USER MANUAL

PATRIOT MAX AND STANDARD PAN SETS

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INTRODUCTION: THEORY OF OPERATION

A maple syrup evaporator works under the principal of a gradient. As the sap boils, it concentrates. As it concentrates, the volume is reduced and the solids (sugar concentration) increase. As the volume is reduced the liquid works to maintain the levels across the evaporator so less concentrated sap flows into areas where there is more concentrated sap. During the evaporation process the percent of sugar will change from the incoming (approximately 2%) to the draw off (approximately 66%).

FORMING THE GRADIENT

When the evaporator is first filled, the concentration of the sap is the same throughout. The gradient is formed as the water is evaporated from the sap in the syrup pan and the flue pan, and as the new sap enters the flue pan.

As the sap boils it loses moisture and becomes denser / more concentrated. As it is becoming concentrated it loses volume. As it loses volume additional sap will try to keep the levels constant and at the same concentration. This is occurring in both the flue pan and the syrup pan.

In the flue pan less concentrated sap enters through the float box into the first flue pan compartment and begins to concentrate. As it concentrates it moves toward the second compartment of the flue pan. Early in the boil the second compartment will become denser as the "fresh" sap entering the first compartment from the float box keeps pushing the denser sap around.

As the syrup pan boils, the sap continues to become denser. The flue pan sap is pushed into the syrup pan making sap in the first syrup pan compartment less dense. The sap from the first syrup pan compartment is pushed to the next compartment where the sap is denser and then to the densest compartment, the "syrup" compartment. The syrup is drawn off the evaporator from this compartment and more sap flows across all the compartments of the evaporator to replace the volume of syrup drawn off.

With a good gradient in place there will be a measurable difference in the liquid levels between one side of the syrup pan and the other. You may note a difference of ½".

<u>PROPER OPERATIONS TO MAINTAIN GRADIENT:</u>

- Firing
- Defoamer
- Minimize Reversal Effects

During operations you will be working to maintain a consistent gradient. This is done through firing level, control of foaming, and minimizing the effects of reversal.

Firing (if using a wood fired arch)

During firing you are seeking to maintain the same boil all the time. By doing so, the liquid "push" in the pans will remain consistent. If the boil reduces, liquid depths in both pans will start to equalize, losing the gradient. In order to maintain the boil the following should be of concern:

1. Wood to use
    a. Mix of hardwood (longer lasting, more BTUs) and softwood (quicker, intense heat).
    b. Avoid slabs as they do not allow heat to evenly reach the pan
    c. Split wood to the diameter and sized in length to match the length of the grates in use

Width of Evaporator	Diameter to Split Wood
24"	2" to 3"
30" and 36"	2" to 4"
40" and 48"	2" to 5"
60" and 72"	3" to 6"

2. Loading wood into the arch
    a. Wood should stay on the grates and a minimum of 2" to 5" inside from the door so wood fire does not heat the arch face

b. Criss-cross the wood as best possible so oxygen can reach all wood efficiently
c. Do not hit the flues when loading wood

3. When to fire
    a. Keep a consistent stack temperature with less than 150°F range
    b. Maintain the arch ½ to ⅔ full
    c. Fire consistently with small amounts of wood to maintain level of heat
    d. Use timer to stay on schedule with firings
    e. Adjust firing intervals as needed to maintain an even boil

Defoamer

The purpose of defoamer is to prevent foam build up in the pans. Foam build up will prevent proper evaporation of the water from the sap. It will give a false liquid level to the float not allowing the incoming sap to flow in a consistent manner. Inconsistent defoamer usage will create large volume adds of sap into the pans as the foam is reduced (when you do add defoamer) and the float seeks to replace the level with incoming sap. The following items should be of concern in the use of defoamer:

1. Use defoamer on a regular basis. It is suggested you add defoamer to the flue pan each time you fire the evaporator or every 5 to 10 minutes.
2. Add defoamer primarily to the flue pan. Modify this only under certain conditions.
3. The estimated usage is as follows: NOTE: This is based on the use of ATMOS 300 Defoamer

Pan Set Width (Inches)	Drops of Defoamer
24	3
30	4
36	4 to 5
40	5 to 6
48	6 to 8
60	7 to 9
72	8 to 11

If using sap that has been concentrated by an RO, use an additional drop for each foot of pan width

4. NEVER add defoamer to the center compartment of the syrup pan. Use one drop at a time in the syrup (draw-off) compartment only.

Minimize Reversal Effects

Reversal occurs when the boil in the pans is reduced (when firing is inconsistent, end of day, change pan flow direction):

1. Maintain a consistent boil
2. After the last syrup draw of the day, draw “sweet” from the syrup pan into a clean container. This will be added to the boiling syrup pan at the beginning of the next boil and aid in setting up the gradient. The guideline for the amount of “sweet” to draw is as follows:

Pan Set Width (Inches)	Gallons of “Sweet”
24	1 to 1 ½
30	1 ½ to 2
36	2 to 2 ½
40	2 ½ to 3 ½
48	3 ½ to 5
60	4 to 7
72	6 to 9

EQUIPMENT DESCRIPTION

The PATRIOT set of evaporator pans have dual level controls allowing a deeper level in the syrup pan and a shallower level in the flue pan. The PATRIOT also offers a flow reversing system comprised of two valves and a single plug. The pans are constructed of 20 gauge stainless steel.

The LEADER MAX flue pan has an 11-½"flue giving 50% more surface area for more fuel efficient performance with a higher evaporation rate. It is available as a raised flue or a combination raised and drop flue pan. The LEADER standard flue pan offers 7 ½" raised flues. Both styles allow for expansion with a parallel flow preheater, a Steam-Away or reverse osmosis unit.

NOTE: Pictures, sketches and drawings presented in this document are not to scale.

A left feed evaporator is defined, as the regulator float box assembly will be on the left side of the flue pan when standing facing the firing door. A right feed evaporator is defined, as the regulator float box assembly will be on the right side of the flue pan when standing facing the firing door.

INCLUDED PARTS:

The Leader PATRIOT Evaporator pan set consists are the following parts:

ITEM	LEADER ORDER #	DESCRIPTION / PHOTO
Standard or MAX Flue Pan	Available from 2'X4' to 6'X10'	
Regulator Box	59078 (For Right Feed) 59079 (For Left Feed)	
Float (10-¾" X 5 ½" X 2")	59025	
Regulator Z-arm	59051	
Flue Brush (for standard flue pan)	60061	
Stainless Steel Machine Screw RH ¼-20 X 3" (qty.: 2)	72454	
2-3/4" #36 SS Band Clamps (qty.: 6)	60049	
Ceramic Pan Gasket	36" – 65162 72" - 65168	

ITEM	LEADER ORDER #	DESCRIPTION / PHOTO
Syrup Pan	Available in 2'X2' to 6'X6'	
Regulator Packing (included with regulator arm)	59065	
Hot Sap Float (4" x 8 ½")	59028	
Stainless Steel Plug 2"	59013	
Flue Brush (for MAX style flue pans)	60056	
Stainless Steel Hex Nut ¼-20 (qty.: 6)	72551	
2" X 2-1/4" Hose Connection (qty.: 3)	60004	
Distribution Pipes (may already be installed in flue pan)		

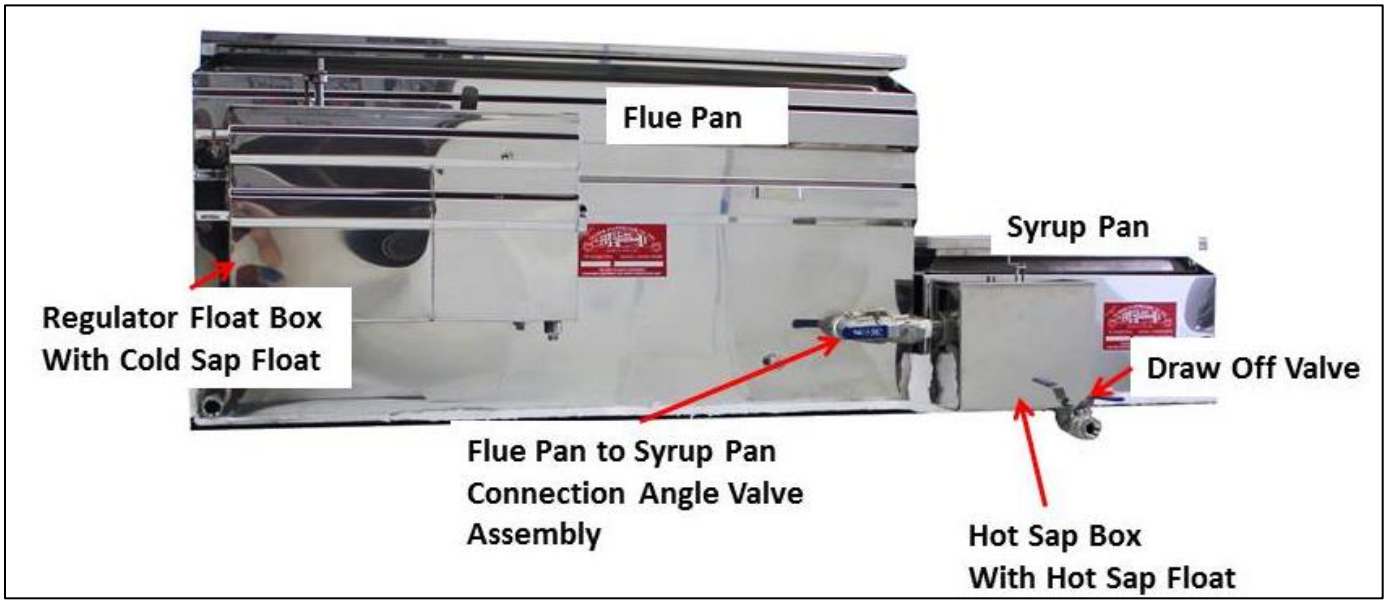
ITEM	LEADER ORDER #	DESCRIPTION / PHOTO	ITEM	LEADER ORDER #	DESCRIPTION / PHOTO
Distribution Box (qty.: 2 – may already be installed at the end of the distribution pipes))					
Pan Width 24”					
1” Stainless Steel Ball Valve Qty: 2	60106		1½” Stainless Steel Ball Valve	60107	
1½” X 4” Stainless Steel Nipple	72100				
Pan Width 30”					
1½” Stainless Steel Ball Valve QTY: 3	60107		1½” X 4” Stainless Steel Nipple	72100	
Pan Width 30”, 40” and 4 FT					
1½” Stainless Steel Ball Valve QTY: 2	60107		2” Stainless Steel Ball Valve	60127	
2” X 4” Stainless Steel Nipple	72120				
Pan Width 5 FT and 6 FT					
2” Stainless Steel Ball Valve QTY: 3	60127		2” 4” Stainless Steel Nipple	72120	
There are two angle valve assemblies supplies with the pan set. The following listing of parts are the components for each 					
1” Stainless Steel Street Elbow	72126		1” X 2 ½” Running Thread Nipple	72118	
1” Close Stainless Steel Nipple	72111		1” Stainless Steel Ball Valve	60106	
1” Stainless Steel Special Street Elbows	72234		1 3/8” Rubber Washer	760045	
1 3/8” Stainless Steel Washer	760055		1” Stainless Steel Hex Nut (qty:2)	760065	

OPTIONAL SETUP ITEMS AND REPLACEMENT PARTS

ITEM	LEADER ORDER #	DESCRIPTION / PHOTO
Pan Gasket Holder	59210	
Hot Sap Float (4" x 8 ½")	59028	
Thermometer 3" or 5" face, 6" stem	61022 3" Face/6" Stem 61028 5" Face/6" Stem	

ITEM	LEADER ORDER #	DESCRIPTION / PHOTO
Sight Level	60156	
Regulator Z-arm	59051	
Rail Gasket	65154 (1/2" X 2" X 25') 65157 (1" X 2" X 25') 65156 Woven ¼" X 1 ½" X 50'	

DIAGRAM OF THE PATRIOT EVAPORATOR PAN SET



SETUP OF THE PATRIOT EVAPORATOR PAN SET

NOTE: The following information pertaining to setup of an evaporator is to be considered one suggested method. Installations should meet all applicable governmental regulations and standards.

RECEIVING YOUR EVAPORATOR:

Upon receipt of the evaporator, it is recommended the following tasks be performed:

1. Protect all incoming materials from damage and the environment. If possible, place the evaporator at the location where it will be setup (See section titled SUGAR HOUSE SETUP).
2. Unpack all materials and check the received materials against the Equipment Description list provided above.
3. Immediately notify Leader Evaporator or your local dealer if there are questions on the received equipment.

SUGAR HOUSE SETUP:

Prior to setup of the sugar house, it is suggested future needs be considered. The requirements for the setup of the PATRIOT evaporator may not be adequate if in the future additional or larger equipment will be needed. If assistance is needed in determining possible future requirements, please contact Leader Evaporator Sales or your local dealer.

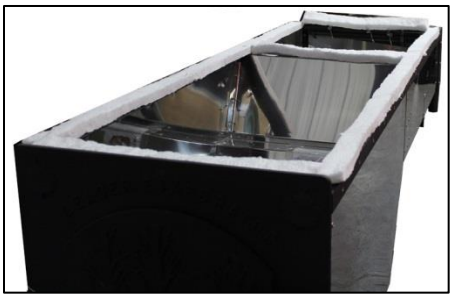
The following are *minimum* clearances recommended around the evaporator. When determining the clearances, keep in mind any additional items/equipment (ex. packaging supplies, canner, table(s), chairs) and where they will be located in the sugar house:

1. Front of the arch: six (6) feet
   a. Allows room for firing and cleaning out of ashes
2. Back of the arch: three (3) feet
   a. Allows for cleaning and removal of the stack
3. Sides of the arch: four (4) feet
   a. Allows for draw off and movement

SETTING UP THE PANS:

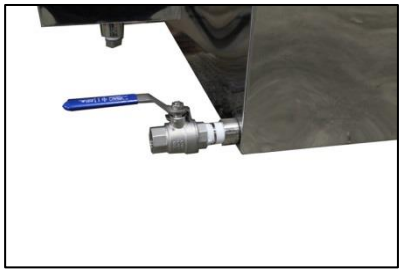
NOTES:

- All arch side directions are as if you were facing the fire door of the arch.
- Prior to setting up the pans, level the arch.
- Prior to setting up the pans, insulate the arch per the instructions provided for that arch.



1. Prior to placing the pans on the arch, line the rails and the top of the baffle(s) with ceramic rail gasket (not included). Use a utility knife to cut the gasket to make a square fit with no gaps.

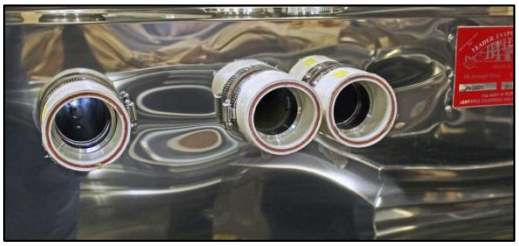
2. Place the flue pan onto the lined baffle and arch rails. Slide the pan tight to the back collar.



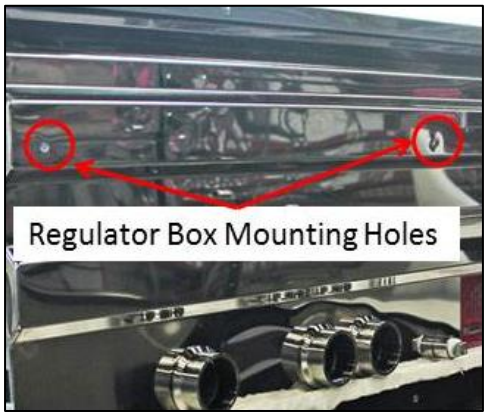
3. Install the drain valve on the right rear corner of the flue pan. Reference the following table to determine the drain connection size.

Pan Width	Drain Connection Size
24”	1½”
30”	1½”
36”	2”
40”	2”
4 FT	2”
5 FT	2”
6 FT	2”

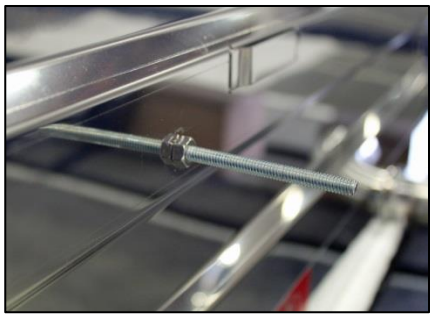
   a. Teflon tape both ends of the supplied (see table above for size) stainless steel 4” nipple. Thread the supplied stainless steel ball valve onto one end of the 4” nipple. Thread the other end of the nipple onto the drain coupling of the flue pan. Tighten.



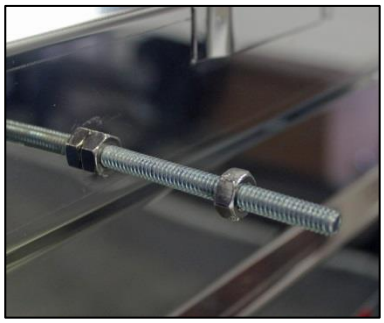
4. Put two #36 band clamps loosely onto each of three 2” x 2 ¼” hose connectors.
5. Place the rubber connectors onto the three regulator connection pipes on the flue pan with the clamp screws facing down.
6. Push each of the rubber connectors tight to the flue pan. Make sure the band clamp closest to the flue pan is over the flue pan regulator connector pipe and tighten the band clamp.



7. Insert a supplied ¼ - 20 X 3” stainless steel machine screw RH through each of the mounting holes in the flue pan located above the regulator box connection pipes. The head of the screw will be inside the flue pan.

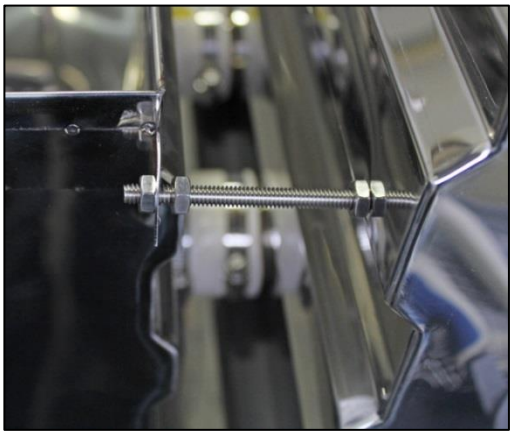


8. Thread a supplied ¼ - 20 stainless steel nut onto each of the machine screws. Turn the nut towards the flue pan until the screw is held into position – do NOT tighten the nut.



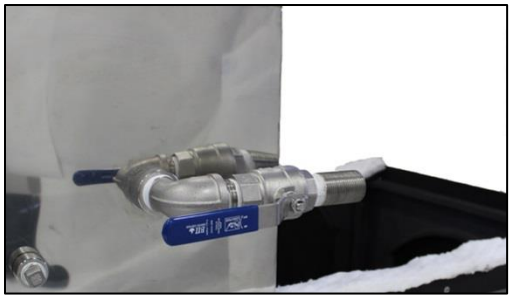
9. Thread a second supplied ¼ - 20 nut onto each screw and turn the nut until it is approximately 1 ½” down on the machine screw.

10. Align the regulator box connections with the rubber connectors on the flue pan.
11. Tilt the regulator box top slightly away from the flue pan and while straightening the regulator box, slide the regulator box connectors into the rubbers connectors on the flue pan and the machine screws in the flue pan into the mounts on each side of the regulator box.
12. Thread a supplied ¼ - 20 nut onto each of the machine screws and finger tighten against the nut on the machine screw. This will hold the regulator box in place.
13. Press the regulator box into the rubber connectors. Ensure the band clamps on each connector are located over the connector pipe on the regulator box and face screw down then tighten the clamps.

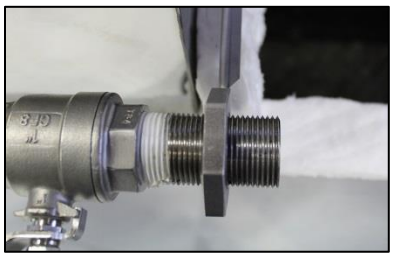


14. Tighten the ¼ X 20 nut closest to the flue pan on each of the machine screws.
15. Move the outside pairs of ¼ X 20 nuts in and out until the regulator box is level along the narrow edge. When it is level tighten the outer nut of each pair against the inner nut.

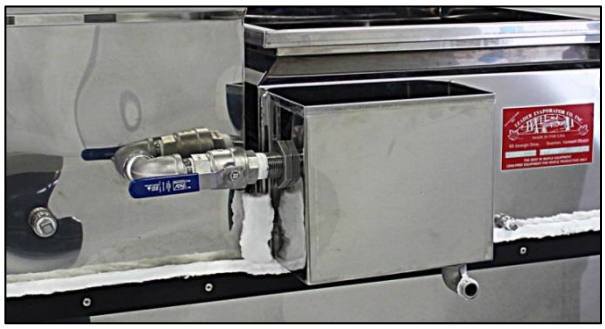
16. Place the pan gasket against the front of the flue pan. If necessary secure it with tape or optionally use a LEADER pan gasket holder (Order #59210).



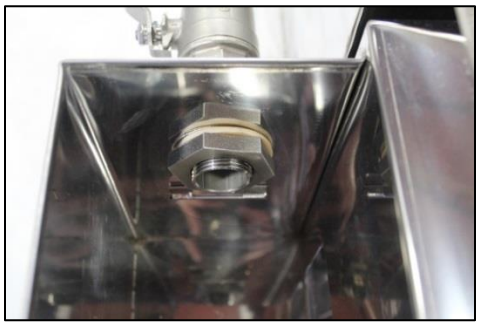
17. Install an angle valve assembly into the couplers located on the front sides of the flue pan. Thread tape all stainless steel threads. Make sure the handles open away from the syrup pan.



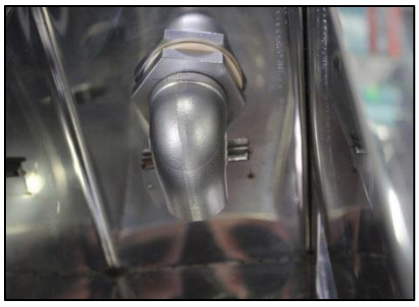
18. Thread a 1” hex nut onto the exposed end of each angle valve assembly. Turn down until the front of the nuts are lined up approximately with the center of the pan gasket.



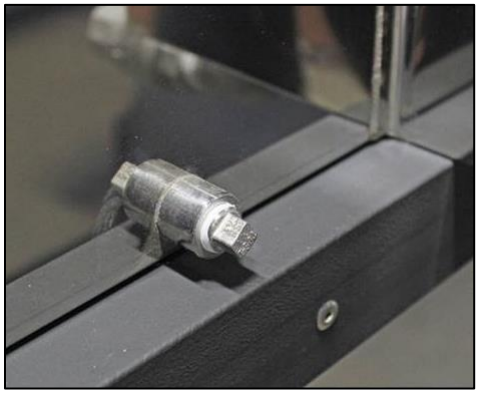
19. Slide the holes in the hot sap float boxes of the syrup pan over the angle valve assemblies. Push on the pan in order to compress the pan gasket in order to install the rail gasket at the front of the syrup pan.
20. Place a piece of 1” rail gasket cut 4” wider than the flue pan, in front of the syrup pan to cover the opening between the syrup pan and the arch.



21. While pressing on the front of the syrup pan, slide the 1 – 3/8” rubber washer, 1- 3/8” stainless steel washer over the exposed end of the stainless steel nipple in the hot sap float box. Thread a 1” stainless steel hex nut onto the stainless steel nipple and tighten. In order to square the pan you may need to turn the stainless steel nut on the back of the hot sap float box.



22. Thread the special stainless steel elbow onto the end of the stainless steel nipple in front of the stainless steel nut. Turn it until the open end is pointed straight down into the float box. The elbow does not need to be tight but should be snugged.



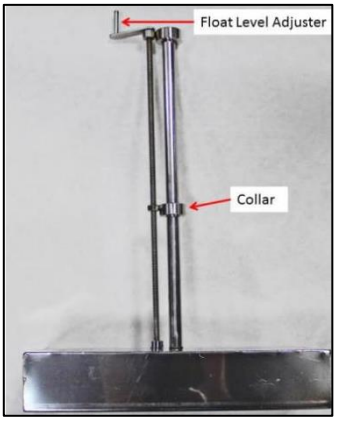
23. Install a thermometer (not supplied)on each side of the syrup pan. The thermometers are mounted in the ¼” threaded fittings near the draw off boxes. Remove the plugs from the fittings in the pan. Teflon tape the threads on the thermometer and thread into the fittings. Tighten and rotate the “7” so it is straight down for easier viewing standing next to the evaporator.

24. Install the supplied stainless draw-off valves so when the valve is open the handle is away from the pan. Sizing of the draw-off connection is shown in the following table.

PAN WIDTH	DRAW-OFF SIZE
24”	1”
30”	1½”
36”	1½”
40”	1½”
4 FT	1½”
5 FT	2”
6 FT	2”

25. Insert the regulator float into the regulator float box. Do not force the regulator arm. The following is one method of inserting the float:

    NOTE: The float should always be positioned so the stem is facing the fork of the regulator arm and the threaded adjustment rod is at the open end of the fork. When the float stem has been positioned under the regulator fork, ensure the adjustment collar is under the fork and the threaded rod is seated in the bracket on the float.



a. Turn the float level adjuster until the collar is about halfway on the rod.

b. Begin inserting the float into the float box while holding up the regulator arm. The float should be angled slightly toward the outside of the float box (away from the flue pan) and lengthwise on end to be able to slide under the regulator arm. The regulator arm will be on the flue pan side of the float stem.

c. Continue to rotate the float downward and under the regulator arm until the float is resting on the bottom of the float box. The regulator arm will be on the side of the float stem.

d. Rotate the float toward the rear of the float box until the regulator fork will slide around the float stem over the adjustment ring. Lower the float back to the bottom of the float box.

26. Connect the raw sap feed to the flue pan regulator box. The bottom of the feed source should be 6 inches above the top of the regulator box. It is recommended a shutoff valve be installed between the sap source and the regulator box. The following is a one method of attaching the sap source to the regulator box. The items for this connection as shown are not included with the evaporator.

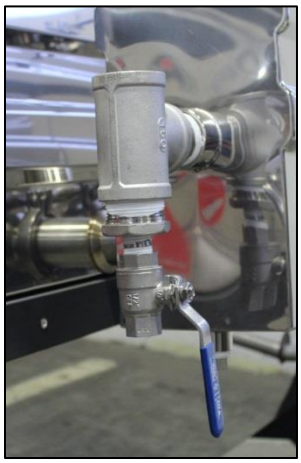
a. Teflon tape:
   i. two 1 ¼" stainless steel close nipples
   ii. ½" stainless steel close nipple
   iii. threaded end of the 1 ¼" stainless steel half nipple
   iv. 1 ¼" to ½" stainless steel reducing bushing threads

b. Thread one end of a 1 ¼" close nipple into the threaded coupler on the end of the regulator box.

c. Thread the 1 ¼" stainless steel "tee" onto the stainless steel nipple and tighten until the open ends are straight up and down.

d. Thread a 1 ¼”to ½” stainless steel reducing bushing into the bottom of the tee.

e. Thread the ½” stainless steel close nipple into the ½” stainless steel ball valve.



f. Thread the ½” stainless steel ball valve and nipple assembly into the adapter in the bottom of the tee and tighten all parts into the tee (adapter, nipple and ball valve). . Make sure the handle of the ball valve can operate without interference.

g. Thread the 1 ¼” stainless steel ball valve onto the end of the close nipple.

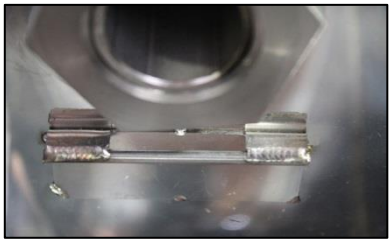
h. Thread the 1 ¼” stainless steel half nipple into the other end of the 1 ¼” stainless steel ball valve.

i. Thread the taped end of the 1 ¼” stainless steel nipple (on the stainless steel ball valve) into the top of the stainless steel tee.

j. Tighten the parts (half nipple, ball valve, close nipple) into the tee. Make sure the handle of the ball valve can operate without interference.

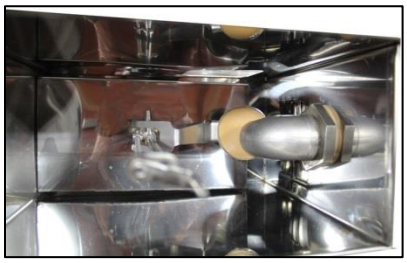
NOTE: The half nipple on the top stainless steel ball valve is optional.

k. Connect the sap source tank to the upper ball valve. The bottom of the sap source tank needs to be a minimum of 6” above the top of the evaporator. Additional height will be needed if a Steam-Away or a preheater are installed. Connections can be made between the sap source tank and the evaporator



27. Install the Z-arm into the hot sap float box (See the section on reversing the flow to determine which box to use). Make sure the packing is in place in the Z-arm cup. The mounting bracket for the Z-arm is located under the angle valve assembly in the hot sap float box. Prior to placing the Z-arm into the bracket, hold it into the installed position and determine if the end of the elbow will be centered on the Z-arm. If not then adjust the 1" nuts and the pan gasket compression.

28. Place the hot sap float into the hot sap box positioned so the adjustment finger on the side of the float stem are on the side of the angle valve assembly.



29. Turn the adjuster handle until the fingers are close to the top of the float. Place the Z-arm fork so the sides of the fork on either side of the stem and over the adjustment fingers. Slide the hook on the other end of the Z-arm into the mounting bracket.

30. `All parts have now been installed for the pans. Check to ensure the following connections are properly installed and tight.
    a. 3 hose connectors between the flue pan and the regulator box
    b. 2 angle valve assemblies between the flue pan and the syrup pan

c. 2 draw off valves on the syrup pan
d. Drain valve on the flue pan
e. Thermometers

NOTE: Plugs and draw off box float should be set for Left Draw Off (See the Operating the Evaporator section)

NEW PAN CLEAN

NOTES:

- Only Leader Evaporator approved chemicals are to be used in operations and maintenance.
- Ensure after use no chemical residue remains on items such as rail gaskets or pan gaskets.

The first boil is done to remove any residual materials from the pans and to "season" the bricking and insulation.

NOTE: When using chemicals be sure to read and follow all precautions.

1. Fill the flue pan and syrup pan with a baking soda : water mix (1 pound:200 gallons) to a level of 2 to 3 inches.
2. Check all fittings for leakage. If there is no leakage, insulate around the flue drain with rail gasket material.
3. To season the bricking, start by building a small fire in the fire box and very gradually build to a normal fire.
4. Boil the solution for approximately 30 minutes. Watch the boil carefully and replenish the solution as needed to ensure the solution in the pans remains at the 2 to 3 inch level using the float.
5. Check all equipment:
   a. No leaks at connections and valves
   b. Pans are boiling evenly
   c. Valves work properly
   d. Draft is correct

Draft is correct when:

- The boil is the same in the syrup pan front-to-back and side-to-side
- The fire door is open the flame, sparks, etc. are drawn toward the rear of the arch.

6. Drain the solution after the evaporator has cooled. CAUTION – ensure the equipment is cool enough to be safely handled for draining.
7. Check the interior of the arch to ensure insulation and bricking are in place.
8. Refill the pans to the 2 to 3 inch level with clean unsoftened, non chlorinated well or spring water.
9. Boil for 30 minutes during which time adjust the floats down to operating levels. NOTE: if may take 10 to 15 minutes for level adjustments to have full effect. After the evaporator has cooled, drain the pans. CAUTION – ensure the equipment is cool enough to be safely handled for draining.

OPERATING THE EVAPORATOR

NOTE: When operating the evaporator be cautious of hazards such as hot surfaces, hot liquids, sparks, and exposed flames.

NOTE: You must be aware at all times of the level of sap in all compartments of the pans. If the level drops too low you can and will damage your pans. If there is too much foam you risk damaging your pans.

NOTE: If you have purchased a scoop or skimmer, do NOT use them to push sap through the evaporator. Doing so will change the gradient in the evaporator.

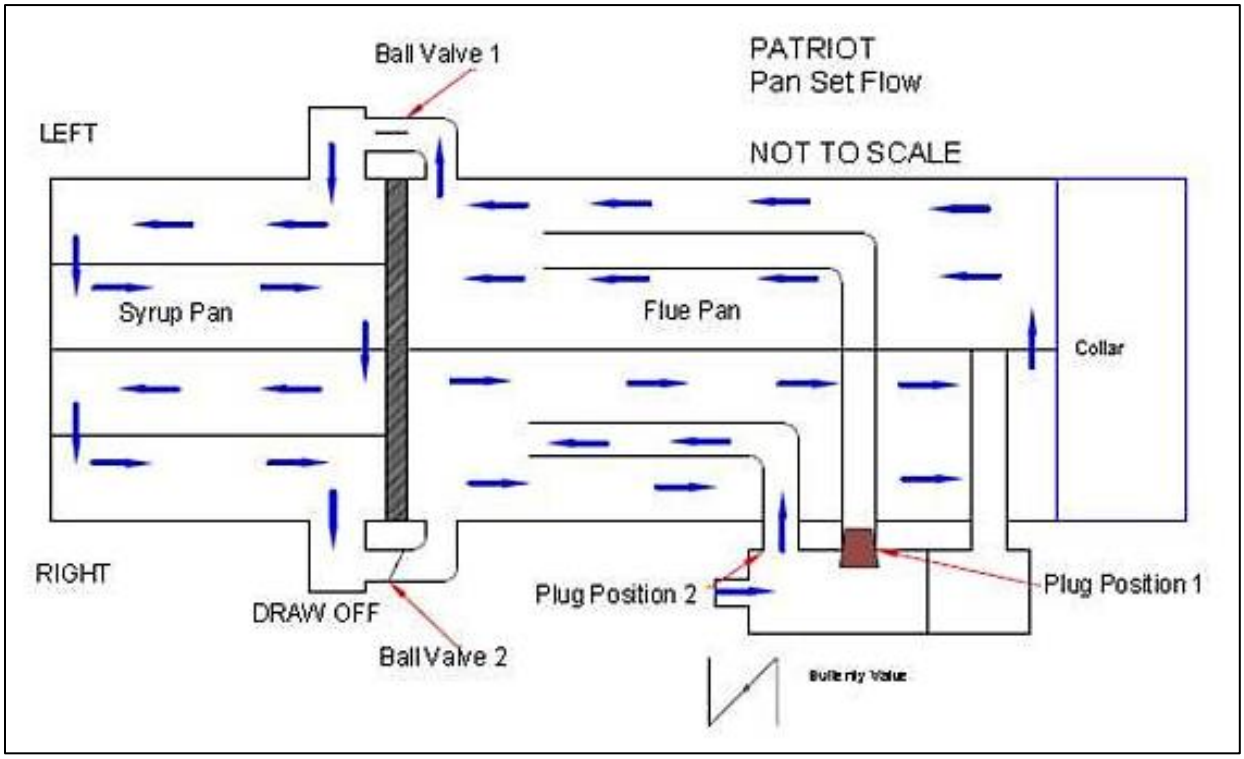
1. Check the evaporator
   a. Make sure all sap sources are flowing freely i.e. not frozen.
   b. Ensure defoamer is usable.
   c. Ensure all fittings are tight.
   d. Make sure all valves are working properly and the floats are properly positioned.
   e. Clean the flues with the flue brush every 8 to 12 hours of boiling.
   f. If using a wood fired arch, ensure the open area in the grates is clean and free of material. If necessary, remove ashes from below the grates.
   g. Open stack covers, cupolas and thimbles.
   h. Open condensate drains.
2. If this startup is for a new evaporator or for the first time of the season, go to the Section titled MAKING SYRUP.

It is recommended in order to minimize the sugar sand and niter, the flow in the syrup pan be reversed daily or when it is noted the bubbles from boiling are drawn back down into the compartment as they break (appear like boiling mud). The following are the instructions for reversing the flow in an PATRIOT evaporator:

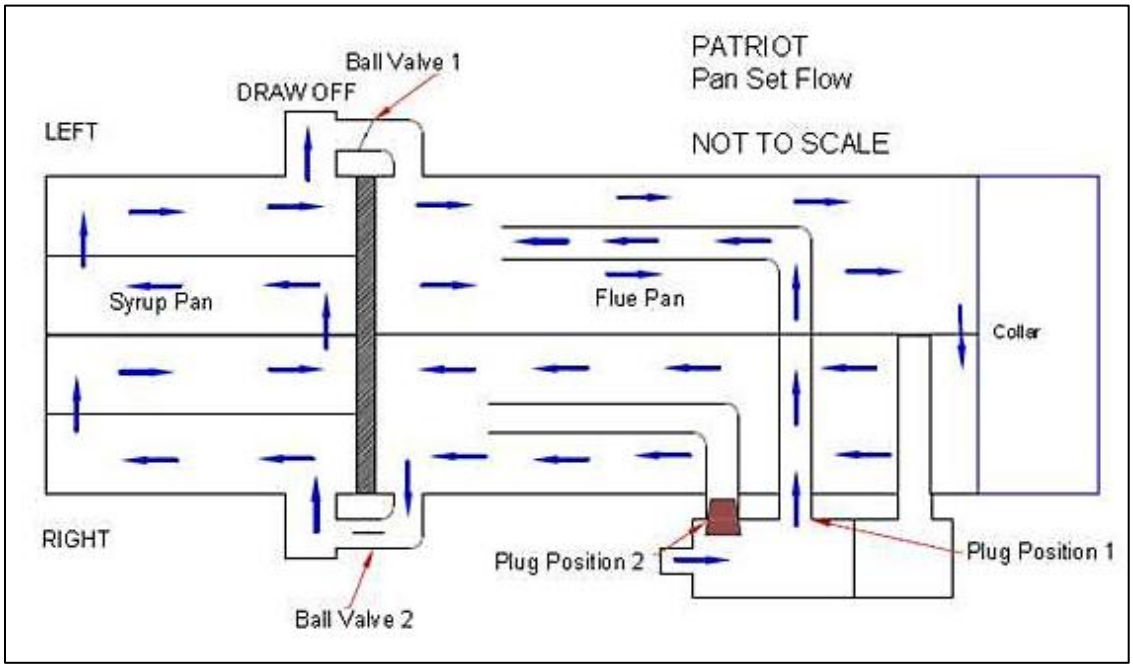
SYRUP PAN REVERSAL

Flow reversal in a PATRIOT evaporator is done by changing the position of a stainless steel plug, two valves, the Z-arm and hot sap float. These plugs control which side of the flue pan the fresh sap enters and which side of the syrup pan will be the finishing side. The diagrams below illustrate the two possible flows in the pan set.

RIGHT DRAW OFF



LEFT DRAW OFF



NOTE: Sap should enter the same side of the flue pan as the syrup is drawn off the syrup pan. Example – if the sap enters the flue pan on the left side, the syrup draw off will be on the left side.

Plug Position 1	Plug Position 2	Ball Valve 1	Ball Valve 2	Z-Arm and Hot Sap Float	Draw Off Side
Plugged	Open	Open	Closed	Left	Right
Open	Plugged	Closed	Open	Right	Left

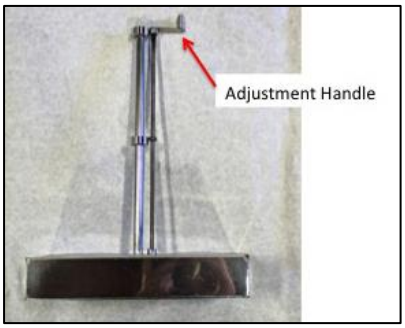
1. Draw off "sweet" from the syrup pan and set aside.
    a. "Sweet" is drawn from the draw off side of the syrup pan into a clean container
    b. The suggested quantity of "sweet" in the following table. The amount of "sweet" drawn should be adjusted with experience and the concentration of sap used.

Pan Set Width (Inches)	Gallons of "Sweet"
24	1 to 1 ½
30	1 ½ to 2
36	2 to 2 ½
40	2 ½ to 3 ½
48	3 ½ to 5
60	4 to 7
72	6 to 9

    c. Set the "sweet" aside in a covered container
2. Identify which positions your plugs and valves are in as illustrated above and change their locations.
3. Make sure the plugs are seated into the holes and the valves are fully closed/opened.
4. When cool enough to safely handle, move the Z-arm and hot sap float to the hot sap box on the opposite side of the "new" draw off side of the syrup pan.

5. Fire the evaporator and bring the syrup pan to a boil then slowly pour the “sweet” into the “new” draw off side of the syrup pan.

MAKING SYRUP



1. Open the valve between the sap source and the regulator float box. Adjust the flue pan regulator box and the syrup pan regulator box floats to set the sap levels as in the guidelines in the following table.. To set the depth using the float, turn the adjustment handle on the threaded rod counterclockwise to raise the sap level and clockwise to lower the sap level.

ARCH	Standard Draft		Forced air or Oil fired		Steam-Away or Preheater with hood		Reverse Osmosis	
Evaporator Width	Flue Pan Depth (inches)	Syrup Pan Depth (inches)	Flue Pan Depth (inches)	Syrup Pan Depth (inches	Flue Pan Depth (inches)	Syrup Pan Depth (inches	Flue Pan Depth (inches)	Syrup Pan Depth (inches
2X6 to 3X10	¾	1 ½	No change	Add ¼	Add ¼	Add ¼	Add ¼	Add ½
3X12 to 4X14	1	1 ¾	No Change	Add ¼	Add ¼	Add ¼	Add ¼	Add ½
5X14 to 6X16	1 ¼	2	No Change	Add ¼	Add ¼	Add ¼	Add ¼	Add ½

Note – if you combine evaporator enhancements add the changes together as stated in the table above for the enhancements added.

2. If this is a new pan set startup or the first startup of the season, put the plug in position 2, close ball valve 1 and open ball valve 2. Put the Z-arm and float into the right hot sap box. Otherwise change the plug positions as outlined in the paragraph describing reversal of the syrup pan.
3. Fire the evaporator.
4. As the flue pan starts to boil, add defoamer (based on ATMOS 300) into the flue pan on the float box side. Recommended quantities to add are in the table that follows. Defoamer should be added close to the inlet from the float box .Remember the inlet side of the flue pan changes with the reversal of the flow. During boiling add defoamer every 5 to 10 minutes or each time the arch is fired. Adjust the time as necessary to control the foam.

Pan Set Width (Inches)	Drops of Defoamer
24	3
30	4
36	4 to 5
40	5 to 6
48	6 to 8
60	7 to 9
72	8 to 11

5. If this is the first boil of the season or “sweet” was not saved from a previous boil, skip to the next section.

As the syrup pan starts to boil, add the "sweet" to the draw-off compartment of the syrup pan. If ball valve number 1 is closed add the "sweet" to the leftmost compartment of the syrup pan. If ball valve number 2 is closed add the "sweet" to the rightmost compartment of the syrup pan.

6. As the syrup pan is boiling, watch for foam higher than the compartment dividers of the pan. If the foam is higher than the dividers, add 1 to 2 drops of defoamer to the syrup compartment of the syrup pan right in front of the draw-off box. Begin adding an additional 1 to 2 drops to the flue pan if the foam persists. It will take 15 to 20 minutes before any change is noted. If these additions of defoamer do not control the foaming, add 1 to 2 drops of defoamer to the draw-off compartment of the syrup pan. The addition should be done at the end of the pan where the draw off is located. REMEMBER you are trying to stop the foaming not the boiling.
7. The sap in the syrup compartment of the syrup pan must be boiled until it reaches 7.0°F to 7.5°F above the boiling point of water (the draw off temperature). The boiling point of water is not a consistent point. Therefore the following is the recommended method for determining the draw-off temperature.
   a. As the sap begins boiling in the syrup pan, monitor the thermometer. The thermometer needle will need to go around completely once and come back to the "7" mark on the thermometer.
   b. When the "7" mark is reached, draw a sample of the liquid from the syrup compartment of the syrup pan and then test with a hydrometer. See ATTACHMENT #1 on the use of a hydrometer.
   c. Adjust the thermometer to "7" when the hydrometer indicates the sap in the pan has turned to syrup. To adjust the thermometer, place the Allen wrench, provided with the thermometer, into the screw and turn until the "7" aligns with the needle.
8. The draw off valves are located under the hot sap boxes on the right and left sides of the syrup pan. When the hydrometer indicates you have syrup, partially open the draw-off valve on the side where the angle valve assembly ball valve is closed and allow the syrup to flow slowly, maintaining the temperature at the "7" mark as long as possible. When the temperature starts to drop below the "7" mark, close the draw off valve.
9. Continually check your incoming sap at the regulator float box and the hot sap box to ensure it is flowing freely.

DAILY SHUTDOWN

1. There are two factors influencing the shutdown of the evaporator; time and sap volume.
   a. It will require approximately 1 hour from the last firing to bring the fire down to embers (coals on the grates) in a wood fired arch.
   b. It will require a volume of sap after the last firing to flood the pans - ensure there is adequate volume left.
2. After the last draw of syrup and last firing, draw-off "sweet" from the evaporator into a clean container. Set the container aside and cover it. NOTE: Suggested quantities of "sweet" to draw are in the table that follows. The quantity of "sweet" should be adjusted based on experience and concentration of the sap being used.

Pan Set Width (Inches)	Gallons of "Sweet"
24	1 to 1 ½
30	1 ½ to 2
36	2 to 2 ½
40	2 ½ to 3 ½
48	3 ½ to 5
60	4 to 7
72	6 to 9

3. Continue to monitor the evaporator as it cools and the fire dies.
4. Shut down considerations:

a. Wood fired evaporator - when there is no more boil in either the flue or the syrup pans and the fire is down to coals on the grates, add sap until the pans are at a depth of 2". This is done by holding the float down or by adjusting the float handles and lowering it. If the sap remaining does not cover the pans to the 2" depth then add clean, unsoftened ,non-chlorinated well or spring water until the depth is reached.

NOTE: The extra sap depth is required as the insulation of the arch (ex. bricks) will hold heat and continue the evaporation process until the heat has been dissipated.

b. Oil Fired Evaporator – when the last sap to be boiled is in the regulator float box, shut off the oil burner(s). NOTE: This applies only if the arch is not lined with brick. If it is lined with brick follow the instructions for the wood fired arch.

MAINTENANCE

NOTES:

- Only Leader Evaporator approved chemicals are to be used in operations and maintenance.
- Ensure after use no chemical residue remains on items such as rail gaskets or pan gaskets.

NOTE: When using chemicals be sure to read and follow all precautions.

DAILY – prior to performing maintenance make sure the surfaces have been cooled.

1. Remove spills and splashes from the pans by wiping with hot water.
2. Follow the steps listed for Syrup Pan Reversal
3. If using a wood fired arch, clean out the ash chamber and the slots in the grates NOT the "V" grooves of the grates.
4. Check all fittings for leakage. Repair / replace as necessary.

PERIODIC

1. Using the supplied brush and rod, brush the underside of the flue pan to remove accumulated material. Cleaning will allow the heat to better reach the sap in the pan.
2. Inspect the rail gasket and pan gasket for areas where heat and smoke maybe escaping. Replace if necessary.
3. If excessive niter and sugar sand is coating the surfaces of the pans with scale, clean the pans with a pan cleaner such as LEADER Order #63006 (1 quart size). The directions are as follows:
   a. Add unsoftened ,non-chlorinated well or spring water to the pans until the coating to be removed is covered with water.
   b. Add 1 quart of concentrated pan cleaner for each 40 gallons of water in the pans.
   c. Heat the solution to simmering and keep at that level for one hour and the scale is noted to dissolve.
   d. Wearing protective gloves, brush the loose scale.
   e. If scale is removed flush the pans with unsoftened ,non-chlorinated well or spring water. If the scale is thick you may need to allow the solution to soak in the pan – no more than 24 hours.
   f. When the scale has been removed, drain off the solution, fill the pans with clean unsoftened ,non-chlorinated well or spring water. Add 2 pounds of baking soda per 200 gallons of clean water. Heat to a light boil, brush the pans, and empty the water from the pans.
   g. Ensure all solution is rinsed from the pans using unsoftened ,non-chlorinated well or spring water.

END OF SEASON

NOTES:

- Do **NOT** allow sap or acid solutions to soak in the pans for more than 24 hours.
- Use ONLY cleaners stated to be for maple syrup equipment.
- Never store or transport the flue pan upside down.

1. Drain the flue pan by closing the sap source to the regulator box and opening the ball valve (for the drain) at the rear of the flue pan.
2. Drain the syrup pan by opening the draw-off valves.
3. Rinse the pans with unsoftened, non-chlorinated well or spring water and then drain.
4. Close the valves on the pans.
5. Clean the pans with a pan cleaner such as LEADER Order #63006 (1 quart size). The directions are as follows:
   a. Add unsoftened ,non-chlorinated well or spring water to the pans until the coating to be removed is covered with water.
   b. Add 1 quart of concentrated pan cleaner for each 40 gallons of water in the pans.
   c. Heat the solution to simmering and keep at that level for one hour and the scale is noted to dissolve.
   d. Wearing protective gloves, brush the loose scale.
   e. If scale is removed flush the pans with unsoftened, non-chlorinated well or spring water. If the scale is thick you may need to continue simmering the solution in the pan.
   f. When the scale has been removed, drain off the solution, fill the pans with clean unsoftened ,non-chlorinated well or spring water. Add 2 pounds of baking soda per 200 gallons of clean water. Heat to a light boil, brush the pans, and empty the water from the pans.
   g. Ensure all solution is rinsed from the pans using unsoftened, non-chlorinated well or spring water.
   h. Refill the pans with unsoftened, non-chlorinated well of spring water and boil hard for 1 hour. Cool then drain the pans.
2. Disassemble pan connections. Inspect all connection hoses and seals.
3. Discard the rail gasket and pan gasket.
4. Set 2X4s across the rail of the arch where the flue pan is usually placed then set the flue pan right side up on the 2X4s.
5. Set 2X4s across the rail of the arch where the syrup pan is usually placed then set the syrup pan right side up on the 2X4s.
6. Cover the pans and arch with plastic or a tarp.

BEGINNING OF SEASON STARTUP

1. Remove the cover and take the pans and 2X4s off from the arch.
2. Install a new rail gasket.
3. Place the pans on the arch and install a new pan gasket between the pans.
4. Assemble the pan connections and install the float box.
5. Wipe and/or rinse out the pans.
6. When filling the pans for the first time check all fittings for leakage and repair if necessary.

FEEDBACK

Please use the following e-mail address (feedback@leaderevaporator.com) to suggest improvements or enter comments on this document. Reference the document title in your note. You may also contact LEADER Customer Service.

NOTES

ATTACHMENT #1: HYDROMETERS

HYDROMETER FUNCTION

A hydrometer works based on the density of the maple syrup. There are two scales on the hydrometer; Brix and Baume. The Brix scale indicates the percentage of sugar in the maple syrup. The Baume scale is a measure of how dense the maple syrup is related to the density of water. The correct density for maple syrup is a minimum of 66% sugar (66°Brix/35.6°Baume). You will need to verify your state's rules and adjust your readings as necessary. The hydrometers supplied by LEADER EVAPORATOR have been calibrated at two temperatures; 60°F Cold Test (66.9°Brix/36°Baume) and 211°F Hot Test (59.1°Brix/32.1°Baume). The maple syrup is expected to be at the upper temperature when it is measured immediately after being drawn off the evaporator.

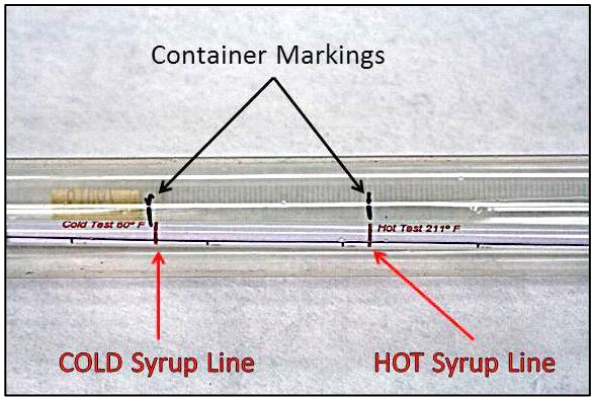
NOTE: Hydrometers from Leader Evaporator by law are calibrated by the State of Vermont. . The HOT and COLD test lines should be considered guidelines. Hydrometers should only be used by reading temperature and Brix/Baume readings.

USE OF A HYDROMETER

NOTE: Hydrometers are very fragile. Two most susceptible points of damage during use are the bottom and where the stem meets the body. Take extreme care when handling a hydrometer.

As hydrometers are susceptible to damage it is recommended the sugar house have a spare.

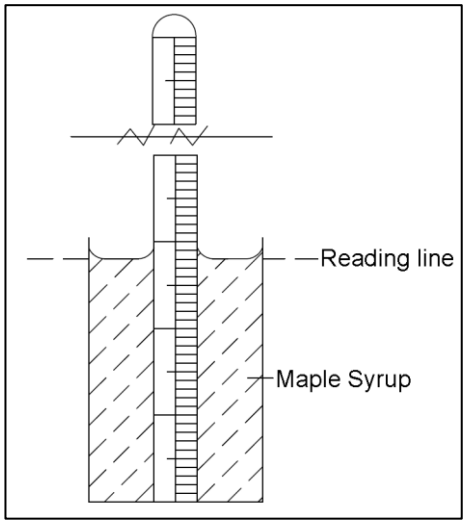
PREPARING A NEW HYDROMETER FOR USE:



1. Unpack the hydrometer from its tube or box.
2. Carefully inspect the hydrometer for any breakage. If you suspect any cracks, fill your test cup with hot water and immerse the hydrometer. If it leaks then it is damaged and can't be used.
3. Place the hydrometer in its original container seated in the packaging and mark the container where the bottom of the hydrometer aligns.
4. Mark the container at the same lines as the HOT and COLD test lines in the hydrometer. When using the hydrometer in the future these lines are a check to ensure the scale inside the hydrometer has not moved.

USING THE HYDROMETER

1. Prior to using the hydrometer for the day, place it into its original container and check the hydrometer lines against the lines you marked on the container. If they do not match then replace the hydrometer.
2. Ensure the hydrometer is clean prior to every use. Accumulated material on the hydrometer will cause the hydrometer readings to be incorrect as it will have extra weight and not float as easily.
3. Hold the test cup upright. Fill the test cup up to ½" to ¾" from the top with the syrup to be tested or from the syrup compartment of the syrup pan. DO NOT HAVE THE HYDROMETER IN THE CUP.
4. Do not allow the syrup to cool. Place the cup on a level surface. Immerse a thermometer into the test cup. Slowly immerse the hydrometer into the syrup in the test cup until it reaches the "HOT" test mark then carefully release it. NEVER DROP THE HYDROMETER INTO THE TEST CUP.
5. Read the temperature from the thermometer.
6. Read the Brix or Baume number from the hydrometer.



NOTE: To correctly determine the Brix/Baume, you need to read from the line of the syrup.

LEADER EVAPORATOR Hydrometers: Hydrometers from LEADER EVAPORATOR are calibrated by the State of Vermont at two temperatures; 60°F Cold Test (66.9°Brix/36°Baume) and 211°F Hot Test (59.1°Brix/32.1°Baume). After numerous measurements it was determined 211°F is the average temperature of syrup when measured immediately after draw-off from the evaporator. When checking syrup at 211°F, the syrup is at the proper concentration when the reading line is at the Hot Test line. If the Hot Test Line is below the reading line of the liquid, continue to boil as the syrup is "light". If the Hot Test Line is above the reading line of the liquid, the syrup is "heavy" and will need to be diluted with sap.

TEMPERATURE °F	Degrees Baume	Degrees Brix
209	32.0	59.0
202	32.25	59.6
193	32.5	60.0
185	32.75	60.4
176	33.0	60.9
167	33.25	61.4
158	33.5	61.8
149	33.75	62.3
140	34.0	62.8
130	34.25	63.3
120	34.5	63.8
110	34.75	64.3
100	35.0	64.8
90	35.25	65.4
80	35.5	65.9
70	35.75	66.4
60	36.0	66.9
50	36.25	67.4

7. Refer to the chart to determine if your syrup is "light" or "heavy". If the reading is higher than the number on the table your syrup is "heavy" and will need to be diluted. If the number is lower than the number in the table, the syrup is "light" and will need to be boiled more.

8. After reading the hydrometer, remove it from the test cup and rinse it with either hot water or hot sap to ensure it is clean. Dump the contents of the test cup into the syrup compartment of the syrup pan or back into it's storage container. Rinse the test cup with hot sap or hot water.
9. During the boiling period, store the hydrometer in a container of clean hot water or hot sap.