pump makes a surging sound. If the pump has not primed (no flow) do not leave pump on more than 2 minutes and follow priming instructions provided in section 10.

Upon power up, a Balboa Spa Pack will display "Pr", which stands for prime. This display condition will last for 4 minutes. If, during this time, you push the jets button the pump will run at high speed until the 4 minutes expires or until you push the jets button again. This high speed mode is available to help drive out air from the pumping circuit. When you first fill the tub in a gradual way, as described next, it is not recommended you use the pump in high speed until the level is at least up to the seats.

As mentioned, the tub should be filled to at least 5 inches (13cm) above the floor or 2 inches (5 cm) beyond the bottom drain (suction) hole. However, you do not need to stop at this level, if you are not seeing any significant leaks. Continue to fill the tub until leaks are noticeable. Close the skimmer valve (push in) and then, with the cover on, both the pump (low speed) and heater can be turned on to raise the water temperature to about 90° F (32°C). The higher temperature accelerates the swelling of the wood, and the water spurting out of the jets helps wet the upper parts of the staves. If you have leaks, keep adding water,

since you don't want air to be sucked into the pump. (If the leaks are significant, then you need to keep the pump and spa pack off, keep the staves moist by spraying water on them and then covering the tub. This way the wood will moisten and start the expansion process, without continuously pouring water into it.) After the above temperature has been reached wait until leaks have subsided significantly. Then slowly fill the tub to a higher level where you again experience significant leaks. Wait to reestablish the temperature, for leaks to subside and continue the process until the tub is full. This method should minimize the total amount of water that is initially leaked during the filling stage. If leaking continues, use the saw dust provided. It will drift into the leaking holes and help plug them up.

If the staves have shrunk and there are considerable gaps between them, then water loss will be excessive and some other remedial steps may need to be taken. These include spraying the wood frequently for three days to keep it moist so the staves will expand. Then use the above procedure but additionally add cups of saw dust to the water. The staves will expand around 4% between being perfectly dry and being fully wet. Absorption of moisture takes time however, so you may need patience.

Initially use only the bromine tablets and occasional shock (Oxy-Pur) as you bring the water to the desired bathing temperature. After the 1st filling, the water will absorb tannins from the wood and it will become brownish. It is safe to use the tub. After 1 week or after the water is dark brown, drain the water. Carry out any necessary maintenance and then refill the tub. Coloring of the water will reoccur for the 2nd and third fill or in some cases longer. Some specific water conditions may cause the tannin to release more slowly, in which case the browning will last longer than the normal 3-4 weeks. Once you are no longer changing the water frequently, you can start using the full water balancing and sanitization procedures.

Experience will allow you to determine at what level to keep the water to account for the displacement that will occur as bathers enter the tub. The smaller tubs have the largest displacement effect per person. The water level should stay above the skimmer intake. If you wish to use the tub below this level, close the skimmer valve (push in).

3.2 Draining Procedure

The tub is drained using the hose bib valve located after the pump. When you wish to replace the water, you can drain the tub either the slow way or the fast way. With the slow method you 1st turn off the breaker. Then attach a garden hose to the drain bib (faucet) and open it. Place the other end of the garden hose at a location where you want the water to drain to. About an inch of water will be left in the bottom of the tub. If you also wish to get rid of this, you will need to use a submersible style pump or wet-and-dry vacuum cleaner.

If you wish to drain the tub faster, you can use the pump to assist. 1st turn the spa pack to the minimum temperature. Then close both the globe valve connected to the outlet of the filter and the skimmer gate valve. The globe valve attached to the pump suction is left open. Again attach a garden hose to the drain bib and open it. Then let the pump run at low speed to create extra pressure which will force water out of the hose at a higher flow rate. Watch the level and when the pump starts to suck in air, turn off the breaker.

When draining the hot tub for the season additional measures to prevent dry-out and to remove any trapped water in the pump, pipes, filter and the heat recovery blanket need to be taken. See the 3rd paragraph in the next sections for details.

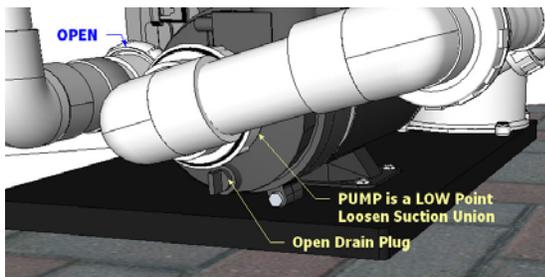
4. Seasonal Use & Drainage

Our cedar hot tubs, with an insulating cover, are reasonably energy efficient. Equipped with a 3 kW or higher heater you will have no problems maintaining a hot water temperature. In moderate winter climates, such as on the west coast of North America (including British Columbia), Central & Northern Europe our tubs can certainly be used throughout all 4 seasons. In extreme winter conditions, such as exist in the interior of Canada and the Northern Central US, outdoor use becomes problematic although

certainly not impossible. Water may freeze over the air valves and controls, heating costs will be high and most people will find -30° air temperatures too extreme. Special insulation techniques would have to be considered to keep a tub running in such extreme winter conditions, in order to keep the heating costs reasonable. These including having the floor insulated (a standard option available at time of order), and insulating the sides and pipes (see the Question and Answers section of Northern *Lights Cedar Tub Assembly Manual*). We also offer an “artic cover” with 50% better insulation coefficient than our regular cover (R21 vs. R14). Never, however, insulate around the pump motor since it generates significant heat that must be allowed to dissipate. It is essential to keep the pump running continuously on low speed in the winter and not to use the timer or filtration cycle during the winter (set filtration setting to FC or 12). Water in the pipes will freeze much before any water in the tub freezes and having the pump running keeps the pipes warmer and the pump additionally adds some heat. Digital controllers have freeze protection sensing. This means that should the water temperature drop to in the range of 44°F (6.6C) the pump is turned on, even if the filtration cycle is not set at continuous.

Persons having ordered a gas heater should not use the gas heater in freezing winter conditions, since spa gas heaters are not designed to be run in freezing temperatures due to condensation problems. Northern Lights Cedar Tubs now offers a hybrid gas/electric heating system. This allows the gas heater to be turned off in sustained freezing conditions but the hot tub can stay heated using the electric heater.

When draining the tub for the winter season, it will be advantageous to wait for frost so the moisture in the wood will freeze. This stops the wood from drying. Turn off the electric breaker and then drain the tub, retaining the residual water that is below the drain hole. For all systems, know where water can get trapped which are typically the low points and get rid of the water at these low points. Remove the filter



cartridge, clean it and store it. Loosen appropriate union fittings on the heater and pump suction to drain the water that is trapped in the pump and heater, which are two of the low points. You also want to open the drain plug in the pump, if it has one. If you also have a gas heater, open the unions and let water drain from its pipes. The water that remains in the tub can safely be allowed to freeze. Add some algaeicide, so the water won't turn bad should it get warm before you are ready to fill the tub

again. If you wish, you can also suck the remaining water out using a wet & dry shop vacuum cleaner or a portable sump pump, to clean the floor. However, after cleaning, add an inch (2.5 cm) of clean water back in and again add some algaeicide. Attach the cover and ensure it is sealing good all around the tub.

In the spring you will find that the staves are still moist. First reconnect any open unions and plugs. Check that all unions have been tightened and that the O-rings have been seated properly. Replace the filter. Check that the isolating valves are open. If you refill the tub while freezing conditions still exist, you need to apply external heat to any location that may have retained ice. This can involve placing a fan style heater on the seat to thaw any ice in the bottom of the tub. Also the tub should be filled to the initial 3" (7.5cm) level (above the suction drain) through the top of the filter using warm water. This will thaw any ice that may be in a low spot in the piping or equipment. Start the filling procedure, as per section 3, paragraph 2. This will avoid the spa pack registering freeze conditions, which with some spa packs can cause problems in quickly heating the water, especially if the pack is set to LOW current mode. Because the wood may have shrunk a small amount (provided you didn't allow it to completely dry out), a little swelling may need to occur again to seal the tub.

Persons living in warm climates, where the tub gets used during the winter but not during the hot summer, need to consider all options, before they decide to drain the tub and allow it to dry out. In a hot desert climate, a drained tub will quickly dry and excessive shrinkage of staves may occur. It would be better to keep the tub filled, with the spa pack set to sleep mode or, if the tub has no digital spa pack, keep the pump running at low speed but with heater off. Of course sanitizer must still remain present and for prolonged no-use the Argenia *Silver Water System* would be ideal. It does not even need the pump to be

running. If this is not an option then consider the Frog Mineral cartridge. If keeping water in the tub is not practical, for some reason, and the tub must be drained and will dry out frequently, then your conditions are such that a liner is the most practical solution. Contact us if this is the case.

A problem that can occur, if the tub is left with residual water in the bottom, is that a dark film can deposit on the wood. The *Argenia Silver Water System* would best prevent this, but if it happens, you should gently scrub this off the bottom of the floor with a Borax solution and then suck it up with a wet & dry vacuum cleaner. The filter and drain screen will catch the rest. You can also use a gentle diluted bleach to get rid of the darker staining or you can simply wait. Over time the sanitizer you use will slowly bleach out the stained floor.

5. Avoiding & Fixing Leaks

Indeed wooden hot tubs will leak when first filled or when refilled at the beginning of the season. The amount of leaked water can vary from considerable to not even being noticeable. Once the wood has swollen sufficiently leaks will usually seal, although we cannot provide a guarantee against this, unless we shipped the tub assembled.

If the tub sealed well and then starts to leak, our experience shows that there is basically one common reason why this occurs, if the tub was not allowed to dry out. Without a doubt this is due to overuse of chlorine (especially Tri-Chlor products) which will attack the wood, causing leaks. If a tub holds water perfectly for months or years and then begins leaking inexplicably, this is usually indicative of over-chlorination. If the problem is identified early enough, the damage can be halted and repaired with little cost or time. This problem can be avoided simply by using a sanitizer system that significantly reduces the need for high levels of chlorine. We use bromine for that reason and even better results are obtained if the Metal Ionization system is used to avoid even bromine.

Much less common than leaks due to halogens are leaks in a hot tub due to an assembly problem. A tub that never seems to seal at all is indicative of this. Our assembly method, if followed, is intended to avoid this. However if these are not followed, to the letter, problems can occur. For example, we have had some customers leave out an entire stave. If the tub was not test fitted and little attention was paid to properly eliminating gaps, leaks above the floor between some staves can stay permanent unless the tub is reassembled. If all the staves are not fully pushed against the floor edge, leaks through the stave dado can occur. This may occur if you ended up with an extreme V and did not check that you had full floor contact at all staves. We also require customers to use silicon caulking at the interface of the floor and staves. If this was not done, some leaks through the dado may not fully seal. Should the tub continue to drip after 2 weeks, we first ask you to use the saw dust we supply. Be sure you remove the filter when doing so. If the leak continues or reappears, we recommend carefully removing the adjoining staves corresponding to each leak, inspecting them, and then repairing the problem. If it is a due to a poorly matching set of staves or damage in a stave that was not previously detected, new staves may be required. If it was due to a caulking problem, remove the old silicone caulking carefully and redo the job. If you feel you need to apply silicone caulking between some staves, then you must do it all the way up the stave. Ensure when the staves are repositioned, the back of the dado will touch the floor edge.

Some customers may not have the option of removing and inspecting the staves, because they have installed the tub in such a manner that they can't get proper access to the outside portion. In that case a 2-part marine epoxy can be beneficial, and some of our customers who have used it have reported good results. You will need to mix it and squirt it into the leaking joints using a hypodermic syringe. The syringe you can obtain from a veterinarian supply store. The 2-part marine epoxy, AeroMarine 300/21 is available from the following source: <http://www.aeromarineproducts.com/>. The tub does not need to be completely dry. Allow the product to set, which may take 2 days.

Remember to not over tighten the straps. They only need to be tight enough to prevent a leak. The gaps between the top straps should be no less than that $\frac{1}{4}$ " (6mm) of the gap in the bottom strap. Excessive pressure will squeeze the staves such that the width will be reduced and the thickness will increase. The wood, if it is then allowed to dry, will not return to the original dimensions it had when first assembled. This will result in gaps between the staves. Such complete drying can ruin the sealing permanently and must be avoided since the tub will then leak profusely for considerable time when refilled. It may in fact never properly reseal. If this happens, a vinyl liner will have to be used.

6. Tightness of Bands

The bottom band will be tightened by the installers until a definite resistance is felt. The middle and upper bands will have a more spongy resistance, since there is no floor to stop further tightening. Do not initially tighten the middle and upper band tensioners more than a $\frac{1}{4}$ inch (0.6 cm) past the gap in the lower band. After the wood swelling has stabilized, back off the middle and top tensioners, $\frac{1}{2}$ turn every 2nd day until the gap in these matches the bottom strap's gap.

We place # 6 or #8 screws below each strap to assist in alignment of the straps. If the tub is left drained, during the off-season, the wood may shrink. The screws serve to hold the straps in place.

7. Preserving the Wood Finish

7.1 Interior Finish

The interior of the tub is kept natural. As long as the wood stays wet the rich cedar appearance will come through. With use, and oxidation, the wood will turn to a whitish-grey colour when dry. It may also become mineralised, if the water is very hard or from adding Ca hardener when water is too soft. However, even under these conditions the natural golden-brown colour will still come through once the wood is re-wetted.

The nemesis of the interior finish is the tri-chlor type chlorine compounds and to a far lesser extent di-chlor or bromine sanitizer. If tri-chlor type of sanitizer is used and/or tri-chlor-based shock is frequently added to water, the surface fibres will, over time, break down resulting in a "pulpy" white surface. This is an undesirable situation that is easily avoided by using bromine products or if you must di-chlor granules. We have compared tubs used year around for 4 years. The tubs using only "tri-chlor" type of chlorine had begun to have a pulpy surface after 1 year or earlier. The tubs that relied on ozone and used only reduced levels of bromine sanitizers or some di-chlor sanitizer showed little evidence of pulping at all after 4 years.

Best, however, is avoiding halogens all together and using the **metal ion system** instead in combination with an ozonator or MPS. This is also cheaper and less work over the long run.

Should the interior surface develop this cellulite or pulpy surface, because you used tri-chlor compounds, you can remove this. Drain the tub and while the surfaces are still wet or damp, gently remove the pulpy material using a plastic kitchen scouring pad. Do this to all surfaces including the bottom of seats. Suck up all the loose scraped-off material, with a wet/dry shop vacuum. After you have refilled the tub, you will need to frequently check the drain strainers, since the residual pulp will collect at these locations, eventually plugging the drain holes. Also, frequently check the filter and clean and replace. After about a week the water should be clear of further fibres. If you then switch to a bromine approach or better yet a metal ion approach you can stop further fibre breakdown. You should quickly notice the beneficial effects in that the suction screen stops getting plugged with pulp.

7.2 Exterior Finish

As with any wood, sun and rain will take its toll on the appearance of cedar wood, unless attention is paid to a wood preservation schedule. Northern Light can deliver assembled tubs with 1 to 3 coat of a Sikken's Cetol 1 RE exterior protective translucent finish applied to the outside and the top end of the staves prepared as discussed below. We use a cedar tint. This Sikken's Cetol 1 RE (satin finish) is a high performing wood stain/preservative. When looking yourself to buy a suitable finish you want to select a wood finish meant for exterior application. It needs to be one that can "breathe". This is to allow moisture to escape and not cause the finish to blister. Other examples are the Penofin Premium Red Label (Western Red Cedar tint) or Penofin Marine Oil Finish (Transparent Natural). These are not the only manufacturers of suitable finishes. We are not able to use and test them all.

Another surface that must be prepared and maintained carefully is the top rim. Since this is an end-cut surface, that would tend to retain water, it is the surface most susceptible to bacterial rot over the long term. To prevent this, 1st this surface of the newly assembled tub should be sanded with a belt sander to a smooth and slightly rounded finish. The fine sandpaper helps to plug the end grain. Then very carefully apply 1 application of a clear "end cut anti-rot" solution that often contains zinc naphthenate. An example is the Armor All product "*Clear Coat Wood preservative 33-72IARM*". An alternative is *Copper Green 32001 Clear Wood Preservative*. Once this has dried apply 1 or 2 coats of the exterior finish you use on the outside surfaces of the staves, and once these have dried apply 1 coat of an exterior oil-based urethane finish, or a 2-part clear marine epoxy (latter will look very shiny). This combination will completely seal the end cut and will also prevent stain from transferring to the white underside of the cover. If this surface finish deteriorates over time, refinish it.

With time, when the appearance of a wood surface becomes dried and pales, apply another coat. The details will depend on the stain you initially selected, so read the products literature. The discolouring of the hot tub staves differs from that of wood that stays dry. The pressure from the interior water (moisture) in the staves, migrates tannin and oils and even resin to the outside that can affect the colouration of oil based wood preservatives. This can be quite variable from stave to stave or cedar batches, because nature doesn't grow wood as though it was a factory produced material. The fading of the finish is highly dependent on the sun exposure. If the tub is in a shaded area, a maintenance coat will need to be applied much less frequently than a tub that has a strong southerly exposure. Top surfaces, such as stair steps, shelves, cover of an enclosure, tend fade and deteriorate faster than vertical surfaces because of the effect of rain or water pooling on such surfaces. You do not want to skip applying the recommended number of coats on such surfaces; in fact you want to apply an additional coat.

The stainless steel bands can be polished and then waxed. The threaded rod and tightening nuts should be lightly greased with waterproof lithium-based greased. These latter items are not stainless steel and if not treated as such can rust.



7.3 Cover Finish

Air born dust dirt and soot mixed with rain or snow will over time deposit a dirty looking film on the cover. This can be removed using water and a product like *Fantastik*. Use a soft brush to help lift the dirt and grime. The photo shows the cleaning in progress. A pressure washer also works very well. A cover protective solution, that provides uV protection, is available from Northern Lights.

8. Control Adjustments

8.1 Temperature

The spa pack will be equipped with a digital control panel. It can take over a day to bring a large tub up to temperature, especially if the water coming out of the faucet is very cold.

The digital temperature control system eliminates the trial & error process of setting the temperature and keeps the water to remain at a much more constant temperature of +/- 1° F. The human body is very sensitive to temperatures around 98.6° Fahrenheit (37°C). When the temperature is only some 3-4 °F (2°C) above this, the time you can be immersed in the tub is limited. For safety reasons, all manufactures of Digital controls are required by law to limit the upper temperature to 104° F (40°C). Below 98.6° F (37°C) the water will still be comfortable however it will not feel hot. Since your body can now dissipate heat you can stay in the tub for extended times, without becoming “drained”.

If the digital panel is switched from **Standard** to **Sleep** mode the control set-point will be 20°F (11°C) below the actual setting. This is useful if the tub will not be used for a while.

Our hybrid heat hot tubs, equipped with gas heaters use the spa pack to supply 230 volts to the gas heater, and a normally open contact that closes when heat is demanded. The gas heater’s own thermostat is in that situation disabled. The exception to the external temperature regulation method is if you are using one of our cottage propane systems. In that case there is no external digital control and the gas heater’s own thermostat is used.

8.2 Cold Water Start-Up

If a tub is being filled with quite cold water, which is below the “freeze protection” temperature of the Spa Pack, the system may behave strangely to you (this is especially true if your spa pack is set to the LOW current mode). The code for freeze protection (for example IC) should be flashing. In such a condition, the spa pack will cause the pump to run at low speed and also turn on the blower circuit (even though no blower is used). Then if the LOW current mode is set to be on (for example with a VS501Z, A10 up) the heater will then not come on. This will result in having only the pump heat available to raise the water temperature and this may not be enough. If you live in a cold winter climate, to avoid this condition, you should use a 40 or 50 Amp breaker so that the spa pack can be set to HI current mode. This will allow the heater to come on when a freeze protection condition occurs.

If your service is 30A and the low current DIP switch setting must be on, then to get around the problem, temporarily switch A10 to Off (down), but be sure you don’t touch the jets button. This will allow the heater to come on and not trip the 30A breaker. After the IC condition has cleared, the A10 switch can be switched to ON (up) again.

If you are doing a fresh fill after the tub has sat drained over the winter, thaw any ice in the bottom of the tub using a fan style electric heater placed on a seat, with the cover on. Then fill to the 5-inch level through the top of the filter using warm water. Then replace filter top and close (push in) the skimmer valve. Keep the cover on and then turn on the power. As the water is warmed by the heater keep adding a little more water such that you can keep the sensors above 45° F (7° C).

8.3 Jets and Air Control Valves

The air to the jets is turned on by twisting the air jet control valve knob. Be sure to turn air off when not in use. Air will cool the water faster, so to avoid excessive energy use, turn the jet air only on when the jets are being used for massaging.

8.4 Pump Hi-Lo Control

The pump has a high and a low speed. This is adjusted by pressing the “Jets” button on the digital panel. When the tub is not in use the pump should remain in low speed. Digital Spa Packs can be set to a “filtration” time cycle. If such a cycle is set, the pump will not stay running in low speed when outside the “filtration period”. If a tub is not controlled by a spa pack, such as is the case for Cottage systems, and instead a pneumatic air switch is used to change the pump speed, then it is mandatory to keep the pump running 24 hrs, during freezing temperatures.

8.5 Light On-Off Control

The light(s) are operated on 12VAC and are transformer isolated. This prevents the possibility of electrocution. The lights are turned off and on by depressing the air-button or the button on the digital panel labeled “Light”. Bulbs (12Volt, 12 Watt) are accessible from the rear of the fixture. A twisting motion is required to remove the socket to replace the bulb. If you have purchased the 22-bulb LED light, it is connected by the same light socket that holds the regular 12-volt bulb.

8.6 Hi Temperature Reset

If heater high temperature trip engages, determine the source and after correcting the problem, follow the reset procedure described with the Digital Spa Pack manual.

9. Keeping Wooden Tub's Water Clear & Sanitary

9.1 The Hot Tub and Spa Challenge

There are several aspects to a hot tub or spa that make it a challenge compared to a pool. The high water temperature causes pores on people's skin to dilate allowing the water to carry away the oils in the pores. The warm water also causes your body to sweat, even though you may be unaware of this. In one hour you may actually lose 2 lbs (0.9 kg) of perspiration to the spa water. Chemically there is very little difference between perspiration and urine. The rapid movement of the water causes a scrubbing action on the skin resulting in removal of dead skin and debris. This will increase the turbidity of the water as happens with water in a bathtub. The temperature and turbulence of the water leads to rapid evaporation rates, which leads to concentration of these materials. Because the volume of water, per person, is low in a hot tub, compared to a swimming pool, two people in a 500gal spa is considered equivalent to 80 people in a typical backyard pool. Thus, the main load for sanitizer and water clarification systems in a hot tub comes from the people who use it, the "*bather load*".

While this definitely represents a challenge compared to pools, the challenge is equal whether the hot tub is made from wood or plastic. It is a common misconception that wooden hot tubs are harder to keep sanitary. In fact, wooden hot tubs are no less unsanitary than acrylic spas. Improperly sanitized, both the wooden tub and acrylic spa can represent a health hazard, but there is no evidence that the natural wood is more likely to harbour organisms as compared to the acrylic material (in fact, in studies of kitchen cutting boards, it was found that while bacteria multiplied and prospered on plastic boards, they died on the wooden ones). The important point to remember is that, regardless of the material from which your tub or spa is made, proper sanitization is the key.

9.2 Physical (Mechanical) Cleansing

A key component in keeping the water clear is the mechanical cartridge filter. Turbid water is usually a sign that the mechanical filtering isn't doing its job. Check the filter and the filter bypass valve (which should not stay partially open. When operating properly, the filter will remove all but the tiniest particular particle matter from the hot tub. This includes particles of dirt and debris coming from the environment or particles left behind by bathers. If left in the water these will lead to turbidity (cloudiness), lead to foaming and odour problems and can substantially reduce the effectiveness of sanitizers. Cartridge filters will give long and excellent service if properly cared for.

Regularly rinsing off the cartridge will remove the larger debris, however deep cleaning must also be done at some frequency, such as once every 1-2 month. Deep cleaning involves using a cleaner liquid, especially formulated for spa filters. The filter is soaked in this liquid, according to the directions. Deep cleaning will remove oily and greasy build-up as well as minerals that may have been deposited. The life of a filter is limited and it must be replaced either when damaged or every 1-2 years.

While the filter, even if properly maintained, does a good job in removing a lot of particulate matter, it is common for the smaller particles to pass through the filter, leading in build-up of micro-particles and turbidity. You may notice that after several large bathing episode the water's turbidity has increased. You may think this is the result of unsanitary water, but in most likelihood it is from the micro-particles that have come off the bathers that are not filtering out. These particles tend to develop like electrical charges so that they repel each other and do not clump together into larger particles so that they will be trapped by the filter. The addition of a flocculent agent, a clarifier, solves this problem. It will neutralize the charges on the micro-particles, so that they now will clump together. The blue thick *Sea Blue* product in our starter chemical kit is such a flocculent agent. If, after a heavy bathing loads, the water has turned turbid, and is not clearing up with time, add 2-3 capfuls of *Sea Blue*. Keep your finger partially on the cap and swoosh it around so

the thick liquid disperses well in the water. By the next day (12 or so hours) the water should be clear again.

Accumulations of body oils, cosmetics and other bather wastes will result in the build-up of these materials along the waterline and in pipes and filters. It causes the scum lines and interferes with the performance of the sanitizer. These types of wastes are effectively controlled by special enzyme containing liquids. Enzymes are naturally occurring biological catalysts that help increase the breakdown rate of complex compounds, such as the ones mentioned. They will take these complex and difficult to control materials and break them down into smaller fragments that can readily be destroyed by oxidizers such as *Oxy-Pur* (MPS) or an ozonator. The descummer product *Nature-Pur*, that is part of our water treatment starter kit, is an enzyme product especially formulated to handle the conditions imposed by a hot tub.

To clean the hot tub surfaces all one has to do is drain the water, and while it is draining use a



sponge-type mop with a long handle to clean the surfaces. In some circumstances a *Borax* solution can help clean areas that have blackened above the water line. Wipe all the top surfaces on which sediments tend to deposit. Most of the sediment that may have deposited on the floor surface or on seats will then be suspended in the water and will be flushed out. Since the drain is above the floor, an inch of water will remain. To drain and clean area, use a wet and dry shop vacuum cleaner. If necessary the tub can be gently scrubbed with a soft brush.

9.2.1 Other Basic Tips

Here are some other basic tips on using your hot tub or spa that are occasionally over looked. They will help keep your water cleaner and clearer, and even save you some money!

People are by far the biggest producer of dirt and grime and dead cells and sediment. Your tub water will last much longer if people go in clean and not use it as a substitute for having a bath or shower.

Never use regular household cleaners for cleaning your spa. These products contain soap or ammonia based products and are very bad for your water chemistry and if you don't get the entire product out of the spa you could wind up with a very large "bubble bath".

One of the most common causes of foamy hot tub and spa water is residual detergent in bathing suits. Try running an extra rinse cycle in the washing machine, or re-rinse swimwear by hand. Another cause is water that is too soft. Add calcium water hardener.

When not using your spa, keep the air control valves closed. Besides these valves letting cold air into the spa water and increasing heating costs, this air can also be full of air borne debris and algae spores that can cloud your water and increases your chemical usage.

Personal hygiene products belong in the shower. Hair spray, hair mousse, styling gels, deodorant, anti-perspiration, sun tan lotion, excess sweat, make-up, skin creams of any sort and excess soap or dyes in bathing suits will cloud your water and clog your filter, reducing its life and increasing your maintenance time.

Floating oil-absorbing sponges are fantastic at reducing the amount of clogging oils that are sent through your filter. Remember to squeeze them out occasionally and to replace them when they start to deteriorate or when they no longer float.

Make sure your filter cartridge is fully seated in the filter compartment. This ensures 100% of the water passing through the filter, rather than bypassing it.

If the tub is not used routinely the wood can get slippery. This has nothing to with the wood and happens with all tubs. The reason this occurs is organic and inorganic matter precipitates out of the water and settles on the seats and floor (as sediment). When the tub is used regularly these materials don't get a chance to accumulate on the surface since they are rubbed off simply by sitting on the seats and the feet rubbing on the floor. Use a sponge mop on the surfaces including on the floor under the seats when draining the tub to lift it off and get it back into solution so it can be trapped by the filter. If you have severe sediment then you want to do this while draining the tub.

One quick and easy way to vacuum debris from the bottom of your spa is to use a wet/dry shop vacuum to remove the residual water after the tub has been drained.

9.3 Water Balancing

While there are many products to greatly help reduce the amount of “chemical” use and maintenance time, NOTHING will make your spa totally maintenance and chemical free. If the truth were told everything we breath, touch and eat is chemical, be they simple elements or compounds or complex organic chemical compounds that form biological life. One aspect of water chemistry is the “*water balance*”. This is the water’s tendency to be *scale forming* on one extreme or being *corrosive* on the other extreme. In between, where it is neither, the water is considered “*balanced*”

There are four common chemical factors that affect the water’s chemical balance:

- *pH*
- *total alkalinity*
- *calcium hardness*
- *total dissolved solids (TDS)*

The first three, along with the temperature of the water, are what determines the overall “*water balance*”.

9.3.1 pH

pH is a measure that tells us how actively acidic or basic (alkaline) the water is. 7 is neutral and below 7 the water is acidic with the strongest possibility being 0. Above 7 the water is basic (alkaline) with the strongest possible reading being 14. A normal range of pH for hot tubs would be 7.2 to 7.6 or neutral to very slightly basic. Water that is either too low or too high in pH will be out of balance and will have the following adverse consequences:

pH – Normal 7.2-7.6	
High pH	Low pH
<ul style="list-style-type: none"> • Poor sanitizer efficiency including ionizer action • Cloudy water • Frequent filter cleaning • Scale formation • Skin and eye irritation 	<ul style="list-style-type: none"> • Poor sanitizer efficiency • Corroded metals/equipment (<u>early heater tubing failure</u>) • Skin and eye irritation • Destruction of total alkalinity

Because normally the desired pH is slightly basic, pH adjustment is often done by adding a “total alkalinity” product like *Alka-Rise* which raises the pH but not excessively and forms a reserve or a “buffer”. This tends to hold the pH at some level, even if acidic products are added, until it is all used up. Beyond this, there are *pH Booster* and *pH Reducer* products in our starter chemical kit.

All things being equal, bathers tend to make the pH go up in time, although when halogen sanitizers are used, these make the pH drop. Always make adjustments by adding small quantities at a time. Then allow the water to completely mix, before testing and adding more. Otherwise you can drive the adjustment too far in the opposite direction,

9.3.2 Total Alkalinity

Changes in pH can be caused by many factors and one significant cause is sanitizer use. Halogen sanitizers can have a significant impact on pH and water balance. However, changes in pH, due to such sanitizers or shock, can be minimized by controlling the total alkalinity. This is a bit of a confusing term in the pure chemical sense. Total Alkalinity refers to the ability of pool and spa water to resist changing in pH. A product is added that essentially keeps the pH in the ideal range and it has reserve or pH holding capacity. pH will drop only after the total alkalinity reserve is all used up. If you used distilled water at pH 7 and just added a drop of acid, the pH would plunge. But with water that has a total alkalinity reserve, the pH would only drop after sufficient quantity of acid was added to have neutralized (used up) the entire alkalinity product. Total Alkalinity is adjusted upward using *Alka-Rise* (sodium bicarbonate) to a particular ppm value, usually in the range of 80 -120 ppm. Usually an adjustment should not be made until total alkalinity is below 80 ppm. Downward adjustment requires an acid forming product, such as *pH Down*. Water that is either too low or too high in total alkalinity will be out of balance and this will result in the following consequences:

Total Alkalinity - Normal 80-120ppm	
High total alkalinity	Low total alkalinity
<ul style="list-style-type: none"> • Hard to change pH • Scale formation • Cloudy water • Skin and eye irritation • Poor sanitizer efficiency • Poor ionizer operation 	<ul style="list-style-type: none"> • Rapid changes in pH or "pH bounce" • Corroded metals/equipment • Skin and eye irritation

9.3.3 Calcium Hardness

The term "hard water" originally came about because water with high levels of calcium does not clean clothes well (hard to clean). The term hardness is now used only to refer to the level of calcium in the water. Soft water refers to water with lesser or no amounts of contained calcium.

There is a balancing aspect to the amount of calcium desired in spa water. High levels tend to result in the calcium wanting to precipitate out, especially at higher temperatures on heater surfaces (form scale) and also at high pH or total alkalinity levels. Scale build up on heaters can lead to premature failure and in decreased efficiency. Soft water on the other hand is aggressive and tends to attack metal parts such as heat exchanges, heaters, heater tubes, etc. resulting in their premature destruction or in pinhole leaks. Well water often is hard and lake or river water often is soft.

Some calcium is very desirable in spa water. The acceptable range of calcium in "balanced water" is 150 - 400ppm. There is no easy way to reduce water hardness except dilution with softer water. However, scaling can be prevented by adding a sequestering agent, which ties up the calcium and prevents it from precipitating. The product *Prevent II* that comes with our chemical kit, is such a sequestering product. However, if you are using an ionizer, such a sequestering agent will also sequester to Cu, Ag and Zn metal ions and prevent proper operation of the ionizer. In that case, either put up with the hard water or put the fill water through a water softener. To increase calcium hardness calcium chloride is used. This is the compound in the *Cal-Rise* container provided with in chemical kit.

Water that is either too low or too high in calcium will be out of balance with the following consequences:

Calcium Hardness - Normal 200-350 ppm	
High Hardness	Low Hardness
<ul style="list-style-type: none"> • Cloudy water • Scale formation • Skin and eye irritation • Poor performance of Ionizer 	<ul style="list-style-type: none"> • Corroded metals/equipment(early heater tubing or heat exchanger failure) • Foamy water

9.3.4 Controlling Foaming

As indicated above, foaming is often associated with water that is too soft (too low in calcium). Therefore 1st check the hardness level and adjust if required. Foaming can also be associated with soap and other products that have entered the water from bathers and failing to completely rinse the filter after changing water. When foaming occurs you can add *Anti Foam* to the water, which will quickly make the foam disappear.

9.3.5 Stain-producing Metals

Stain formations or coloured water are associated with the metals iron and copper. While iron in fill water is colourless, it will react with oxidizers to produce a rusty red colour in water or produce orange coloured staining. This is often confused with tannins leaching out of the wood especially if the tub has been in operation for over ½ year. If after numerous refills and more than 6 month use of the tub, the water is still turning brownish, the cause is likely iron oxidizing, not tannin leaching. Copper on the other hand causes green water and stains ranging from blue-green to black. Copper is responsible when fingernails or hair turn green. Copper can be in the fill water or can come from galvanic action with heat exchangers or if leaving copper ionization electrodes on too long.

The best way to remedy the iron oxidation problem is to run the fill water through an iron water treatment system. The sequestering agent, *Prevent II*, which stops calcium from precipitating, also helps prevent the metals Iron and Copper from precipitating (but it does not stop the oxidation). However, such a sequestering product may cause other effects such as interfering with the proper operation of an ionizer and possibly initially turning the hard water milky.

9.3.6 Total Dissolved Solids (TDS)

Total dissolved solids are the sum of all the solid materials dissolved in the water. The measure normally runs above 2500 ppm. TDS is comprised of many different chemical compounds from calcium, to salts, to soap residue, to dead organic products, etc. Their effect is not alike. However, when the TDS levels get above the 2500 range problems are likely to start occurring. For example salt water bromine generators lose effectiveness. Water will more easily become cloudy, it will be difficult to maintain water balance and sanitizer effectiveness and there can be foaming problems. The solution is to drain the water and replace it with fresh water.

9.4 Micro-Organism (Bacteria) Control – Sanitation and Oxidation.

The previous two topics dealt with keeping the water clear and non-corrosive. Biological organism controls, such as disinfection, sanitization, oxidation or shocking are terms associated with controlling bacteria, viruses, algae and the dead biological wastes produced by bathers. You may be able to avoid the use of halogens such as chlorine or bromine, but another product will then need to take its place. Something has to do the “*dirty deed*” of destroying the bacteria. Whether you think of the alternative product as being “chemical free” is often a personal perception or how the product is marketed.

The process of controlling microbes including bacteria and viruses is known as disinfection or sanitization. To avoid further confusion, we will call it sanitization. This sanitization is critical since the high water temperature along with the aeration make this water an ideal environment for the growth of harmful bacteria. Added to this are the bathers’ wastes (which form food for the bacteria) and altogether this combination must be attended to in order to keep the water healthy. As we have indicated, the bathers leave behind a lot of organic wastes (food for bacteria) and bathers are also the main sources of the initial bacteria that contaminate the water. It is best to control both the micro-organisms and the wastes right after bathing is completed. In doing so, we control the population of these organisms while they are at their lowest numbers. We don’t give them a chance to multiply. If we don’t control them, with a sanitation method, they can grow and multiply using the dead organic wastes as food. If allowed to multiply they become a hazard to the person who uses the tub next time. However, if they are destroyed after the bathing episode is completed and the cover is left on the tub, the water will stay healthy. If the microbe population is allowed to multiply the water can also become turbid. Turbid water, after a bathing episode, is usually just caused by particles that are not filtering out, not due to excessive bacteria.

While a wide variety of methods exist, for sanitizing a spa/hot tub, Northern Lights has limited the choice of what we supply to bromine, metal ionizers, ozone and none-chlorine oxidizer known as MPS. This is still a large variety and which combination a customer should use is governed by factors such as effectiveness, convenience and cost. You will notice we have not mentioned the most common sanitizer used in the industry, chlorine. This is because certain chlorine products especial common bleach and tri-chlor tablets and chlorine produced by salt-water chlorinators, will attack the wood. Rather than attempting to deal with the nuances of various chlorine sanitizers, we have simply made a point to avoid them in wooden hot tubs and declared them “*Not Safe for Wooden Hot Tubs*”. If chlorine is used, for some reason, be sure it is the *Di-Chlor* granular type, **not Bleach such as Chlorox or the Tri-chlor type** found in tablets or pucks or **Chlorine Salt Water Generators**

Before we describe the pros and cons of the various methods lets try to obtain a common understanding of the term sanitization and oxidation. Sanitation, as mentioned, is simply the term used to describe a process that destroys or kills live bacteria and viruses. Let’s use several analogies. You are a farmer and are trying to get rid of a nuisance coyote. You have choices such as the use of poison, a trap or a gun. All these would be the equivalents of what sanitizers do to germs (kill them). Now you have a dead coyote and you know this will be food for other critters, such as rats or flies. If you don’t want this “dead meat” around, because the rats and flies are even worse pests, then you could burn the carcass. This “burning” is equivalent to what oxidizers do to dead organic matter, in the spa situation. But we also know that if the coyote had been caught in a fire, he would also have died. Thus, oxidation can under certain conditions destroy dead food matter as well as live organisms. So oxidation can in some situations also sanitize.

The terms oxidizer and oxidation suggests they have something to do with a chemical reaction involving oxygen. However, in modern chemistry oxidation is defined in terms of a reaction where the substance (being oxidized) gives up electrons to the element or compound that take away the electrons (the oxidizer). Of course, in doing so the original form of the substance being oxidized is destroyed. Common oxidizers (elements or compounds that easily attract electrons) include the halogens (chlorine, bromine, etc.), oxygen, ozone, potassium monopersulfate (MPS), to name some. Common reductants (elements or compounds that readily give off electrons) are the active metals, hydrogen, carbon, carbon monoxide, to

name some. In the hot tub situation, the important thing to note is that organic compounds, including oils, lotions, as well as living microbes, contain hydrogen and carbon. Depending on the oxidizer, its concentration and factors like contact time, temperature and pH, these organic compounds are susceptible to being broken up or destroyed by the right oxidizer. A strong oxidizer in the pool and spa industry is often referred to as shock, such as potassium monopersulfate (MPS). The term shock, however is a throw-back from when chlorine was used to “super chlorinate” or shock pool water to oxidize the dead organic waste materials. Nowadays MPS or ozonators are substituted for such super-chlorination.

Bromine will react with amines (nitrogen- based compounds) to form smelly compounds known as bromamides. While these still have some sanitizing effect they are not nearly as effective as free bromine, HOBr, that is not smelly. Oxidizers such as MPS and Ozone will react with these bromamides converting them back to the more effective free bromine and removing the smell.

9.4.1 Bromine

Bromine, like chlorine, is a member of the halogen chemical family. Bromine has gained wide acceptance as a sanitizer especially on spa/hot tubs and has become the dominant sanitizer because users do not experience the same level of odours and skin irritation as they often do with chlorine. In addition, bromine is far less pH dependent than chlorine. It is the only sanitizer that we use (chlorine we don't use) that is officially approved as a full-spectrum sanitizer when a certain residual (base line of active bromine) is maintained. When added to water, bromine forms Hypobromous acid (HOBr) and Hypobromide ions (OBr⁻). These exist together in an equilibrium state that depends on the pH. Only HOBr is the effective sanitizer and while the OBr⁻ is a weak oxidizer, it exists in small quantities at the normal required pH levels, as the following table shows:

pH	HOBr	OBr ⁻
6.0	100%	0%
7.0	99%	1%
7.5	94%	6%
8.0	83%	17%
9.0	30%	70%

HOBr is the bacteria killing agent, if at the right concentration and if the bacteria are in contact with it for the right amount of time. HOBr will also combine with waste products and if these contain nitrogen (such as ammonia from sweat and urine) then bromamides are formed. Unlike the equivalent chloramines, formed in the case of chlorine, these do not produce the same level of odour (not to imply they are odourless) or skin irritation. The bromamides still are effective as a sanitizer, and, as mentioned above, if oxidized will separate to the free bromine, HOBr, again.

We provide Bromine in two basic forms:

- 1) **2-part system (recommended to be used)** consisting of part 1- *Mineral-Aid* (35% NaBr salt solution) or *Bromine Booster* (100% NaBr salt) is added to the water and part 2 – *Oxy-Pur* (pH stabilized MPS which is a chlorine free oxidizer) is added after each bathing session.
- 2) **Brominating tablets** used in a floating feeder that stays in the water in combination with an oxidizer treatment (MPS or *Oxy-Pur*) added after bathing. Not recommended for continuous use because it degrades the wood.

9.4.1.1 The Use of the Two-Part System

If used correctly, this approach does not expose the bather to any significant amounts of smelly nitrogen based bromamines or high levels of bromine while actually bathing. The first part, *Mineral Aid* (35% NaBr salt brine naturally present in sea water) or *Bromine-Booster* (100% NaBr in powder form) is added at fill-up time in specific quantities as outlined on the bottle (125 ml/1000 l of *Mineral-Aid* or 50 gms/1000 liters of *Bromine Booster*). Then, if a new fill, you add the part 2 – *Oxy-Pur* (pH stabilized

MPS, a chlorine free oxidizer) in the amount of 125 gms/1000 l. Do not use the tub for 12 hours after adding these two.

The NaBr, when added does nothing by itself until the oxidizer (part 2), MPS (*Oxy-Pur*), is added. The MPS acts both as an oxidizer destroying dead organic compounds that came with the fresh fill water and also reacts with the NaBr to produce the HOBr (sanitizer) and OBr (weak oxidizer) killing any live micro-organisms.

Thereafter, the regime is to add 30mg (1 capful)/1000 litres of *Oxy-Pur* at the end of the day after the day's bathing session. This will oxidize (break-down) the dead organic compounds and containments the bathers introduced into the water and react with unused NaBr as well as bromide compounds that were previously used to produce the active HOBr again to destroy any bacteria that the bathers may have introduced. If the tub hasn't been used, you don't need to do this. Or, if the bathing session was short and didn't involve many people, you can reduce the amount added. You will discover that by the next day the water is clear yet mostly absent of HOBr (test strip reading will be low or zero). If it is a personal residential use tub do not fuss when you test the water and you get no indication on your strips before bathing. Do the testing after you have used the tub and after you have added the *Oxy-Pur*. This is when micro-organisms that came off the bathers should be killed. If you try to keep the bromine reading at the 2-4 ppm level all the time, you will likely over-brominate and end up with a rash. You will replenish the NaBr occasionally (once a week for a highly used tub and once every 2 weeks for a lightly used tub) by adding 30 ml/1000 l of *Mineral-Aid* (or 12 gms/1000 l of *Bromine-Booster*). If you use the tub sporadically, you won't need to add *Oxy-Pur* daily.

The following table provides the water volumes contained in the various sized hot tubs. The chemical quantities, indicated for the larger tubs is large, because the water contained in these tubs is large. However if the tub is not subjected to a high number of bathers the amount of bacteria and organic wastes produced will be at a lower end and you will have to experiment by how much you can reduce the after-bathing addition of *Oxy-Pur*. If you use *Bromine-Booster* instead of *Mineral-Aid* the quantities in grams will be in a ratio of 2.5 less in grams as shown in ml for *Mineral-Aid* in the table. Also, if you are using an ozonator, downward adjustments of the *Oxy-Pur* may be possible. This will also require some initial experimentation.

Tub Size	Liters	US Gallons	Initial Mineral Aid (ml)	Weekly Mineral Aid (ml)	Initial Oxy-Pur (gms)	Oxy-Pur Added After Large Bathing Load (gms)
Small	1334	351	167	40	167	40
Regular	1819	479	227	55	227	55
Large	2378	626	297	71	297	71
Extra Large	3124	822	391	94	391	94

See Note below to measure Oxy-Pur without a scale

9.4.1.2 The Use of Brominating Tablets

This is an alternative, less preferred method to the 2-part method. It can be used as a backup to augment the 2-part method. In this case brominating tablets, containing a combination of bromine and chlorine compounds, are inserted into a floating or in-filter feeder dispenser. The tablets slowly dissolve and continuously release the bromine sanitizer to the water. In this case you will have a stronger concentration of sanitizer in the water when you bathe. Be aware however the chemical makeup of bromine tablets is 1-bromo-3-chloro-5, 5-dimethylhydantoin and thus this is not chlorine free. While the active ingredient is again HOBr the chlorine component in the compound acts to regenerate the used bromine ions back into HOBr, but it will also have some reaction with the wood (turning it pulpy over time), albeit less aggressively than if chlorine tablets were used. However, if the bathing load is too large, the residual bromine that this meth-

od produces will be used up and you should treat the water with MPS (*Oxy-Pur*) to destroy the organic bather's wastes and give the bromine dispenser a chance to re-establish some bromine reserve. With this method, it does not hurt to have some NaBr (*Mineral-Aid*) present in the water, so that when adding the MPS, bromine will re-establish itself instantly. Sometimes the use of NaBr for such purpose is called a "bromine starter".

The setting of the dispensers will depend on the size of the tub. The desired reading on the strips of 2-4 ppm may be hard to establish on a continuous basis. Be aware that our larger tubs contain significantly more water than does an acrylic spa for which the information is usually given. Even on our small tub you can expect to have the dispenser fully open. For larger tubs, you may also need to keep additional tablets in a 2nd dispenser or in a glass kept underneath a seat on the floor, where it won't get knocked over. The test strips tend to be notorious for not indicating well and if you have ample tablets in use and they are dissolving at a good rate (cartridge lasts less than 1 week) and you are getting a rash, the likely cause is too much bromine being present.

Note 1 – Millilitres of Mineral-Aid can be measured with a measuring cup. Powdered Oxy-Pur has a density of approximately 1.5. So if you measure with a measuring cup, divide the grams in the table by 1.5 to obtain the ml to add. Also 1 capful is approximately 30 gms.

Tub Size	Liters	US Gallons	Initial Mineral Aid (ml)	Initial Oxy-Pur (gms)	Bromine Tablet Weekly Dissolve Rate	Oxy-Pur Added After Large Bathing Load (gms)
Small	1334	351	167	167	7	40
Regular	1819	479	227	227	9	55
Large	2378	626	297	297	12	71
Extra Large	3124	822	391	391	16	94

See Note on previous page to measure Oxy-Pur

If the tub is not subjected to a high number of bathers, the amount of bacteria and organic wastes produced will be at a lower level and you will have to experiment by how much you can reduce the tablet dissolve rate. Also, if you are using an ozonator, downward adjustments of the tablet dissolve rate can be made. This will require some initial experimentation.

9.4.2 The Use of Metal Ions or Mineral Treatments

Metal ions, such as Silver, Copper and Zinc, have long been recognized for their ability to keep water fresh for drinking. Pioneers used to place copper and silver coins in their barrels of drinking water as they travelled west. Now we see these metals being used by the spa industry to treat the water. Northern Lights Cedar Tubs Inc provides a Silver Mineral Cartridge system manufactured by King Technology under the *Spa Frog* brand. We also provide electronic Silver, Copper and Zinc ionization system manufactured by Argenia. While these are effective at stopping the growth of bacteria and algae they are not as full spectrum as is bromine and especially for public use hot tubs, bromine use cannot according to the regulations be avoided.

9.4.2.1 Spa Frog Silver Mineral Cartridge

The Spa Frog Mineral Cartridges are formulated to work in a bromine environment, as opposed to other brands (such as *Nature 2*) which are formulated to work in a chlorine environment. The in-filter version of this cartridge system has the water which is passing through the filter, also pass over the silver mineral purifier. The silver metals act to suppress both bacteria and virus in the water. Because these cartridges do not control organic waste and do not assure control of all bacteria or algae it is highly desirable to use them as a supplement to any of the previous bromine sanitizer methods, rather than the primary control method. When used, the amount of work that the bromine sanitizer has to do is reduced allowing the use of lower levels of bromine. The combination of bromine and silver minerals is a true synergistic action. The *Frog Mineral* cartridge is effective of a period of 4 month and this is very convenient for the hot tub owner. For the larger tubs two cartridges in a floating unit are recommended instead of the single in-filter cartridge.

9.4.2.2 Silver/Copper/Zinc Electric Ionization

Theory

The Argenia “Copper” water treatment system actually produces 80% copper (Cu), 10% Silver (Ag) and 10% Zinc (Zn) ions. This system, combined with an oxidizer (*Oxy-Pur and/or ozonator*) and good filter cleaning procedures, produces crystal clear water (in residential hot tubs) without the use of chlorine and bromine. It produces this clear water with the least effort and operating cost. In commercial hot tubs, regulations still require 1-2 ppm of bromine residual to be maintained.

Why is this ion combination effective? 1st electrically charged copper ions (Cu²⁺) in the water search for particles of opposite polarity, such as bacteria, viruses and fungi. The positively charged copper ions then form electrostatic compounds with the negatively charged cell walls of micro-organisms. These compounds disturb cell wall permeability and cause nutrient uptake to fail. Thus the copper ions cause many micro-organisms to starve and copper is particular effective against algae. Copper ions further penetrate the micro-organism’s cell wall and as a result they will create an entrance for silver ions (Ag⁺). These (silver ions) penetrate the core of the micro-organism. Silver ions bond to various parts of the cell, such as the DNA and RNA, cellular proteins and respiratory enzymes, causing all life support systems in the cell to be immobilized. As a result, there is no more cellular growth or cell division, causing bacteria to no longer multiply and die out. The ions remain active until they are absorbed by a micro-organism. The third component, zinc, stimulates healing of the skin and prevents stains and rings on the spa basins. While the copper and silver ions are effective against simple micro-organisms reproduction, they do not react with complex cells and are harmless to the skin.

Operating Instruction

To successfully use the ionizer the water does need to be balanced properly. This means you should measure the water's properties with a test strip and then adjust the total alkalinity in the 80-120 ppm range and the calcium water hardness in the 150 - 300 ppm range. pH should be in the 7.2-7.6 range. High pH and total alkalinity and/or hard well water above 400 ppm and/or water containing sulphur may result in Copper compounds such as CuSO_4 forming around the electrodes and the water may need to be treated first with a water softener and then a pH reducing compound such as muriatic acid. If ever total dissolved solids reach 2000 ppm, it's a sign that it is time to change the water.

The ion concentration is measured with a liquid copper ion concentration measurement kit. The test kit, if a Motte's 3619 test kit, requires 5 drops of two different liquids to be added. The resulting colour (viewed through the top of the test tube) is correlated to a copper ppm concentration. When a tub is first filled with fresh water (and after the water is balanced as above), the ionization controller is adjusted to maximum (push large dose button). At this setting it produces 100mA of current and this can theoretically ionize 1 litre of water to 0.4ppm copper in 6 seconds. To do so the water must be conductive. Normally it will be, but should there be any doubt the addition of two table spoons of regular salt into the hot tub will ensure it is conductive.

The 0.4ppm copper concentration should theoretically, if the water is quite conductive, be reached in the time given in the table below. But typically, it takes much longer. First time you use the ionizer, be sure you don't forget to turn the setting of large dose hours down, so you don't inadvertently overdose. When the time given in the table has elapsed, test the copper concentration level. It is not unusually for the concentration to increase at a much slower rate than the table indicates. If the 0.4ppm level has not been reached keep the controller on the maximum setting until it has and record the total time it took for future fresh fills. The ideal concentration for hot tubs is between 0.4-0.8 ppm. If it is much higher, you need to drain some water and dilute the remaining water with fresh water. (Overdosed water will have a distinctive greenish hue and may also result in greenish scum and even dye skin or bathing suits green.) Once you have the concentration near the 0.4ppm, set the controller to the normal "ion/action" mode and adjust the output to 1-2 %, or even turn it to 0%. Monitor the concentration initially once every week, to get a feel if you need to adjust the ionic action makeup rate. The ion concentration will normally stay reasonably constant unless you add a fair amount of make-up water. In that case, you can switch the unit to large dose mode again until the 0.4-0.8 ppm Cu reading is re-established. Concentration can rise on its own if water evaporates and you don't add make up water. *Note: The A400H controller has persistent memory. If power fails the unit will remember the settings.*

The metal ions do nothing to remove dead organic matter or organic compounds such as oils. For this reason an oxidizer is needed (either an ozone oxidation system or a non-chlorine oxidizer compound such as *Oxy-Pur* (MPS), or both...occasionally adding *Oxy-Pur* (MPS)). It further requires good filtering procedures to be used, because filtering is what keeps the water clear looking. For example, clean the filter once per month and use a flocculent (*Sea Blue*) to remove fine particles when water becomes somewhat turbid, and use enzyme-based descummers weekly or bi-monthly).

Proper filtering and filtering enhancement products are described in section 9.2. It is important that chlorine products be avoided, because chlorine makes the silver ions ineffective. High pH (above 8) must also be avoided.

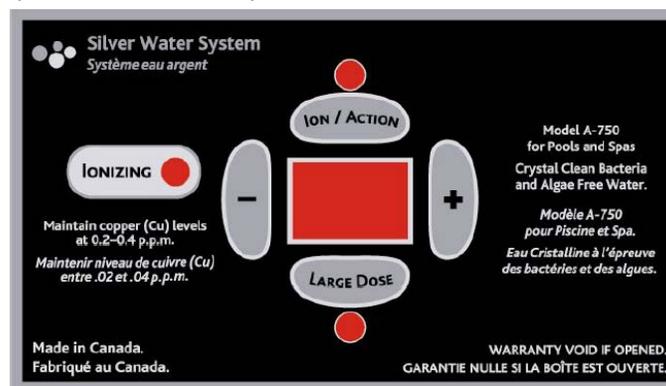
If using an ozonator as the normal oxidation means, set the filtration cycle of the spa pack to at least 6 hrs. At a filtration cycle of 6 hrs every 12 hours, enough ozone will be produced to oxidize the organic contaminants. If you wish you can instead, use the powder oxidizer product, *Oxy-Pur* (MPS), after each bathing session. If you do use an ozonator, it is still a good idea to add some *Oxy-Pur* after a heavy bathing session.

Follow the instructions in section 9.2 regarding turbidity control using a flocculent (*Sea Blue*) and in controlling scum build up, if scum becomes excessive.

Large Dose Operation – Hours (theoretical) Needed with Highly Conductive Water

Tub Size	Liters	US Gallons	Theoretical Hrs to Reach 0.4ppm Cu Concentration
Small	1334	351	2.2
Regular	1819	479	3.0
Large	2378	626	4.0
Extra Large	3124	822	5.2

How the Control Panel (DIGITAL DISPLAY) Functions



Ionizing When the “ionizing” light is blinking, it means that the system is ionizing the water. The ionizing LED light will not blink if the electrodes are not fully submerged in water. The more ions that are being released in the water, the faster the light will blink!

Ion/Action This user defined setting is the duty cycle, or the number of minutes in each hour the ionizer is on for.

Large Dose This should be used when the ionizer is first installed or the ion level is very low. This setting releases the maximum amount of ions for the number of hours the user defines (24 hours is the initial suggestion). The display will count down the amount of hours left. The system will return to the previously set ion/action setting when the large dose ends. You may want to use this button when you refill your spa or there has been a large amount of spillage or water loss. Use at your discretion.

“-” This button will *decrease* the duty cycle time or large dose hours.

“+” This button will *increase* the duty cycle time or large dose hours.

OPERATING INSTRUCTIONS (Use these instead of the instructions that come with the Argenia Unit)

- POWER UP!** When unit is plugged into J18 the unit will receive power, if the spa pack is powered up. The digital display should turn on.
- On a fresh fill, first balance the water (get alkalinity, pH and hardness correct)
- TOUCH THE LARGE DOSE BUTTON FOR NEW START UP’S!** When you see the large dose light come on the unit is producing the maximum amount of ions. The default setting is for the unit to then stay in large dose mode for 24 hrs, but we suggest you turn it down to 3 or 4 hrs (03 -04 display) until you know your water and know how long it takes to achieve 0.4 ppm Cu concentration. Then in future set this time after a refill. Monitor the Copper ion concentration with the Cu test kit, every two hours. Once you have a .4 -.6 ppm reading, turn off the large dose mode by touching the Ion/Action button.
- SET THE ION (DUTY CYCLE) TIME:** Touch “Ion/Action” button to set the duty cycle time to 0%. If you spill water and add make up water, set the Ion/Action setting to 10% for a few hours. Take a Cu ion reading and once you are back in the .4 -.6 ppm range turn the setting down to 0% or, if you use the tub daily you can leave the setting on about 1- 2%. This will very slowly continue to produce some ions.

Trouble-shooting:

- If the cell is not conducting the ionizing light will not be on. It should be on steady while in large dose mode and blink proportional to setting when in Ion/Action mode.
- You can test the ionizer's operation by placing the electrodes in 1 Litre of water and testing the copper concentration after 30 seconds of immersion time.
- If you have very hard water, treat (soften) the water before it enters the tub. Do not use a sequestering agent (stain & scale preventer) since it also sequesters copper, silver and zinc ions. Also, be sure you have the pH in the 7.2 -7.6 range.
- If the water is hard or contains sulphur, copper sulphate may form and this will tend to collect of the electrodes as a greenish deposit. It is important to only have the ionizer producing ions when there is flow; so ensure the skimmer valve is open and the spa pack is set to continuous filter cycle, while you have the ionizer in large dose mode. Leave the ion/action setting at 0, if you then change the filtration cycle to any setting that is not FC. Each time you change water, you must remove the electrode unit and clean it.

9.4.3 Oxidation and Shock Treatment

Oxidation was explained in section 9.4. Shock is term that stems from historical days when pools were super-chlorinated every so often (20-30ppm) to reach the break-point where chlorinated waste products would break down and be destroyed. This could also be accomplished with other products such as MPS. However these are high levels that then would require the concentration to dissipate before the water could be used again. Today the term shock is merely another term for a strong oxidizer. Shock treatment then is the application of a strong chemical oxidizer (Oxy-Pur, a pH neutralized MPS for example) to control (oxidize) biological wastes and other organic compounds. The product of choice, which has already been mentioned numerously, is *Oxy-Pur* (pH neutralized potassium monopersulfate (MPS)). There are other forms of shock but ensure they are chlorine free and are pH neutralized and are safe for wood. Without the pH neutralizing agents MPS will quickly drop the pH of water. The same company that makes this also makes it in a none-pH neutralized version and in fact the label it as *Shock*. Shock treatment is best performed after each bathing episode. By adding the specified dose of 30ml/1000 l at that time, the wastes will be oxidized and thus destroyed immediately after they were left by the bathers. This eliminates these wastes from acting as a food source for microorganisms. This shock treatment will be needed after a heavy bathing session even if one has an ozonator.

9.4.4 The Use of an Ozonator

Ozone has gained wide acceptance in spa/hot tubs. Ozone readily oxidizes organics and amines in pool and spa water to remove or alter them. They are then unavailable to combine with bromine to form bromine based compounds. Ozone accomplishes this important work because it is a much stronger and faster acting oxidizer than bromine. Chemically, ozone is a highly reactive oxidizer and is an especially effective in its ability to break-down dead organic material (dead skin, oils, etc.) it comes in contact with these. While effective as an oxidizer, ozone has a very short life, especially in hot water. It is for that reason that only the water that actually comes in contact with it that is treated. This tends to be the water near the top part of the hot tub, although as water is drawn in at the bottom and squirted out by the jets, with time all the water has a chance to make contact with ozone. Because ozone it is short lived and because is not effective as a sanitizer (destroying bacteria, viruses, algae) and is not recognized by the EPA as an approved sanitizer in the hot tub. It is used for its ability to oxidize dead organic matter and which would be food for bacteria and thus make such material useless as a nutrient for bacteria. It removes the need for the bromine to perform an oxidation function (which without adding ozone or MPS, would consume 80% of it to do this oxidation job). Thus, the bromine is available entirely for the sanitizing and the residual bromine reserve functions, meaning far less need to be used. The ozonator is plugged into the spa pack's ozonator receptacle. For maximum benefit the filter cycle can be set to continuous (FC), so that the ozonator will be on 24/7. The ozonator receptacle is only energized during the filter cycle. Since the ozonator requires the aspiration suction created by a jet or ozone venturi, the pump must be on, in order for ozone enriched air to be sucked from the ozonator into the water.

9.4.5 Algae, White Water Mold and Biofilm Control

Problems with certain algae growth can occur in a hot tub. Slimy round milk scum like deposits developing on staves or seat surfaces are a form of algae. If rubbed they will come off and float in the water in different size flakes. A different organism entirely is white water mold, which is a fungus. It manifests itself as feathery paper consistency growths on surfaces that have little flow. Another undesirable growth or deposit is known as biofilm. This is mixture of colonies of bacteria mixed with solids, oils and other organic matter. If it gets going, it can deposit everywhere, but especially in low turbulence areas, including in the interior of pipes.

Algae, in whatever form it takes, can be easily treated by using a copper based spa algaecide (not included with our chemical kit). Copper ions, as produced by our ionizer *electrodes*, are also an excellent algae control mechanism. It is also possible to use a liquid elemental copper solution such as *Cleanwater Blue*.

To also prevent the white water mold it is important to use the non-chlorine oxidizer MPS, as instructed, daily or after each use of the hot tub. If this mold gets established a good cleaning of all surfaces including piping with a concentrated MPS solution and possibly a biofilm removal liquid, is required. Use the same technique as described for removing biofilm discussed next.

To get rid of biofilm you will need to change the water. However, before you drain it, first lower the spa pH to 7.0 or less and turn down/turn off the heat so the temperature will be lowered. Super-shock (oxidize) the hot tub with a 4⁺ times the normal shock dosage of non-chlorine MPS shock (Oxy-Pur for example). You want to kill or weaken the organism. Then use a biofilm or spa flush product, such as *Serum Part 1- Total Cleanse*. Serum products are available from <https://watercarerx.com/products/>. Alternative to Part 1 is a spa flush product, such as *Rendezvous Spa Rinse* or *Leisure Time Jet Clean*. Follow the direction provided on the containers. After running the jets with this solution in the water for the prescribed time, drain the water. Give the spa another additional rinse and flush with your garden hose. Spray water into every jet and orifice that the nozzle will fit into. Drain remaining water and refill the hot tub. Balance the chemistry and begin sanitation and filtration. To prevent reoccurrence of biofilm add Serum Part 2 – Total Maintenance as instructed on the bottle. Alternative to the Part 2 is a copper algaecide or elemental copper solution such as *Cleanwater Blue*, or the *Argenia Copper* ionizer.

9.5 Too Many Choices- Just Summarize what to Use!

The topic is no doubt complex as the previous sections will suggest. Many customers just want to have something that works. They know spas and hot tubs have been around and that the water can be controlled. “Give me what everyone else uses”, is all they request. Others are under the belief (real or imaginary) that chemicals are bad for them, especially chlorine or even bromine, and they wish to be “chemical free”. Yet others don’t worry about the chemicals but don’t wish to have a daily task of adding products or making adjustments. We have simplified our approach to what we normally will deliver.

- 1) For the “*give me what everyone else uses*” person, we provide a starter chemical kit that is quite comprehensive. It contains the products mentioned in the sections dealing with mechanical treatment, water balancing, bromine sanitization and oxidation. It also contains a basic 4-way test strip as well as a floating tablet dispenser. This kit, which comes with instructions, is illustrated in the next Figure. It has all the products you need to keep your water clear and sanitary.

Deluxe Starter Chemical Kit



- 2) For the persons who want convenience but have no great problem with chemical treatments, we offer the above chemical kit supplemented with an ozonator. The ozonator, once installed, is attention free and by using it the amount of Bromine and MPS (Oxy-Pur) added on a daily basis, can be reduced. The cost of the ozonator is therefore recovered by reduced use in sanitizer chemicals.
- 3) For customers, who want salt water therapy, we do offer, in lieu of 2) a system employing the Tubby salt water bromine generator. In this case bromine is generated electrochemically instead of with the two-part bromine approach.
- 4) The system that does an excellent job, including control of algae, with the least amount of attention and with the lowest long term cost, is the metal ionization system combined with an ozone oxidizer (or alternatively addition of the MPS oxidizer Oxy-Pur). This allows chlorine and bromine to be completely avoided. It is our best water sanitation system.

You can improve upon each of these options by using a good cartridge filter such as buying a Harmsco Part No H4950 Sure Safe anti microbial filter. See http://harmasco.com/pdf/SP_SureSafe_FINAL0204.pdf on the Internet. We recommend you do this once you need a new filter, since it is only marginally more expensive than a regular filter.

Recommended

Good	Better	Best
<p>1 Use Std Bromine Chemicals</p>	<p>2 Use Std Bromine Chemicals + Ozonator</p>	<p>4 Use Ag/Cu/Zn Metal Ionization + Ozonator</p>
		 Bromine products are not to be used.
Chemical Kit	Chemical Kit	Limited Chemicals
4-way red Test Strip	4-way red Test Strip	Cu Test kit + 4-way Test kit (pH , total Alk & Calc Hardness only)
Specialty Conditioners	Specialty Conditioners	Specialty Conditioners
Prevent II (sequestering agent)	Prevent II	Prevent II
Nature Pur (descumner)	Nature Pur	Nature Pur
Sea Blue (floculent)	Sea Blue	Sea Blue
Balancing Products	Balancing Products	Balancing Products
Alka-Rise	Alka-Rise	Alka-Rise
pH Booster	pH Booster	pH Booster
pH Reducer	pH Reducer	pH Reducer
Cal-Rise	Cal-Rise	Cal-Rise
Sanitizer/Oxidizers	Sanitizer/Oxidizers	Sanitizer/Oxidizers
Tablet Dispenser		non
Brominating Tablets		non
Mineral-Aid (35% NaBr) Pt 1	Mineral-Aid	non
Oxy-Pur (MPS) Pt 2	Oxy-Pur	Oxy-Pur
	+	+
		Argenia Silver Water System 
	+	+
	 Ozonator	 Ozonator
Discussion:	Discussion:	Discussion:
<p><i>Fully able to keep tub water clear and sanitary.</i></p> <p><i>Use 2-part bromine system</i> <i>Or</i> <i>Floating dispenser with MPS (Oxy-Pur) and some initial NaBr(Mineral-Aid) as a starter</i></p>	<p><i>Rated Better-yet over 1 because it allows sanitizer/oxidation chemicals to be reduced and requires less overall attention than 1</i></p> <p><i>Use 2-part bromine system</i></p>	<p><i>Rated Best because this system gets as close as it gets to a chemical (bromine or chlorine) free approach. Requires virtually no chemical products except for initial water balancing and occasional MPS (Oxy-Pur) use and occasional use of filtering enhancement products. Also controls algae very well. Once adjusted properly, the system requires next to no attention, and annual operating cost is minimal.</i></p>
<p><i>Annual Cost of the chemicals, when used as per container instructions will be high, increasing with the volume of the tub.</i></p>	<p><i>Annual cost of chemicals + mineral cartridges somewhat lower than 1, but initial cost is somewhat higher</i></p>	<p><i>2nd highest initial cost but this is offset by lowest operating costs. Electrodes require occasional cleaning. Replacement of electrodes no sooner than 5 years.</i></p>

9.6 Water Trouble Shooting

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Dark Brown Water	New Tub	Allow for 3 fresh water fills, each lasting <u>at least</u> 2 week to remove the tannin that first comes out of the cedar wood and colours the water. When using the water maintain proper sanitizer levels. Too much (bromine) is just as bad as too little.
	Old Tub	If water still turns brown, this is likely caused by iron in the water, that is being oxidized by air, ozone and MPS (Oxy-Pur). Best way to eliminate this is to pre-treat the water using an iron removal treatment system. If this is impossible you may have to live with this. A sequestering agent may help.
Turbid (cloudy) water	Filter problems	Inspect filter cartridge for tearing and cracking. The spring-loaded check valve that bypasses the flow if flow through filter exceeds specifications may be stuck open.
	Microscopic particles from heavy bathing load. These may be too small to filter out.	Add <i>Sea Blue</i> flocculent to cause the particles to combine together so they can be filtered out. Also test water for pH and adjust if necessary.
	High TDS levels High total alkalinity or High pH levels	Test all chemical levels and make the appropriate adjustments. If total dissolved solids (TDS) are too high fill tub with fresh water
Slipper Surfaces	Sediment deposits on top of seats and on floor	Use sponge to wipe off sediment and get it into the water. Then add some Sea Blue and allow it the sediment to get caught by the filter. Also use MPS after each bathing session according to directions. It will take some time for the water to clarify. If condition is too severe, because of long hiatus in the tub use, drain the tub while cleaning all the surfaces and then refill with fresh water.
	Formation of algae on wood surfaces	Round white soft blotches growing on inside surfaces. Will break up into flakes that then float in the water. Buy a copper based spa algaeicide and treat as per instructions. Consider use of electronic metal ionization system which produces copper ions which suppress algae.
	Formation of White Water Mold on surfaces	This is manifested by white mucous or feathery paper like formations on the wood fibers and elsewhere in the tub that lacks flow and sunlight. Best prevented by regular use of an oxidizer (MPS – Our Oxy-Pur) and use ionizer at higher concentrations, such as 0.8ppm. Once established drain tub, clean surfaces and treat with a strong oxidizer solution (high strength MPS solution). Flush piping with a spa flush or biofilm removal solution. Then fill tub with fresh water ensure water is balanced and use 2-part bromine at double strength, part 2 renewed every 6 hours for 2 days.
	Formation of Biofilm	This may have similar appearance as white water mold, but is a bacteria colony mixed with solids and other organic compounds. Tends to build up in areas hard to clean, such as under the seats and in pipes. Follow procedure explained in section 9.4.5

Fibres in Solution	Loose white fibrous material pulp floating in water and collecting on suction screen and in the filter	Interior wood surfaces have become soft and pulpy, likely because of steady use of products containing chlorine. Drain tub and with a scouring pad, remove pulpy material from wood surfaces, including benches. The wet scraped-off material can be removed using a wet and dry shop vacuum. Refill tub and check drain screens and filter frequently until water has cleared up. <u>It is recommended that you immediately stop using tri-chlor products, that you switch to one of the methods depicted in the table on the previous page.</u>
Skin irritation	Improper pH or Total Alkalinity levels. Insufficient sanitizer or too much sanitizer being used	Test all balancing chemical levels and make the appropriate adjustments. If you are continuously adding bromine product, because you are not seeing a reading on the test strips, you probably have over-brominated and are getting a reaction from the bromine. Read section 9.4.1.1 on use of two-part bromine system and use it as described in this section, not as described on the bottles. Add non-chlorine shock such as our Oxy-Pur (MPS) after use to temporarily raise bromine concentration, if reading is low.
Eye irritation	Low sanitizer levels or excess 'combined bromamines or chloramines.'	Test all chemical levels with an accurate test kit and make the appropriate adjustments. Follow instructions in this manual on how to use the 2-part bromine system. Shock your spas water with MPS (Oxy-Pur) per instructions in section 9.4.1.1
Excessive foam	Build-up of body oils or cosmetics.	Generally, there will also be a scum line around the top of the spa (see next problem). Regular use of MPS (Oxy-Pur) should break up these kinds of products. Use of Nature-Pur (a descummer) makes these products even more susceptible to oxidation by MPS. Sea Blue (floculent) will help to help to filter the smaller particles away. If a scum line is present clean it with a sponge or clean it and the tub and the filter and then fill with fresh water. Either way, the filter should be thoroughly cleaned by soaking overnight in a Spa Filter Cleaning Solution. An oil absorbing sponge and Nature-Pur (a descummer) can help in preventing this in the future.
	Laundry detergent residual in swimwear.	Use defoamer or refill tub with fresh water. Make it a habit to run an extra rinse cycle on the washing machine or re-rinse well by hand.
	Excess organic contaminants	Some organic matter is prone to causing foamy water as it breaks down in the filter (maple leaves especially). Generally using Spa Defoamer to break up the foam, then Descumner (Nature Pur) to break up the organic contaminants and possibly also Sea Blue (floculent) to help filter them away followed by thoroughly cleaning your filter will clear up the problem. It may however be necessary to drain and refill your spa if the foaming is quite excessive.
	Low Total Hardness	Test water for total hardness and if necessary increase with Calcium Ruse.
Oily, scummy water line	Body oils, dirt, soaps	Scum line may be able to be removed with paper towel. Adding Nature-Pur (descumner) weekly and frequently clean filter usually eliminates this problem.
Black Staining above water line	Metals precipitating or mould or algae growth	If due to metals dissolve with diluted muriatic acid and use a sequestering agent in the water (Prevent II). If mould or algae is suspected, apply a mould and algae remover when cleaning the tub. Use an algaecide in the water or, better yet, use the

		electronic ionizer. Also deploy an ozonator to keep air space above water enriched with ozone which will kill the mould or algae that may wish to deposit above the damp water line.
Unstable pH	Low total alkalinity levels	Test total alkalinity levels with an accurate test kit and if necessary increase with an Alka-Rise.
pH resistant to changing	High total alkalinity levels	Test total alkalinity levels with an accurate test kit and if necessary decrease with a pH Reducer or dilute the water

9.7 Quick Water Treatment Summary Instructions

9.7.1 Tub without an Ionizer and Ozonator

Residential Tub without Ionizer

Tub is drained, cleaned and rinsed.

Any remaining water is removed with wet and dry vacuum
Tub is filled with fresh water

Balance the water

Total Alkalinity = 80 - 120

pH = 7.2 - 7.6

Calcium Hardness = 150 - 400 ppm

Water Sanitation 1-time Procedure After Fresh Fill

140 ml of Nature-Pur

Wait 1 day and then add

Add Mineral Aid and Oxy-Pur

Small Tub

Add 170 ml of Mineral Aid (~ 1/6 of 1000 ml bottle)

Add 170 gm of Oxy- Pur (~ 1/6 of 1000 ml bottle)

Medium Tub

Add 225 ml of Mineral Aid (~ 1/4 of 1000 ml bottle)

Add 225 gm of Oxy- Pur (~ 1/4 of 1000 gm bottle)

Large Tub

Add 300 ml of Mineral Aid (~ 1/3 of 1000 ml bottle)

Add 300 gm of Oxy- Pur (~ 1/3 of 1000 gm bottle)

Extra Large Tub

Add 400 ml of Mineral Aid (4/10 of a 1000 ml bottle)

Add 400 gm of Oxy- Pur (4/10 of a 1000 gm bottle)

On-Going Water Sanitation (Wait at Least 1-Day)

After each heavy daily use, or otherwise at least
after each 3rd light use, add Oxy-Pur oxidizer

40 gm for Small Tub

55 gm for Medium Tub

70 mg for large Tub

94 mg for Extra-large Tub

Once per week for heavily used tub, or once every

2 weeks for lightly used tub add Mineral Aid

40 gm, 55 gm, 70gm or 94 gm for

Small, medium, Large and X-large respectively

As needed add

3- 4 capfuls of Sea Blue flocculent if water remains
turbid

140 ml of Nature-Pur when water needs clarifying
or descumming

Clean Filter once per month or as needed

Replace Filter once per year

Change Water Once every 6 month or as Needed

9.7.2 Tub with an Ionizer and Ozonator

Standard Tub with Ionizer and Ozonator

Tub is drained, cleaned and rinsed.

Any remaining water is removed with wet and dry vacuum
Tub is filled with fresh water

Balance the water

Total Alkalinity = 80 - 120

pH = 7.2 - 7.6

Calcium Hardness = 150 - 400 ppm

Water Sanitation 1-time Procedure After Fresh Fill

Add Mineral Aid and Oxy-Pur

Small Tub

Add 170 ml of Mineral Aid (~ 1/6 of 1000 ml bottle)

Add 85 gm of Oxy- Pur (~ 3 capfuls from a 1000 ml bottle)

Medium Tub

Add 225 ml of Mineral Aid (~ 1/4 of 1000 ml bottle)

Add 112 gm of Oxy- Pur (~ 4 capfuls from a 1000 gm bottle)

Large Tub

Add 300 ml of Mineral Aid (~ 1/3 of 1000 ml bottle)

Add 150 gm of Oxy- Pur (~ 1/8 of 1000 gm bottle)

Extra Large Tub

Add 400 ml of Mineral Aid (~ 4/10 of 1000 ml bottle)

Add 200 gm of Oxy- Pur (~ 2/10 of 1000 gm bottle)

Turn Filter Cycle to Continuous (read spa pack instructions)
and Ionizer to Large Dose Mode with setting to number
of hours* that will result in 0.4 -0.8 ppm Copper.

Once achieved turn Ionizer to Ion/Action mode with 01 setting
Change Filter cycle to the Normal Start and Stop Times

On-Going Water Sanitation (Wait at Least 1-Day)

After each days heavy use, or otherwise once per week
add Oxy-Pur oxidizer

40 mg for Small Tub (~ 1-1/2 cap fulls from a 1000 gm bottle)

55 mg for Medium Tub (~ 2 cap fulls from a 100 gm bottle)

70 mg for Large Tub (~ 2-1/2 cap fulls from a 1000 gm bottle)

94 mg for Extra Large Tub (~ 3 Cap fulls from a 1000 gm Bottle)

As needed add

3 - 5 capfuls of Sea Blue flocculent if water remains turbid and
140 ml of Nature-Pur when water needs clarifying or descumming

Clean Filter once per month or as needed

Replace Filter once per year

Change Water Once every 6 month or as Needed

* hrs setting will require an initial experimentation to determine
how many hrs it takes to achieve required ppm Cu concentration

9.8 Replacement Chemicals

Northern Lights Cedar Tubs offers replacement chemicals that are approved for use in wooden hot tubs. These come in various sizes. To order, phone or go to the web page:

Cedar Tubs Direct
204 977 1674 Ext 221
visit <http://direct.cedartubs.com/>

For European customers : contact Northern Lights Europe, www.northernlights.be or email to info@northernlights.be or phone + 32 (0)3 248 76 11



10. Controls Troubleshooting

Q: Why does my ground fault circuit interrupter (GFCI) or residual current device (RCD) trip when I turn on my new tub?

A: The ground fault circuit interrupter may be wired wrong. Be sure that the neutral wire is installed correctly. GFCIs require the load neutral to be attached directly back of the GFCI itself. Less common is incorrect wiring of the pump.

Q: Why has my ground fault interrupter (or residual current device) suddenly start to trip as soon as power is applied?

A: This would indicate that there is an electrical current leak at the heater element and it should be replaced. Improper alkalinity and water hardness will cause heater tubing pitting and early failure.

Q: Why does my tub not heat after I turn on the breaker?

A: If you get a Dr, Dy, Lf indication the filter may be dirty or you may have an airlock. Make sure that the filter and the drain screens are clean to allow proper flow through the heater. An airlock can prevent the pump from functioning properly. If there is not enough flow, the protection logic will shut the heater off to prevent it from overheating and possibly burning out.

Q: Why does my tub heat but the temperature is 20°F below the setting of the top-side control panel?

A: This will occur with Balboa spa packs, if the spa pack is in “sleep” mode (*S* will flash). The spa pack needs to be set to “Standard” mode. See Appendix of the Plumbing and Electrical Instructions.

Q: My pump is running but there is no flow - why?

A: The pump should not be left running more than 2 minutes if there is no flow coming out of the jets. If water level is below the skimmer hole the skimmer valve should be closed. Check that the isolation globe valves are open. If they are open and there is no flow, there may be an air lock in the pump: Try running the pump on high speed momentarily. Then loosen the pump's discharge union momentarily to bleed air until water flows out. Also ensure the filter is purged by opening the nut in the lid until water comes out. With the pump primed and water above the skimmer hole, you can open the skimmer valve again. If none of these correct the problem, the pump impeller may be damaged such as a sheared impeller shaft. Remove the pump and check the wet end.

Q: Why does my system run only for several minutes and then trip the breaker?

A: The breaker may be too small: Have an electrician check current draw and that the wiring and the breakers are sized properly and have been tightly connected.

Q: Why does my flow seem erratic and surges or comes and goes in spurts?

A: The most common reason for this is that the water level is below the skimmer and you did not close the skimmer valve. This may also result in the heater coming on and off sporadically and can easily result in failure of your heater element. Be sure that the skimmer valve is open only when the water level is above the skimmer hole.

Q: I turned on power to start the tub but the pump seems to be running in a reverse sequence. The pump runs in high speed instead of low speed and visa versa. What is wrong?

A: Most likely you got shipped a motor that has the low and high speed wiring not matching the Spa Pack. At the motor, reverse the high and low speed wires (black & red or black and brown).

Q: I filled my tub, the pump runs but IC is displayed. What is wrong?

A: Most likely your fill water is quite cold (below 7°C or 44°F) and this is below the freeze protection temperature. Different spa packs behave differently in what is allowed to come on. Some will go into pump-high speed mode until the water temperature has risen above the freeze protection point. Others like the new VS/GS models will run in Lo speed. If the spa pack is interlocked so the heater won't come on if the pump is running in high speed, then the heater will stay locked out until the pump heat raises the temperature to above the freeze protection point. If you have an older spa pack don't have the spa pack set to low current mode, if you don't need to.

11. Warranty Claims

Northern Lights Warranty is described in the Assembly instructions for the hot tub and in the plumbing installation instructions. The warranty covers manufacturing defects only for the wooden parts and the manufacturer's warranty on the electrical parts. Coverage is not provided for failing to follow instructions (such as operating a gas heater in freezing temperatures) or for incorrect operation of equipment or for careless use of the hot tub. We do cover items damaged in transit or items not received or wrong items received. To make a warranty claim on an electrical component you will need the full serial number and manufacture date. The item will need to be returned. We cover shipping the replacement unit by surface transportation only. The faulty item shipping costs are born by the client. If you need to make a warranty claim, contact us 204 977 1674 Ext 222 or email to dieter@cedartubs.com (technical support)