TABLE OF CONTENTS

INTRODUCTION: THEORY OF OPERATION ............................................................................................................3
FORMING THE GRADIENT .....................................................................................................................................3
PROPER OPERATIONS TO MAINTAIN GRADIENT: ...........................................................................................3
Firing ....................................................................................................................................................................3
Defoamer .............................................................................................................................................................4
Minimize Reversal Effects ................................................................................................................................5

EQUIPMENT DESCRIPTION .................................................................................................................................6

DIAGRAM OF THE AMERICAN EVAPORATOR ..................................................................................................8

SETUP OF THE AMERICAN EVAPORATOR ........................................................................................................9
RECEIVING YOUR EQUIPMENT: ..........................................................................................................................9
SUGAR HOUSE SETUP: ......................................................................................................................................9
PREPARE THE ARCH .........................................................................................................................................9
SETTING UP THE PANS: ...................................................................................................................................10
THE FIRST BOIL ..................................................................................................................................................10

OPERATING THE EVAPORATOR ..........................................................................................................................18
SYRUP PAN REVERSAL .......................................................................................................................................19
MAKING SYRUP ..................................................................................................................................................21
DAILY SHUTDOWN ...............................................................................................................................................22

MAINTENANCE ...................................................................................................................................................23
DAILY ...................................................................................................................................................................23
PERIODIC ............................................................................................................................................................23
END OF SEASON ................................................................................................................................................23
BEGINNING OF SEASON STARTUP ....................................................................................................................24

FEEDBACK ...........................................................................................................................................................24

NOTES ................................................................................................................................................................24

ATTACHMENT #1: HYDROMETERS ......................................................................................................................25
HYDROMETER FUNCTION ..................................................................................................................................25
USE OF A HYDROMETER ..................................................................................................................................25
PREPARING THE HYDROMETER FOR USE ........................................................................................................25
USING THE HYDROMETER ................................................................................................................................25
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 becomes 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 measureable difference in the liquid levels between one side of the syrup pan and the other. You may note a difference of ½”.

PROPER OPERATIONS TO MAINTAIN GRADIENT:
- 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
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, the syrup pan flow will reverse and flow to the flue pan. 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 for the arch size in use;

<table>
<thead>
<tr>
<th>Width of Evaporator</th>
<th>Diameter to Split Wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>24”</td>
<td>2” to 3”</td>
</tr>
<tr>
<td>30” and 36”</td>
<td>2” to 4”</td>
</tr>
<tr>
<td>40” and 48”</td>
<td>2” to 5”</td>
</tr>
<tr>
<td>60” and 72”</td>
<td>3” to 6”</td>
</tr>
</tbody>
</table>
2. Loading wood into the arch
   a. Wood should stay on the grates and 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
   a. Keep stack temperature in a range of 150°F
   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, near where the sap is entering, at a 5 to 10 minute interval or each time you fire the evaporator.

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

<table>
<thead>
<tr>
<th>Pan Set Width (Inches)</th>
<th>Drops of Defoamer</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>36</td>
<td>4 to 5</td>
</tr>
<tr>
<td>40</td>
<td>5 to 6</td>
</tr>
<tr>
<td>48</td>
<td>6 to 8</td>
</tr>
<tr>
<td>60</td>
<td>7 to 9</td>
</tr>
<tr>
<td>72</td>
<td>8 to 11</td>
</tr>
</tbody>
</table>

4. NEVER add defoamer to the center compartment(s) of the syrup pan. Use one drop at a time in the syrup (draw-off) compartment near the draw off box.
Minimize Reversal Effects

Reversal occurs when the boil in the flue pan is reduced (when firing is inconsistent, end of day, change pan flow direction). As the flue pan boil reduces, the level is reduced so more fresh sap is added and sap will flow back from the syrup pan. This causes the “sweet” in the syrup pan to mix back across the syrup pan and increases the volume of sap in the flue pan. To minimize this effect:

1. Maintain a consistent boil even during reversal.

2. After the last syrup draw of the day or during reversal, draw “sweet” in a quantity suggested in the following table:

<table>
<thead>
<tr>
<th>PAN WIDTH</th>
<th>Suggested Minimum Gallons &quot;SWEET&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>72</td>
<td>15</td>
</tr>
</tbody>
</table>

Adding “sweet” to the draw off compartment of the syrup pan will raise the concentration in that compartment shortening the time it will take to reestablish the gradient.
EQUIPMENT DESCRIPTION

The AMERICAN set of evaporator pans offer the user an easy and efficient method of reversing the liquid flow. The flue pan and the syrup pan are tig welded of 20 gauge stainless steel. The partitions are full seam welded.

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.

The Leader AMERICAN Evaporator consists of the following parts:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>LEADER ORDER #</th>
<th>DESCRIPTION / PHOTO</th>
<th>ITEM</th>
<th>LEADER ORDER #</th>
<th>DESCRIPTION / PHOTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syrup Pan</td>
<td>As Ordered</td>
<td></td>
<td>Flue Pan</td>
<td>As Ordered (Left or Right Feed, Size)</td>
<td></td>
</tr>
<tr>
<td>4” Ceramic Pan Gasket</td>
<td>Sized to evaporator width</td>
<td></td>
<td>Regulator Box</td>
<td>As Ordered (Left or Right Feed)</td>
<td></td>
</tr>
<tr>
<td>Regulator Packing (included with regulator arm)</td>
<td>59065</td>
<td></td>
<td>Float with Collar (10 ¾” X 5 ½” X 2”)</td>
<td>59025</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel Plug 2” (qty: 2)</td>
<td>59013</td>
<td></td>
<td>Flue Brush</td>
<td>60058</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel Machine Screw RH ¾-20 X 3” (qty: 2)</td>
<td>72454</td>
<td></td>
<td>Stainless Steel Hex Nut ¼-20 (qty: 6)</td>
<td>72551</td>
<td></td>
</tr>
<tr>
<td>2 ¾” #36 SS Band Clamps (qty: 10)</td>
<td>60049</td>
<td></td>
<td>2” X 2 ¼” Hose Connection (qty: 3)</td>
<td>60004</td>
<td></td>
</tr>
<tr>
<td>4 ½” X 2 ¾” Hose Connection (qty: 2)</td>
<td>60007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>LEADER ORDER #</td>
<td>DESCRIPTION / PHOTO</td>
<td>ITEM</td>
<td>LEADER ORDER #</td>
<td>DESCRIPTION / PHOTO</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>---------------------</td>
<td>------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaporator 24” in Width</strong></td>
<td></td>
<td></td>
<td><strong>Evaporator Width 30” and 36”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>¾” Stainless Steel Ball Valve (qty: 3)</td>
<td>60104</td>
<td></td>
<td>¾” Stainless Steel Ball Valve (qty: 1)</td>
<td>60104</td>
<td></td>
</tr>
<tr>
<td>60104</td>
<td></td>
<td></td>
<td>60104</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OPTIONAL SPARE PARTS, SETUP PARTS AND OPERATIONS EQUIPMENT AND SUPPLIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DIAGRAM OF THE AMERICAN EVAPORATOR

NOTE: AMERICAN pan set shown on a LEADER standard wood fired arch.
SETUP OF THE AMERICAN EVAPORATOR

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 EQUIPMENT:

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

1. Protect all incoming materials from damage and the environment. If possible place the equipment 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 AMERICAN 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 for around the arch. 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

PREPARE THE ARCH

1. Set the arch on an appropriate foundation. See the recommendations for the arch type to be used.
2. Level the arch front to back and side to side.
3. Insulate the arch as required for the arch type being used.
SETTING UP THE PANS:

NOTE: All arch side directions are as if you were facing the fire door of the arch.

1. Prior to placing the pans on the arch, line the rails with ½” 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 arch rails. The flue pan should be positioned so it is centered on the rails and the flue pan drain is aligned with the drain hole in the arch.

3. If not previously installed follow these steps to install the flue pan distributor pipes and distribution boxes:
   a. Locate the feed pipe connections from the regulator float box of the flue pan.
4. Teflon tape both ends of the provided stainless steel nipple (¾” x 8” for less than 40” in width and 1 ¼” X 6” for 40” width or wider). Put one end of the nipple through the drain hole in the arch and thread it into the drain in the flue pan. Tighten the nipple.

5. Thread the provided stainless steel ball valve (3/4” for less than 40” in width and 1 ¼” for 40” or wider) onto the exposed end of the stainless steel nipple. Tighten so the handle of the ball valve is on top.

6. Seal around the drain pipe with rail gasket material.

b. Insert the shorter distributor pipe into the regulator box feed connection. Insert the longer distribution pipe into connection located in the divider of the flue pan. The distributor pipes should point toward the front of the flue pan. Let the pipe rest on the flues.

c. Slide a distribution box onto the open end of each of the distributor pipes. They should be positioned so the “clip” side will be down towards the flues.

d. Line the bottom clip of the distribution box up with a flue, keeping the pipe as straight as possible, and slide it over the flue to secure it in place.

NOTE: When installed properly, the ends of the distributor pipes should be almost the same location in the two compartments.
7. Put two #36 band clamps onto each of three 2” x 2 ¼” hose connectors.

8. Place the rubber connectors onto the regulator connection pipes on the flue pan.

9. Push each of the rubber connectors tight to the flue pan. Make sure each band clamp closest to the flue pan is over the flue pan regulator connector pipe and tighten the band clamp.

10. 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 heads of the screws should be inside the flue pan.

11. 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.

12. 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.
13. Align the regulator box connections with the rubber connectors on the flue pan.
14. Tilt the regulator box top slightly away from the flue pan and while straightening the regulator box, slide the regulator box connectors into the rubber connectors on the flue pan and the machine screws in the flue pan into the mounts on the side of the regulator box.
15. 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.
16. Press the regulator box into the rubber connectors. Ensure the remaining band clamps on each connector are located over the connector pipe on the regulator box then tighten the clamps.
17. Tighten the ¼ X 20 nut closest to the flue pan on each of the machine screws.
18. 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.
19. 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).
20. Place two #36 band clamps on each of the 4 ½” X 2 ¼” hose connectors.
21. Slide the connectors onto the flue pan connector elbows located on the left and right sides closest to the front (syrup pan end).
22. Install the syrup pan by placing it onto the arch while inserting the syrup pan connector pipes into the open end of the hose connectors attached to the flue pan.

23. Slide the hose connectors so they are each over the flanges of the flue pan and syrup pan connector pipes.

24. Cut a piece of rail gasket 28” in length and inset it between the front of the syrup pan and the front edge of the arch. If the gap is too wide use a double thickness of rail gasket.

25. Position the band clamps on the hose connectors so they are over the flanges of the connector pipes and elbows. Push the syrup pan toward the flue pan to compress the pan gasket then tighten the clamps.

26. 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. By installing two thermometers, when the syrup flow is reversed the thermometer stem on the incoming side will be cleaned.
27. Teflon tape the threads of the fitting on the bottom of the draw off box located on each side of the syrup pan.

28. Thread a supplied ¾” or 1” (depending on the pan size) stainless steel ball valve onto each draw off box taped fitting. Tighten the ball valve so the handle is positioned upright.

29. 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 tip 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. Tip the float toward the rear of the float box until the regulator fork will slide around the float stem over the collar. Lower the float back to the bottom of the float box.

30. Connect the raw sap feed to the flue pan regulator box. The bottom of the feed source should be a minimum of 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 recommended 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. 1 ¼” to ½” stainless steel reducing bushing threads

b. Thread one end of a 1 ¾” close nipple into the threaded coupler on the end of the regulator box.

c. Thread the 1 ¾” 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 a Teflon taped 1 ¼” stainless steel close nipple into the 1 ¼” stainless steel ball valve.

h. 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.

i. Tighten the parts (ball valve, close nipple) into the tee. Make sure the handle of the ball valve can operate without interference.
31. 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 hose connectors between the flue pan and the syrup pan
   c. 2 draw off valves on the syrup pan
   d. Flue Pan Drain
   e. Thermometers
   f. Drains

THE FIRST BOIL
The first boil is done to remove any residual materials from the pans will “season” the brickling and insulation of a new arch.

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 brickling, 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.
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 then 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. Open hood thimbles and drains, cupolas and stack covers.
   c. Ensure defoamer is usable.
   d. Ensure all fittings are tight.
   e. Make sure all valves are working properly and the float is properly positioned.
f. Clean the flues with the flue brush every 8 to 12 hours of boiling. NOTE: The rod supplied with the arch has a threaded end. The flue brush can be screwed onto the rod to clean the flues.
g. Ensure the open area in the grates is clean and free of material. Do not remove ashes from the “V” grooves of the grates.
h. Remove the ashes from below the grates.

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 AMERICAN evaporator:

**SYRUP PAN REVERSAL**

Flow reversal in an AMERICAN evaporator is done by changing the position of two stainless steel plugs. 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.

**LEFT DRAW OFF**

![Diagram of left draw off](image)

**RIGHT DRAW OFF**

![Diagram of right draw off](image)
Draw Off Side | Plug Position 1 | Plug Position 2 | Plug Position 3 | Plug Position 4
---|---|---|---|---
Right | Plugged | Open | Open | Plugged
Left | Open | Plugged | Plugged | Open

1. Do draw of “sweet” from the syrup pan as part of the daily shutdown or if doing a mid-cycle reversal 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” to draw as follows. The amount of “sweet” drawn should be adjusted with experience and the concentration of sap used.

<table>
<thead>
<tr>
<th>PAN WIDTH</th>
<th>Suggested Minimum Gallons “SWEET”</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>72</td>
<td>15</td>
</tr>
</tbody>
</table>

c. Set the “sweet” aside in a covered container

2. Identify which positions your plugs are in as illustrated above and change their locations.
   a. If your plugs are in positions 1 and 4 move them to positions 2 and 3.
   b. If they are in positions 2 and 3 move them to positions 1 and 4.

3. Make sure the plugs are seated into the holes tightly.

4. Adding the “sweet”
   a. For a beginning of day start, when the middle of the syrup pan reaches a boil, slowly add the “sweet” to the syrup compartment of the syrup pan.
      i. If you inserted the syrup pan plug into position 3, pour the “sweet” into the compartment on the left.
      ii. If you inserted the syrup pan plug into position 4, pour the “sweet” into the compartment on the right.
   b. If doing a mid-day (mid cycle) reversal, maintain an even fire throughout the process adding the “sweet” to the new draw off compartment at the completion of the syrup pan plug position changes.
      i. If you inserted the syrup pan plug into position 3, pour the “sweet” into the compartment on the left.
      ii. If you inserted the syrup pan plug into position 4, pour the “sweet” into the compartment on the right.
MAKING SYRUP

1. Open the valve between the sap source and the regulator float box. Adjust the float in the regulator float box so the sap level is over the flues about 1 – 1/2”. 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.

2. Syrup pan liquid level is adjusted using the cold sap regulator float. As the liquid rises in the flue pan it rises in the syrup pan. The level in the syrup pan is adjusted for the type of sap being run. The higher the concentration of the sap (ex. from an RO), the deeper the sap should be run.

<table>
<thead>
<tr>
<th>ARCH</th>
<th>Standard Draft</th>
<th>Steam-Away or Preheater with hood</th>
<th>Reverse Osmosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporator Width</td>
<td>Sap Depth (Inches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2X4 to 30X10</td>
<td>1”</td>
<td>Add ¼”</td>
<td>Add ½”</td>
</tr>
<tr>
<td>3X8 to 40X12</td>
<td>1 ¼”</td>
<td>Add ¼”</td>
<td>Add ½”</td>
</tr>
<tr>
<td>4X10 to 4X14</td>
<td>1 ½”</td>
<td>Add ¼”</td>
<td>Add ½”</td>
</tr>
<tr>
<td>5X12 to 5X16</td>
<td>1 ¾”</td>
<td>Add ¼”</td>
<td>Add ½”</td>
</tr>
<tr>
<td>6X14 to 6X18</td>
<td>2”</td>
<td>Add ¼”</td>
<td>Add ½”</td>
</tr>
</tbody>
</table>

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

3. If this is a new pan set startup or the first startup of the season, put the plugs in position 2 and position 4. Otherwise change the plug positions as outlined in the paragraph describing reversal of the syrup pan.

4. Start the fire in the evaporator.

5. As the flue pan starts to boil, add 3 drops of defoamer (based on ATMOS 300) into the flue pan on the side the fresh sap is entering. 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.

6. 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 middle of the syrup pan starts to boil, add the “sweet” to the draw-off compartment of the syrup pan. If the plug is in position 4 add the “sweet” to the right compartment of the syrup pan. If the plug is in position 3 add the “sweet” to the left compartment of the syrup pan.

7. 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 drop of defoamer to the syrup pan in the draw off compartment near where the end of the pan, where the draw off is located. If the addition of the defoamer to the syrup pan is required 2 or 3
times an hour, increase the scheduled amount of defoamer added to the flue pan by 1 to 2 drops. NOTE: Suggested scheduled adds to the flue pan are at the time of each firing or every 5 to 10 minutes.

8. 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, use a hydrometer to test the syrup. 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.

9. The draw off valves are located under the draw off boxes on the right and left sides of the syrup pan. When the hydrometer indicates you have syrup, open the draw-off valve on the side where the plug is installed 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.

10. Continually check your incoming sap, at the regulator float box to ensure it is flowing properly.

DAILY SHUTDOWN

1. There are two factors influencing the shutdown of the evaporator; time and sap volume.

   a. It will require approximately 30 minutes to 1 hour depending on arch style 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 from the last firing to embers and to flood the arch so ensure there is
      adequate volume left prior to the last firing.

2. After the last draw off and last firing, draw-off “sweet” into a clean container, in the following suggested
   quantities. Set the container aside and cover it. NOTE: The quantity of “sweet” should be adjusted based on
   experience and concentration of the sap being used.

<table>
<thead>
<tr>
<th>PAN WIDTH</th>
<th>Suggested Minimum Gallons &quot;SWEET&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>72</td>
<td>15</td>
</tr>
</tbody>
</table>

3. Continue to monitor the arch as done for normal operations.

4. When there is no more boil in either the flue or the syrup pans and the fire is down to coals on the grates (in a wood fired arch), 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.

MAINTENANCE

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 brush and rod (both supplied with the arch) 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 clean, 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 clean, unsoftened, non-chlorinated well or spring water. If the scale is thick you may need to allow the solution to soak 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 to 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 clean, 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 clean, 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 clean, 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 clean, 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 to 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 clean, unsoftened, non-chlorinated well or spring water.

2. Disassemble pan connections. Inspect all connection hoses.
3. Discard the rail gasket and pan gasket.
4. Inspect all arch insulating materials (brick, insulating board, blanket). Replace if missing or damaged.
5. Clean the grates.
6. Raise the flue pan out of the arch and finish draining.
7. Thoroughly brush the soot from the flues of the flue pan.
8. 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.
9. 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.
10. Cover the pans and arch with plastic, a tarp or hoods.

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. Insulate around the flue pan drain.
7. 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 THE 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.

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.

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

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 its 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.