EXTREME 2
Reverse Osmosis System

Leader Evaporator Co., Inc.
49 Jonergin Drive
Swanton, VT 05488
Tel: 802-868-5444
www.leaderevaporator.com
INTRODUCTION
A Leader Evaporator Springtech EXTREME Reverse Osmosis system is designed to significantly improve the producer’s productivity by generating high sugar percentage sap. Through use of high pressure, the system removes water from the sap resulting in a more concentrated sugar solution entering the evaporator. This in turn shortens the boil time required resulting in fuel and time savings.

Some of the features of the Springtech EXTREME 2 are:
- Easy accessibility to pumps and membranes
- Stainless steel frame, membrane housings, pumps and pump housings
- Fast wash cycle
- With reasonable sap – the ability to generate high brix concentrate with a single pass
- Flow meters for the permeate of each membrane and one for the system concentrate

THEORY OF OPERATION
In reverse osmosis, through the use of special semi-permeable membranes and high pressure, water is forced, in a pure form, through the membrane while the concentrated solution remains outside the membrane and is concentrated. For the sugar maker this means water (permeate) is removed from the sap and a sap with a higher sugar level (concentrate) is produced for the evaporation process.

Terms
- Semi-permeable Membrane – Unit consisting of multi layers of spacers and membranes
- Pre-Filter Unit – Designed to remove suspended solids from the sap incoming to the reverse osmosis system
- Feed Pump – The initial pump designed to supply the reverse osmosis unit with sap and maintain pressure in the system
- Pressure Pump – The pump designed to provide the pressure needed to force the sap through the reverse osmosis membrane
- Pressure Vessel – The containment unit for the semi-permeable membrane
- Permeate – Purified water removed from the maple sap during the concentrate cycle
- Concentrate – the maple sap having a higher percentage of sugar because water (permeate) has been removed
- Permeate Holding Tank – A tank designed to hold a minimum twice the hourly output of the system
- Concentrate Cycle – Process during which water is removed from maple sap resulting in Concentrate and Permeate
- De-Sugaring Cycle - Process to reclaim sugars from the membrane during which Permeate is run through the reverse osmosis unit using Concentrate cycle valve settings
- Rinse Cycle – Cleaning process of passing stored Permeate through the Reverse Osmosis system and out to drain
- Chemical Wash Cycle – Process of chemical washing the membranes by recirculating a solution through the reverse osmosis system. Dependent on requirement, chemical maybe be alkali or acid.
- Permeability Test – Test to determine the performance of the membranes against a benchmark
- Sap Recirculation Loop – Process of recirculating output from the concentrate cycle to the raw sap tank, increasing the concentration of the sap in the tank
Description of Membrane

The basic units of the reverse osmosis membrane are described in the cross section drawing.

- Attached to the permeate tube is a membrane unit consisting of a permeate carrier between two membranes.
- There are a number of these membrane units attached around the outside of the permeate tube.
- Between each of the membrane units is a spacer through which the sap and concentrate can flow.
- The permeate tube is perforated so the permeate can be collected from the membrane unit.
- At each unit as the sap is pressurized, the permeate can flow through the membrane and be carried to the permeate tube. The concentrate cannot penetrate the membrane and is pushed out the membrane assembly.
- The membrane units are wound around the permeate tube and an outside support structure is placed around the wound assembly.

The drawing above represents the flow of liquid through a membrane in the system. The membrane is housed in a pressure vessel (not shown).
EQUIPMENT DESCRIPTION

The LEADER EVAPORATOR Springtech EXTREME Reverse Osmosis System is designed to offer maximum concentration to cost performance. Through optimizing of pumps and membranes the reverse osmosis systems deliver greater flow potential to the user. The LEADER EVAPORATOR Springtech EXTREME Reverse Osmosis system is designed and built using the same principles of superior quality applied to our evaporators.

The LEADER EVAPORATOR Springtech EXTREME Reverse Osmosis System is covered by a manufacturer’s warranty – See ATTACHMENT #4.

NOTES:
1. Pictures, sketches and drawings presented in this document are not to scale.
2. Directions (right and left) will be as facing the front of the system.
**Feed Pump**
Provides liquid to the system and is the first stage of pressurizing the system.

**Pressure Pump**
Second stage of pressurizing the system required to process the sap through the membranes.

**Recirculation Pumps**
Recirculates liquid within the vessel to which they are attached.

**Prefilter Assembly and Wash Tank**
Each prefILTER requires a 20” cartridge filter.
Wash tank is used to mix the chemical solution for cleaning the system.
Control Panel
Start button when pressed starts the system pumps in sequence.

The STOP or STOP / ALARM RESET is a master reset for all the alarms and will stop the machine when pressed.

The Temperature Meter indicates the temperature of the liquid flowing through the system.

*Pressure Alarm* indicates a pressure condition in the system related to the pressure pump requirements. The alarm light may be solid (low pressure) or blinking (prefilter). This alarm can be part of normal operations. The machine will shut down when the indicator light is activated.

*High Temperature Alarm* indicates the Wash cycle has completed. This alarm is part of normal operations. The machine will shut down when the alarm light is on.

*Motor Failure Alarm* is due to a motor contactor tripping. Contact Leader Evaporator.

Flow Meters
The Concentrate Meter indicates the liquid flow from the concentrate side of the pressure vessels in gallons per minute.

The Permeate Meters indicate the permeate flow from each membrane in gallons per minute.

Pressure Gauges
Feed pump pressure is read after the prefilters.

Membrane pressure is read after the last membrane.
**Sampling Ports**
Concentrate port is used to sample the liquid concentrate to determine the sugar percentage.

The Permeate ports are used to sample the permeate from the membranes to determine if they are allowing sugar to pass through.

**V1 and V2 Valves**
V1 controls the pressure to the membranes. It is opened ½ way when starting then adjusted to reach the pressure wanted. Close V1 to raise the pressure in the system.

V2 controls the flow from the concentrate side of the membranes. It is opened ½ way when starting then adjusted to the desired concentration level.

**Flow Control Valves**
These valves control the flow of liquid through the system
V3 – Permeate flow
V4 – Concentrate flow
V6 – Feed flow
V18 – Cleaning or Concentrate flow
V19 – Drain or Wash Tank

<table>
<thead>
<tr>
<th>VALVE</th>
<th>TYPE</th>
<th>SET POSITION</th>
<th>LIQUID FROM - TO</th>
<th>SET POSITION</th>
<th>LIQUID FROM-TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3</td>
<td>3-Way</td>
<td>HANDLE POINTING UP</td>
<td>Membranes to Permeate out</td>
<td>HANDLE POINTING DOWN</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V4</td>
<td>3-Way</td>
<td>HANDLE POINTING UP</td>
<td>Membranes to Concentrate out</td>
<td>HANDLE POINTING DOWN</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V6</td>
<td>3-Way</td>
<td>HANDLE POINTING TOWARD PUMP</td>
<td>External to Feed Pump</td>
<td>HANDLE POINTING TOWARD WASH TANK PIPE</td>
<td>Wash Tank to Feed Pump</td>
</tr>
<tr>
<td>V18</td>
<td>2-Way</td>
<td>HANDLE POINTING PERPENDICULAR TO PIPE</td>
<td>No Flow</td>
<td>HANDLE POINTING PARALLEL TO PIPE</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V19</td>
<td>3-Way</td>
<td>HANDLE POINTING VERTICAL</td>
<td>Membranes to Wash Tank</td>
<td>HANDLE POINTING HORIZONTAL</td>
<td>Membranes to Drain</td>
</tr>
<tr>
<td>WD</td>
<td>3-Way</td>
<td>HANDLE POINTING VERTICAL</td>
<td>Recirculation to feed pump</td>
<td>HANDLE POINTING HORIZONTAL</td>
<td>Drain Wash Tank</td>
</tr>
</tbody>
</table>
The Leader Springtech EXTREME Reverse Osmosis system consists of the following parts:

### Included Equipment

<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>Springtech EXTREME 2</td>
<td>700028</td>
<td><img src="image1.png" alt="Strainer" /></td>
<td>Strainer Y 1-½” modified with bleeder valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Springtech EXTREME 2 User Manual</td>
<td></td>
<td><img src="image2.png" alt="User Manual" /></td>
<td>Springtech EXTREME 2 Quick Start Guide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1” Quick Coupler C</td>
<td>47148</td>
<td><img src="image3.png" alt="Coupler" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qty: 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Optional Setup Equipment, Parts and Supplies

<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>Membrane Preservative, 1 lb.</td>
<td>70001</td>
<td><img src="image4.png" alt="Preservative" /></td>
<td>Sani-Membrane, 2.2 KG</td>
<td>69992</td>
<td><img src="image5.png" alt="Sani-Membrane" /></td>
</tr>
<tr>
<td>Citric Acid, 1 lb.</td>
<td>70008</td>
<td><img src="image6.png" alt="Citric Acid" /></td>
<td>Glycol, 1 gal.</td>
<td>70009</td>
<td><img src="image7.png" alt="Glycol" /></td>
</tr>
<tr>
<td>20” Cartridge Filter</td>
<td>70012</td>
<td><img src="image8.png" alt="Cartridge Filter" /></td>
<td>Food Grade Grease</td>
<td>55095</td>
<td><img src="image9.png" alt="Food Grade Grease" /></td>
</tr>
<tr>
<td>12” Sap Hydrometer</td>
<td>61061</td>
<td><img src="image10.png" alt="Sap Hydrometer" /></td>
<td>Long 2” Diameter Test Cup</td>
<td>59006</td>
<td><img src="image11.png" alt="Test Cup" /></td>
</tr>
<tr>
<td>Digital Refractometer</td>
<td>61058</td>
<td><img src="image12.png" alt="Digital Refractometer" /></td>
<td>Sap Refractometer</td>
<td>61073</td>
<td><img src="image13.png" alt="Sap Refractometer" /></td>
</tr>
<tr>
<td>pH Meter</td>
<td>61060</td>
<td><img src="image14.png" alt="pH Meter" /></td>
<td>pH Meter Replacement Probe</td>
<td>61060P</td>
<td><img src="image15.png" alt="pH Meter Replacement Probe" /></td>
</tr>
</tbody>
</table>
SETUP
NOTES:

- All materials used should be approved for potable water. No copper should be used.
- When installing plumbing for the system, factor in the system may need to be moved for such items as maintenance. It is recommended the connections be made with fittings such as quick disconnects.
- All feed piping to the Springtech system must be at least as large as the feed on the system itself – 2” is recommended
- All installations must meet applicable governmental regulations.

Area Required
The space to be used should be capable of preventing the RO system from freezing. Additionally it will need to have adequate ventilation during operations to prevent overheating.

The dimensions of the unit are
- Width – 34”
- Length – 75”
- Height – 71”

A minimum of two feet around the system is recommended. You must also be able to obtain an additional 4 feet in length in order to remove membranes and pump assemblies.

The room should have adequate drainage. The walls, ceiling and floor should be easy to clean.

Power Requirements
The system requires 220V / 1 Phase, 49.2 amps. All electrical work should be done by a licensed electrician and meet all local codes.

<table>
<thead>
<tr>
<th>MOTOR ID</th>
<th>MOTOR FUNCTION</th>
<th>SIZE (HP)</th>
<th>NAMEPLATE AMPERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Feed Pump</td>
<td>1</td>
<td>7.4</td>
</tr>
<tr>
<td>M2</td>
<td>Pressure Pump</td>
<td>7.5</td>
<td>30</td>
</tr>
<tr>
<td>M3</td>
<td>Recirculation Pump</td>
<td>1.5</td>
<td>5.9</td>
</tr>
<tr>
<td>M4</td>
<td>Recirculation Pump</td>
<td>1.5</td>
<td>5.9</td>
</tr>
</tbody>
</table>

NOTE: Any time the control panel is opened, the power should be turned off at the source.
**Electrical Schematic**  
The schematic for the system is located in – [ATTACHMENT #1](#)

**General Connection Layout**  
The following illustrates a generalized layout for connections with the Springtech EXTREME RO System. The first drawing shows tank connections to the system. The second drawing shows an arrangement of valves to connect the incoming liquid to the system. Dependent on the location, other arrangements are likely. It is beyond the scope of this document to recommend the best layout for all situations. It is recommended you contact your LEADER EVAPORATOR sales person or your local Distributor / Dealer for assistance in deciding the correct tanks and layout for your needs.

**SIMPLE 3 TANK R/O DIAGRAM**

![Diagram of Simple 3 Tank R/O Diagram](#)

**Liquid Source Selector**
Valves should be in the R/O room for ease of operation. Additional valves and tanks may be required depending upon installation.

**Strainer Connections**
Plumbing from the supply tanks is recommended to be 2” ID. The input to the strainer will need to be reduced to 1 – ½”. The strainer is not mounted to the system. It will need to be mounted by the user. The connection can be made as follows:

1. Identify the flow direction through the strainer. There is an arrow on top of the strainer which shows the direction of flow. The input side pushes the liquid through the strainer prior to it going into the system. Additionally, when mounting the strainer, the spigot should be on top as it will need to be opened to bleed air from the system,

2. Install a valve before the Y strainer so the strainer can be removed and cleaned.

**V6 Connection**
The V6 valve is to be setup so the connection can be easily disconnected and reconnected as necessary. The following is the recommended connection detail.

1. Teflon tape a 1 ½” F style quick coupler.
2. Thread the F style quick coupler into valve V6. Tighten the coupler. NOTE: Secure valve V6 so as not to break it when tightening the coupler.

3. Obtain a length of 1 ½” braided hose that will connect to the strainer output on the incoming liquid source.

4. Slide a 1 ½” stainless steel band clamp over one end of the hose.

5. Slide the hose onto a 1 ½” C style quick coupler and tighten the clamp over the coupler. NOTE: For demonstration purposes the picture does not show the hose fully slid onto the quick coupler.

6. Pull the metal latches on the quick coupler out to the sides (perpendicular to the body of the quick coupler) then slide the open end of the coupler over the F style coupler on valve V6.

7. Raise the metal latches on the quick coupler back to the side of the C quick coupler while pressing the couplers together.

**WD Connection**

The WD valve is to be setup so the connection can be easily disconnected and reconnected as necessary. It is the connection from the wash tank to drain. The following is the recommended connection detail.

1. Teflon tape a 1 ½” F style quick coupler.

2. Thread the F style quick coupler into valve WD under the wash tank. Tighten the coupler.

3. Obtain a length of 1 ½” braided hose that will connect to the drain.

4. Slide a 1 ½” stainless steel band clamp over one end of the hose.

5. Slide the hose onto a 1 ½” C style quick coupler and tighten the clamp over the coupler.

6. Pull the metal latches on the quick coupler out to the sides (perpendicular to the body of the quick coupler) then slide the open end of the coupler over the F style coupler on valve WD.

7. Raise the metal latches on the quick coupler back to the side of the C quick coupler while pressing the couplers together.

**Vessel and Pump Drains**

Vessel and pump drains are provided with a ½” stainless steel ball valve. Container being drained may contain concentrate. It is recommended the drains be setup to allow collection of the liquid. You will need (items sold separately);

- 3 – ½” PVC adapters
- 3 – ½” Stainless Steel band clamps
- 3 pieces of ½” Food Grade Braided hose long enough to connect to the drain adapter and to reach the collection point
The drains are located:

- 1 under each membrane
- 1 under the pressure pump

* The feed pump drain is a ¼” stainless steel fitting in the front of the pump housing at the bottom in which the temperature sensor is mounted.

An additional drain, the wash tank overflow drain can be connected using either a 1 – ½” straight adapter or a 1 – ½” combo elbow adapter (items sold separately).

Install drain connections as follows:

1. Teflon tape the ½” PVC adapter.

2. Thread the PVC adapter into the stainless steel ball valve.

3. Cut ½” ID braided hose to length (to reach from the ball valve to the point where you will be collecting the liquid). Place a ½” stainless steel band clamp over one end of the hose. Slide the hose onto the PVC adapter. Position the stainless steel band clamp over the hose on the adapter and tighten the band clamp.

**V3, V4 and V19 Connections**

V3, V4 and V19 valves are to be setup so the connections can be easily disconnected and reconnected as necessary. The following is the recommended connection detail.

In order to assemble the connections you will need (braided hose and clamps sold separately):

- 3 – C style Quick Couplers (supplied)
- 3 (minimum) – 1” Stainless Steel Band clamps
- 1” ID braided food grade hose with length to make the connections for the Permeate and Concentrate tank.

The connection to the drain can be made with flexible hose.
V19 – Connection To Drain

1. Cut 1” ID flexible hose to reach from the valve V19 to the drain connection.
2. Place at least one 1” stainless steel band clamp over one end of the hose. Slide the hose onto the 1” C style quick coupler.
3. Position the stainless steel band clamp(s) over the hose on the coupler and tighten the band clamp(s).
4. Secure the other end of the hose to the drain connection.
5. Connect the quick couplers by opening the latches on the C style coupler (position the metal latch arms out perpendicular to the body of the coupler) then sliding the C coupler onto the F coupler. Pull the metal latch arms back down to the sides of the C coupler.

V3 – Connection To Permeate Storage

1. Cut 1” ID braided hose to length – from valve V3 to the fill connection for the permeate tank.
2. Place at least one 1” stainless steel band clamp over one end of the hose.
3. Slide the hose onto a 1” C style quick coupler.
4. Position the stainless steel band clamp(s) over the hose on the adapter and tighten the band clamps.
5. Secure the other end of the hoses to the tank fill connection.
6. Connect the quick couplers by opening the latch on the C style coupler (position the metal latch arms out perpendicular to the body of the coupler) then sliding the C coupler onto the F coupler. Pull the metal latch arms back up to the sides of the C coupler.

V4 – Connection To Concentrate Storage

1. Cut 1” ID braided hose to length – from valve V4 to the fill connection for the concentrate tank.
2. Place at least one 1” stainless steel band clamp over one end of the hose.
3. Slide the hose onto a 1” C style quick coupler.
4. Position the stainless steel band clamp(s) over the hose on the adapter and tighten the band clamp(s).
5. Secure the other end of the hose to the tank fill connection.
6. Connect the quick couplers by opening the latch on the C style coupler (position the metal latch arms out perpendicular to the body of the coupler) then sliding the C coupler onto the F coupler. Pull the metal latch arms back up to the sides of the C coupler.
OPERATION

When starting the Reverse Osmosis unit there is a sequence in which the pumps will activate. Pressing the START button will first activate the feed pump. In normal operations within 30 seconds the pressure pump will start followed by one recirculation pump and finishing with the second recirculation pump.

During any cycle if permeate is not available, use non chlorinated well or spring water.

Startup of System with Little or No Fluid

1. Set the system valve for a rinse cycle (see page 27).
2. Turn off the power to the system at the source.
3. Open the control box by unfastening the latches/buckles on the left side then opening the door carefully to the right.
4. Turn off the pressure and recirculation pump breakers:

<table>
<thead>
<tr>
<th>BREAKER ID</th>
<th>CIRCUIT</th>
<th>START POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB1</td>
<td>Feed Pump</td>
<td>ON</td>
</tr>
<tr>
<td>CB2</td>
<td>Pressure Pump</td>
<td>OFF</td>
</tr>
<tr>
<td>CB3</td>
<td>1.5 HP Recirculation Pump</td>
<td>OFF</td>
</tr>
<tr>
<td>CB4</td>
<td>1.5HP Recirculation Pump</td>
<td>OFF</td>
</tr>
</tbody>
</table>

5. Close the control box cover and refasten the latches/buckles.
6. Turn on the power to the system at the source.
7. Ensure your source valves (water or permeate) are open to feed the system.
8. Press the START button to start the feed pump.
9. Run the feed pump until most of the bubbles are gone from the flow meters located on the front of the system. This will take 3 to 4 minutes. Not all the bubbles can be removed.
10. Press the STOP button to stop the feed pump.
11. Turn off the power to the system at the source.
12. Open the control box by unfastening the latches/buckles on the left side then opening the door carefully to the right.
13. Position breakers CB1, CB2, CB3 and CB4 to the ON position.
14. Close the control box cover and refasten the latches.
15. Turn on the power to the system at the source.
16. Proceed to the instructions for the Initial System Cleaning.
Initial System Cleaning
To prepare the system after setup;

1. Put approximately 1200 US gallons of non-chlorinated well or spring water into a clean permeate storage tank.
2. Set the valves for and run a rinse cycle (see page 27) using a minimum 600 US gallons of water from the permeate tank. While this cycle is running check all fittings, piping, connections and hoses for leaks. Repair as necessary.
3. At the end of the rinse cycle change the position of valve V19 so the liquid flow is directed to the wash tank. When the wash tank is approximately ⅔ full, return V19 to the drain position.
4. Mix alkaline R/O soap with the liquid in the wash tank until the required pH is reached. To determine the required pH, refer to the Machine Serial Number Data Sheet that initially accompanied the system. NOTE: If the membrane is changed, reference the data sheet accompanying the new membrane.
5. Set the valves for and run an alkaline wash cycle (see page 30) allowing the system to run until the automatic temperature shutdown at 118°F.
6. Set the valves for and run a rinse cycle (see page 27) using a minimum 600 US gallons of water from the permeate tank.
7. Run the benchmark permeability test (see page 19).

Data Logging
Data on the operation of the system should be recorded and kept. See ATTACHMENT #2 for the data sheet format. The following data is recorded:

- Date – date the information is collected
- Activity – Concentration cycle (enter a C) or Test (enter a T)
- Sap % - the sugar concentration of the raw sap
- Concentrate % - the sugar concentration of the concentrate from the system – test results from the concentrate port
- Permeate 1 Flow – gallons per minute of permeate from membrane 1 – reading from the top of the stainless steel float in the permeate flow meter
- Permeate 2 Flow – gallons per minute of permeate from membrane 2 – reading from the top of the stainless steel float in the permeate flow meter
- Concentrate Flow – gallons per minute of concentration from the system – reading from the top of the stainless steel float in the concentrate flow meter
- Temperature – reading from temperature gauge on the control panel of the system (°F)
- Feed Pressure – reading from the pressure gauge on the control panel of the system (psi)
- Membrane Pressure – reading from the pressure gauge on the control panel of the system (psi)
- Water Removal % - percent of water removed from incoming sap – calculated as follows
  - PERMEATE FLOW – Add Permeate 1 Flow and Permeate 2 Flow together
  - TOTAL FLOW - Add Permeate 1 Flow , Permeate 2 Flow and Concentrate Flow together
  - Divide PERMEATE FLOW by TOTAL FLOW and multiply the result by 100
  - Record this number as the Water Removal %
- GPH Processed – gallons per hour being processed by the system- calculated as follows
  - TOTAL FLOW – Add Permeate 1 Flow, Permeate 2 Flow and Concentrate Flow together
  - Multiply Total Flow by 60 and record the resulting number as the GPH Processed
Cycles and Timing
The Springtech EXTREME 2 has 4 defined cycles; Concentrate, Desugar, Rinse and Wash. The following table outlines recommended intervals. NOTE:

<table>
<thead>
<tr>
<th>CYCLE</th>
<th>INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrate</td>
<td>Run 1 to 6 hours dependent on sap quality</td>
</tr>
<tr>
<td>Desugar</td>
<td>Run at the end of every Concentrate cycle OR at the end of each days use whichever is first</td>
</tr>
<tr>
<td>Rinse</td>
<td>Run after the Desugar cycle</td>
</tr>
</tbody>
</table>
| Wash        | Chemical wash after a rinse. A chemical wash should be run after 6 hours of concentrating OR at the end of each days use whichever is first. 

NOTE: If only a few hundred gallons of sap was run and the machine is to be cleaned, run a hot water wash

The following cycles always need to be run in sequence when used:
- Desugar
- Desugar - Alkaline Soap Wash (also called Alkaline Soap Wash cycle)
- Desugar - Alkaline Soap Wash - Acid Soak - Alkaline Soap Wash (also called Chemical Wash cycle)

Permeability Test
A permeability test determines the permeate flow rate of a membrane. When a membrane is new it will usually have a permeate flow rate above 10 GPM when tested. The first or second use will condition the membrane which reduces the permeate flow rate. Typically due to the construction of the membrane the flow will be reduced by 10% to 15% resulting in a permeate flow rate testing between 9 GPM and 10 GPM. The membrane flow rate should be tested after the conditioning and this flow rate will be the benchmark for comparison in future testing.

The permeability test is used to monitor the performance of the system. It is based on comparing the results of a benchmark test taken when the system is conditioned or at the end of the previous season after the final cleaning is completed. The permeate flow rate is the basis for the results of the test. Due to the inability to completely clean the membrane, membrane flow rate reductions of up to 10% to 15% as measured season to season are possible. When flow rates have reduced to an unacceptable working level, contact Leader Evaporator for assistance.

LOGGING DATA FOR THE PERMEABILITY TEST
To log data for the Permeability test, use the Membrane Permeability Test Sheet. A copy is attached (see Attachment #3) from which copies can be made. Use the sheet as follows:

1. A separate sheet is to be used for EACH membrane in the system ex. a model EXTREME-2 requires 2 Test Sheets as there are 2 membranes in the system.
2. Fill in your name in the field labelled “Customer Name”.
3. The Model Number field will have the system prefilled.
4. Find the Serial Number of the system on the Machine Serial Number Data Sheet and write it in the field labelled “Machine Serial #”.
5. In the field labelled “Membrane Location”, fill in the location of the membrane to be tracked. To determine the membrane location:
   a. The largest numbered membrane is on the top.

   NOTE: Membrane locations are also specified on the Machine Serial Number Data Sheet.
6. Find the membrane manufacturer information on the Machine Serial Number Data Sheet and write it into the field labelled “Membrane Manufacturer”.
7. Find the membrane serial number, on the Machine Serial Number Data Sheet, for the specific membrane being tracked and write it into the field labelled “Membrane Serial #”.

8. After the initial membrane conditioning or after the final end of season cleaning, perform a permeability test. For each membrane, record the flow rate measured for that membrane in the Benchmark Flow Rate column. This number can be filled in the Benchmark Flow Rate field for all subsequent tests until a new Benchmark test is performed.

Performing the permeability test:
1. Perform a rinse (see page 27) then fill the wash tank ⅔ full of permeate by moving valve V19 to the horizontal left position.
2. Set the valves in the wash cycle position (see page 30).
4. Run the system until the temperature reaches 55°F.
5. Adjust the membrane pressure to 200 psi using valves V1 and V2. Valve V18 may need to be opened slightly. 
   **NOTE:** If the starting temperature is higher than 55°F, the same results can be obtained at 70°F and 150psi operating pressure.
6. Record the permeate flow onto the Membrane Permeability Test Sheet in the Measured Flow Rate field, if not performing a Benchmark Flow Rate test.

A permeability test should be performed after each wash cycle. The test is performed as described above for steps 2 through 6. Compare the flow rate obtained in the test with previous benchmark rates. If the measured difference (see the calculation below) is 15% or more then further cleaning will be necessary. See the flow chart on page 21.

To calculate the difference to the benchmark, do the following calculation:
1. Subtract the measured flow rate from the benchmark flow rate.
2. Take the result and divide it by the benchmark flow rate.
3. Multiply the answer by 100 and record the result in the Measured Difference field on the Membrane Permeability Test Sheet.

\[
\left( \frac{\text{Benchmark Flow Rate} - \text{Measured Flow Rate}}{\text{Benchmark Flow Rate}} \right) \times 100 = \text{Measured Difference (\%)}
\]
Concentrate Cycle

1 to 6 hours or at the end of each day use whichever is first

Less Than 1 hour

Desugar

Rinse

Hot Water Wash

Rinse

Desugar

Rinse

Alkali Soap Wash

Rinse

Permeability Test

Less than 15% difference from benchmark flow?

YES

NO

Alkali Soap Wash

Rinse

Permeability Test

Less than 15% difference from benchmark flow?

YES

NO

Citric Acid Soak - minimum 8 hours
Flow Valve Information
The following is a table illustrating the type of valve being used and where fluid flows when the valves are in certain positions. NOTE: Flow as stated only occurs when all valves are set for the proper cycles.

<table>
<thead>
<tr>
<th>VALVE</th>
<th>TYPE</th>
<th>SET POSITION</th>
<th>LIQUID FROM - TO</th>
<th>SET POSITION</th>
<th>LIQUID FROM-TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3</td>
<td>3 - Way</td>
<td>HANDLE POINTING UP</td>
<td>Membranes to Permeate out</td>
<td>HANDLE POINTING DOWN</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V4</td>
<td>3 - Way</td>
<td>HANDLE POINTING UP</td>
<td>Membranes to Concentrate out</td>
<td>HANDLE POINTING DOWN</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V6</td>
<td>3 - Way</td>
<td>HANDLE POINTING TOWARD INCOMING PIPE</td>
<td>External to Feed Pump</td>
<td>HANDLE POINTING TOWARD WASH TANK PIPE</td>
<td>Wash Tank to Feed Pump</td>
</tr>
<tr>
<td>V18</td>
<td>2 - Way</td>
<td>HANDLE POINTING PERPENDICULAR TO PIPE</td>
<td>No Flow</td>
<td>HANDLE POINING PARALLEL TO PIPE</td>
<td>Membranes to Valve V19</td>
</tr>
<tr>
<td>V19</td>
<td>3 - Way</td>
<td>HANDLE POINTING VERTICAL</td>
<td>Membranes to Wash Tank</td>
<td>HANDLE POINTING HORIZONTAL</td>
<td>Membranes to Drain</td>
</tr>
<tr>
<td>WD</td>
<td>3 - Way</td>
<td>HANDLE POINTING VERTICAL</td>
<td>Recirculation to feed pump</td>
<td>HANDLE POINTING HORIZONTAL</td>
<td>Drain Wash Tank</td>
</tr>
</tbody>
</table>

The following is a summary table of the system cycles and the related valve settings for the cycle specified. Detail on the cycle settings is in the sections that follow.

<table>
<thead>
<tr>
<th>CYCLE</th>
<th>Concentration</th>
<th>Desugar</th>
<th>Rinse</th>
<th>Wash</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Open ½ way then adjust</td>
<td>Open ½ way then adjust</td>
<td>Open Fully</td>
<td>Open Fully</td>
</tr>
<tr>
<td>V2</td>
<td>Open minimum ½ way then adjust</td>
<td>Open minimum ½ way then adjust</td>
<td>Open Fully</td>
<td>Open Fully</td>
</tr>
<tr>
<td>V3</td>
<td>Handle Points UP</td>
<td>Handle Points UP</td>
<td>Handle Points DOWN</td>
<td>Handle Points DOWN</td>
</tr>
<tr>
<td>V4</td>
<td>Handle Points UP</td>
<td>Handle Points UP</td>
<td>Handle Points DOWN</td>
<td>Handle Points DOWN</td>
</tr>
<tr>
<td>V6</td>
<td>Handle Points Toward Incoming Pipe (Sap)</td>
<td>Handle Points Toward Incoming Pipe (Permeate)</td>
<td>Handle Points Toward Incoming Pipe (Permeate)</td>
<td>Handle Points Toward Wash Tank Pipe (Wash Tank)</td>
</tr>
<tr>
<td>V18</td>
<td>Handle Perpendicular to Pipe (closed)</td>
<td>Handle Perpendicular to Pipe (closed)</td>
<td>Handle Parallel to Pipe (open)</td>
<td>Handle Parallel to Pipe (open)</td>
</tr>
<tr>
<td>V19</td>
<td>Handle Points VERTICAL</td>
<td>Handle Points VERTICAL</td>
<td>Handle Points HORIZONTAL</td>
<td>Handle Points VERTICAL</td>
</tr>
<tr>
<td>WD</td>
<td>Handle Points VERTICAL</td>
<td>Handle Points VERTICAL</td>
<td>Handle Points VERTICAL</td>
<td>Handle Points VERTICAL/ HORIZONTAL</td>
</tr>
<tr>
<td>Drains</td>
<td>Closed</td>
<td>Closed</td>
<td>Closed</td>
<td>Closed</td>
</tr>
</tbody>
</table>

NOTE: During the Rinse cycle, if the machine shuts down due to low pressure and the feed line has been bled or during the Wash cycle if the machine shuts down due to low pressure, check the prefilters. If the prefilters are dirty, replace and retry the rinse/wash cycle. If the prefilters appear clean or are new and the problem continues, partially close valve V18 until an operating pressure of 50 – 80 psi is reached and run the remainder of the cycle.

Adjusting V1 and V2 for Operations
The recommended pressure for operations is of 200 - 350 psi.
V2 is adjusted for concentration output by flow or % sugar.

There are two methods of determining how to set the V1 and V2 valves.

- **Concentrate Preferred** – Turn V1 to a minimum pressure and turn V2 until the desired concentration is obtained. Adjust V1 until the pressure desired is reached. Readjust V2 until the concentration desired is reached.
- **Volume Preferred** – Turn V2 to a minimum and Turn V1 until the desired flow is reached. Adjust V2 until the concentration desired is reached. Readjust V1 until the desired flow is reached.

**Sample Port Use**

When using the concentrate sample port, run approximately 1 test cup of concentrate through in order to purge the lines. Pour that cup back into the raw sap tank. Draw a second cup and sample.

The permeate sampling ports should be purged as done with the concentrate sample port. The permeate through these ports should be sampled once per day.

**Concentrate Cycle**

In this cycle the system inputs sap or pre-concentrated sap and cycles it through the membranes resulting in a concentrated liquid (concentrate) and the water being removed (permeate).

There are two output options within the Concentrate Cycle. The first is to direct the concentrate to the concentrate tank. The second is to direct the concentrate to the sap tank – this is called the Sap Recirculation Loop. Valves are required between valve V4 and the concentrate tank allowing the option for concentrate to be directed to the sap tank (valves sold separately).

**Standard Concentrate Output**
Concentrate Cycle Valve Settings – also available on the Quick Start Guide

1. Position the valves as follows:

V1 – Open ½ way to start then adjust to the desired maximum pressure. The recommended operating pressure is 200-350 psi.

V2 – Open a minimum of ½ way to start then adjust to the desired concentration level of flow.

V3 – The flow indicator should be UP

V4 – The flow indicator should be UP
2. Press the START button on the control panel. Within 30 seconds all pumps should start.

3. If the system does not continue to run due to a LOW PRESSURE ALARM;
   a. Light is SOLID - Repeat Step 2 up to 2 additional times. The STOP ALARM RESET button will need to be pressed after each time.
   b. Light is BLINKING – Press the STOP button to reset the alarm. Check the prefilters, changing as necessary. Repeat Step 2.

4. If the system does not start on the third try, bleed the system. To bleed the system, open the valve on the top of the strainer (installed before valve V6) until all the air is released from the system. Close the bleed valve.

5. When the machine has started, adjust V1 and V2 to produce the desired conditions.

**Desugar Cycle**
In this cycle the permeate is run in a Concentrate cycle to flush accumulated sugar from the membranes. Dependent on the operation, the Desugar process may be done in one of the following ways:

- Flushing liquid for the full cycle is run to the concentrate tank
- Flushing liquid for the full cycle is run to the sap tank
- Flushing liquid for the part of the cycle with the highest concentration of sugar is run to the concentrate tank then the remainder is run to the sap tank
Flush Liquid Running To Concentrate Tank (first part of Desugar with higher sugar % being rinsed out)

Flush Liquid Running To Sap Tank (later part of Desugar with lower sugar % being rinsed out)

Desugar Cycle Valve Settings – also available on the Quick Start Guide

1. Position the valves as follows:
   - **V1** – Leave valve where it was set during the concentration cycle
   - **V2** – Leave the valve where it was set during the concentration cycle.
2. Press the START button on the control panel. Within 30 seconds all pumps should start.
3. If the system does not continue to run due to a LOW PRESSURE ALARM;
   a. Light is SOLID - Repeat Step 2 up to 2 additional times. The STOP ALARM RESET button will need to be pressed after each time.
   b. Light is BLINKING – Press the STOP button to reset the alarm. Check the prefilters, changing as necessary. Repeat Step 2.
4. If the system does not start on the third try, bleed the system. To bleed the system, open the valve on the top of the strainer (installed before valve V6) until all the air is released from the system. Close the bleed valve.
5. Check the concentrate sugar % level approximately every 5 minutes. The Desugar cycle should be run until the concentrate sugar is down to at least 1% to 2%.
6. Run a rinse cycle (see page 27).

**Rinse Cycle**

In this cycle permeate is run through the system at high volume and low pressure to rinse sugar, minerals and bacteria from the R/O. A rinse cycle is required before and after every wash cycle. At least 600 US gallons of permeate is
required in a rinse following a chemical wash. Desugar and rinsing the system every 4 to 6 hours can help to maintain higher performance rates.

Rinse Cycle Valve Settings – also available on the Quick Start Guide

1. Position the valves as follows:

   V1 – Open the valve completely
   V2 – Open the valve completely

   V3 – The flow indicator should be DOWN. Valve is open for recirculation within the system.

   V4 – The flow indicator should be DOWN. Valve is open for recirculation within the system.

   V6 – The flow indicator should be toward the pipe incoming from the liquid source selector. Input from source selector should be from the permeate tank.

   V18 – Handle should be parallel to the pipe. Valve is open.
2. Press the START button on the control panel. Within 30 seconds all pumps should start – some air purge may be required.

3. If the system does not continue to run due to a LOW PRESSURE ALARM;
   a. Light is SOLID - Repeat Step 2 up to 2 additional times. The STOP ALARM RESET button will need to be pressed after each time.
   b. Light is BLINKING – Press the STOP button to reset the alarm. Check the prefilters, changing as necessary. Repeat Step 2.

4. If the system does not start on the third try, bleed the system. To bleed the system, open the valve on the top of the strainer (installed before valve V6) until all the air is released from the system. Close the bleed valve.

5. If the system does not start due to a LOW PRESSURE ALARM partially close valve V18 until an operating pressure of 50 – 80psi is reached and run the remainder of the cycle.

6. Run the Rinse cycle until a minimum of 600 US gallons of stored permeate has been used. If the Rinse is to be followed by a Wash cycle, at the end of the rinse, fill the wash tank approximate ⅔ full by turning the V19 valve vertically down.
**Wash Cycle**
There are three different wash cycles. A hot water wash which can be run when good clear sap was processed and the flows are still good. An alkaline soap wash is done to remove bacteria from the system. An acid soak and wash is done to remove mineral deposits from the system. Generally the acid soak is used the system does not recover flow rates after the alkaline soap wash.

**Hot Water Wash**
1. Perform a rinse cycle (see page 27) using a minimum of 600 US gallons of permeate stored for system rinsing.
2. Toward the end of the rinse cycle, turn valve V19 toward the wash tank feed position. This will direct the flow of permeate to the wash tank. When the wash tank is ⅓ full, return V19 to the drain position.
3. Set the valves as listed below.
4. Start and run the system until it shuts down automatically. The system will shut down when the temperature reaches 118°F.
   NOTE: If the machine shuts down due to low pressure, check the prefilters. If the prefilters are dirty, replace and retry the wash cycle. If the prefilters appear clean or are new and the problem continues, partially close valve V18 until an operating pressure of 50 – 80psi is reached and run the remainder of the cycle.
5. Perform a Rinse cycle (see page 27) using a minimum of 600 US gallons of stored permeate water.

**Alkaline Soap Wash**
1. Perform a rinse cycle (see page 27) using a minimum of 600 US gallons of permeate stored for system rinsing.
2. Toward the end of the rinse cycle, turn valve V19 toward the wash tank feed position. This will direct the flow of permeate to the wash tank. When the wash tank is ⅓ full, return V19 to the drain position.
3. At the completion of the rinse cycle, add R/O soap (LEADER Order # 69992) to the wash tank and mix. Mix alkaline R/O soap with the liquid in the wash tank until the required pH is reached. To determine the required pH, refer to the Machine Serial Number Data Sheet that initially accompanied the system. NOTE: If the membrane is changed, reference the data sheet accompanying the new membrane.
4. Set the valves as listed below.
5. Start and run the system until it shuts down automatically. The system will shut down when the temperature reaches 118°F. Check the pH of the wash solution every 15 minutes. Maintain the pH by adding soap as needed.
   NOTE: If the machine shuts down due to low pressure, check the prefilters. If the prefilters are dirty, replace and retry the wash cycle. If the prefilters appear clean or are new and the problem continues, partially close valve V18 until an operating pressure of 50 – 80psi is reached and run the remainder of the cycle.
6. Perform a Rinse cycle (see page 27) using a minimum of 600 US gallons of stored permeate water.
7. Drain the wash tank. The drain valve is located under the wash tank. Turn the flow indicator to the left.

**Acid Soak**
1. Perform an alkaline Soap wash as listed above.
2. At the end of the rinse cycle (following the wash) turn valve V19 toward the wash tank feed position. Run until the wash tank is approximately ⅓ full, return V19 to the drain position.
3. Add 1 – ⅓ cups of citric acid to the wash tank and mix.
4. Run a wash cycle. The system will shut down when the temperature reaches 118°F.
5. Shut off the system and allow the acid solution to soak for 8 to 24 hours.
6. Drain the wash tank.
7. Perform a rinse cycle (see page 27) using a minimum of 600 US gallons of stored permeate water.
8. Perform an alkaline soap wash as detailed above.
9. Drain the wash tank.
10. Perform a rinse cycle (see page 27) using a minimum of 600 US gallons of stored permeate water.
Wash Cycle Valve Settings – also available on the Quick Start Guide

1. Position the valves as follows:

   V1 – Open the valve completely
   V2 – Open the valve completely

   V3 – The flow indicator should be DOWN. Valve is open for recirculation
   V4 – The flow indicator should be DOWN. Valve is open for recirculation.

   V6 – The flow indicator should be toward the pipe rear. Valve is open to the wash tank.
2. Add the chemical required for the type of wash to be performed. NOTE: Ensure the wash tank is filled first.
3. Press the START button on the control panel. Within 30 seconds all pumps should start.
4. For an alkaline soap wash - run the Wash cycle until the system shuts down automatically. The system shutdown is based on the temperature of the liquid. When the liquid reaches 118°F the system will shut down.
5. If the system does not continue to run due to a LOW PRESSURE ALARM;
   c. Light is SOLID - Repeat Step 2 up to 2 additional times. The STOP ALARM RESET button will need to be pressed after each time.
   d. Light is BLINKING – Press the STOP button to reset the alarm. Check the prefilters, changing as necessary. Repeat Step 2.
6. If the system does not start on the third try, bleed the system. To bleed the system, open the valve on the top of the strainer (installed before valve V6) until all the air is released from the system. Close the bleed valve.
7. If the system does not start due to a LOW PRESSURE ALARM partially close valve V18 until an operating pressure of 50 – 80psi is reached and run the remainder of the cycle.
8. Press the STOP ALARM RESET button to reset the alarm.
9. Open the wash tank drain valve to drain the wash tank. When the wash tank is empty, return the drain valve to the recirculation position.
10. Run a rinse cycle (see page 27) using a minimum of 600 US gallons of permeate from the permeate storage tank.
11. Do a permeability test (see page 19). If the test is good, continue the rinse cycle with any additional permeate.
MAINTENANCE
Pre Filters
When the feed pump pressure drops below 20 psi, the prefilters may need to be changed. The procedure to change the prefilters is as follows: NOTE – there are two filter housings mounted side by side. Change each one separately.

1. Loosen and remove the lower portion of the filter housing.

2. Empty the liquid from the housing.

3. Remove the filter from the housing.

4. Wipe the O-rings of the top of the assembly then apply a light coating of food grade grease such as LEADER order #64436.

5. Rinse out the housing. Insert a new filter into the housing aligning one of the open ends over the alignment projection.
6. Bring the lower filter housing, with the filter installed, up to the underside of the top of the filter housing on the system. Carefully align the open top of the filter with the alignment projection in the top of the filter housing. Thread the bottom of the housing onto the top of the housing and securely hand tighten.

Membrane Removal and Installation

NOTE: Membrane surfaces could produce splinters during handling. It is recommended clean leather gloves be worn when handling membranes.

**Removal**

1. Stop the system by pressing the STOP button.
2. Position valve V6 to the wash position.
3. Set valves V3 and V4 in a rinse cycle position.
4. Open the drain of the membrane housing to be changed. Allow to the membrane to drain until empty.
5. Disconnect the permeate line quick coupler from the end of the membrane housing. Quick couplers are located on the right side of the membrane housing.
6. Carefully move the permeate pipe to the side.
7. Remove the bolts from the metal clamp between the top of the membrane housing and the recirculation pump.
8. Slide the gasket rubber to the pipe on the pump side of the connection.
9. Using (2) - 9/16” wrenches remove the bolts fastening the end of the membrane housing to the body of the membrane housing.

10. Remove membrane housing cap from the membrane.

11. Remove the alignment coupling from the end of the membrane.

12. Remove the membrane from the housing. If the membrane plug on the other end of the membrane is attached, remove it. Note – the membrane will contain liquid.

**Installation**

1. Inspect and replace if necessary the four (4) O-rings of the membrane plug. Lightly lubricate the O-rings with permeate or non-chlorinated well or spring water then slide the plug into the membrane.
2. Place an alignment fixture into the membrane housing. The fixture used in the factory is pictured here. A suitable fixture can be constructed with a piece of wood 2”X4”, a screw eye and a length of wire.

3. Inspect and lubricate the brine seal with permeate or non-chlorinated well or spring water.

4. Using the alignment fixture as a guide, slide the membrane into the housing. Ensure the membrane goes all the way into the housing with the membrane plug seated into the end of the housing.

5. When the membrane is seated, gently lift the front of the membrane and remove the alignment fixture.

6. Check the O-rings on the alignment coupler, replace if damaged. Lightly lubricate the O-rings, if necessary, with permeate or non-chlorinated well or spring water then insert the coupling into the end of the membrane.

7. Inspect the O-rings on the membrane housing cap, replace if damaged. Lubricate the O-rings with permeate or non-chlorinated well or spring water, if necessary. Install the membrane housing end cap aligning the pump connection on the cap with the recirculation pump pipe.

8. Reinstall and tighten the bolts and nuts around the housing cap. It is recommended the bolts be tightened in a crisscross pattern.

9. Slide the clamp rubber coupler over the membrane housing pipe so that it rests between the grooves.

10. Place the two clamp halves over the rubber seal and aligning the pieces with the grooves in the connector pipes. Place the bolts in the clamp and tighten. Check to ensure the clamp is properly seated and tightened by ensuring the two halves fit tightly together.
11. Reconnect the permeate line to the end of the membrane housing using the quick coupler.
12. Follow the instructions for the Beginning of Season Startup (see page 39).

Daily
Each day, it is recommended the following be done:
1. Remove, clean and reinstall the strainer in the Y-strainer.
2. Sample the permeate liquid from each of the sampling ports;
   a. Purge the permeate sample lines by running the system and drawing a volume of permeate from each port approximately equal to a test cup.
   b. Draw a sample for testing. Test the permeate sugar level using either a refractometer or a hydrometer.
   c. If the results indicate there is any sugar present there is a possible problem with the membrane O-rings, connector or alignment coupling. Check the troubleshooting chart.
3. Check all hoses, piping, fittings and connections for leaks. Repair as necessary.
4. Run a cycle of Desugar (see page 25) – Rinse (see page 27) – Alkaline Soap Wash (see page 30) – Rinse (see page 27)
5. Do a Permeability test (see page 19)
6. Inspect and clean storage tanks
   a. Permeate
   b. Concentrate
   c. Sap

Periodic
1. When the feed pump pressure drops below 20 psi, the prefilters need to be inspected and, if necessary, changed (see page 33).
2. If a permeability test (see page 19) indicates the system performance is less than 85% of the benchmarked performance;
   a. Run a cycle of Rinse (see page 27) – Alkaline Soap Wash (checking pH 2 to 3 times and adding additional soap as necessary)– Rinse (see page 27) and repeat the permeability test (see page 19).
   b. If necessary or at the end of the season, run a cycle of Rinse (see page 27) – Acid Wash (see page 30) – Rinse (see page 27) – Alkaline Soap Wash – Rinse (see page 27) and repeat the permeability test (see page 19).
3. Pump motors will need to be lubricated. The following table describes the lubrication requirements. NOTE: The output of the grease gun will need to be measured prior to lubricating the bearings in order to ensure the proper amount of lubrication is used.
   a. All bearings require EXXON POLYREX EM lubricant.

NOTE: Lubricate the bearings ONLY at the interval specified. Over lubrication will cause the bearings to fail.

<table>
<thead>
<tr>
<th>MOTOR ID</th>
<th>MOTOR FUNCTION</th>
<th>HP</th>
<th>Bearing Location</th>
<th>Lubrication Interval (hrs)</th>
<th>Lubrication Amount (ounces)</th>
<th>Bearing Location</th>
<th>Lubrication Interval (hrs)</th>
<th>Lubrication Amount (ounces)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2</td>
<td>Pressure Pump</td>
<td>7.5</td>
<td>Pump end</td>
<td>3600</td>
<td>6.1</td>
<td>Non Pump End</td>
<td>3600</td>
<td>3.9</td>
</tr>
</tbody>
</table>
End Of Season Shutdown and Storage
If permeate is not available to perform the rinse and wash cycles stated in the following procedure, obtain the necessary volume of water using non chlorinated well or spring water.

The following flow chart outlines the steps to follow for the first steps in preparing the system for shutdown. Note the text version follows in Steps 1 – 4.

1. Do an alkaline soap wash (see page 30).
2. Run a permeability test. Compare the results to the benchmark used at the beginning of the season.
a. If the results show a difference of greater than 15% and the difference in the percentage is less than the previous alkaline soap wash cycle, repeat the alkaline soap wash cycle.
b. If the results show a difference greater than 15% and there was no improvement as compared to the previous alkaline soap wash cycle continue to the next step – Acid Soak Cycle.
c. If the difference is 15% or less, continue with Step 4.

3. Do an acid soak cycle (see page 30) allow the machine to soak for 1 to 7 days starting the system on the first day and allowing it to run to the auto shutdown temperature of 118°F. Run the system to temperature the same way on the last day of the cycle. Run a permeability test (see page 19).

4. If the difference in results is 15% or less – record the permeability test results. If the results are greater than 15%, contact Leader Evaporator for assistance.

5. Drain the wash tank (valve WD) then close the drain.

6. In the wash tank mix:
   a. 9 US gallons of permeate
   b. 2 US gallons of glycol
   c. 2 teaspoons of membrane preservative

7. Set the system valves for a wash cycle (see page 30) and run the system for 15 minutes. Drain the wash tank.

8. Empty then reinstall the prefILTER housing.

9. Drain the pumps then close all drains.

10. Maintain a temperature minimum of 40°F to 50°F in the area where the system is stored. Do not allow the system to freeze.

NOTE: If there is a possibility of the system freezing, drain all the fluid from the system.

11. Drain and clean all storage tanks. Cover them in order to keep dirt and pests out. NOTE: If permeate is not available for cleaning, use non-chlorinated well or spring water.

**Beginning of Season Startup**

As permeate will not be available to perform the rinse and wash cycles stated in the following procedure, obtain the necessary volume of water using non-chlorinated well or spring water.

1. Connect the reverse osmosis system to the concentrate, permeate and feed lines.
2. Replace prefilters.
3. Open the control box by unfastening the latches/buckles of the left side then opening the door carefully to the right.
4. Turn off the pressure and recirculation pump breakers:
<table>
<thead>
<tr>
<th>BREAKER ID</th>
<th>CIRCUIT</th>
<th>MOTOR</th>
<th>START POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB1</td>
<td>Feed Pump</td>
<td>M1</td>
<td>ON</td>
</tr>
<tr>
<td>CB2</td>
<td>Pressure Pump</td>
<td>M2</td>
<td>OFF</td>
</tr>
<tr>
<td>CB3</td>
<td>1.5HP Recirculation Pump</td>
<td>M3</td>
<td>OFF</td>
</tr>
<tr>
<td>CB4</td>
<td>1.5HP Recirculation Pump</td>
<td>M4</td>
<td>OFF</td>
</tr>
</tbody>
</table>

5. Close the control box cover and refasten the latches/buckles.
6. Ensure your source valves (water or permeate) are open to feed the system.
7. Position the valves for the rinse cycle.
8. Press the START button to start the feed pump.
9. Run the feed pump until most of the bubbles are gone from the flow meters located on the front of the system. This will take 3 to 4 minutes. Not all the bubbles can be removed.
10. Press the STOP button to stop the feed pump.
11. Check all fittings, hoses, connections and parts of the system for leaks. Repair as necessary.
12. Open the control box by unfastening the latches/buckles of the left side then opening the door carefully to the right.
13. Position breakers CB1, CB2, CB3 and CB4 to the ON position.
14. Close the control box cover and refasten the latches.
15. Run a rinse cycle (see page 27) until a minimum of 600 US gallons of water have been processed. Near the end of the rinse cycle turn valve V19 down and fill the wash tank 2/3 full. Return valve V19 to it’s original position.
16. Run a hot water wash cycle (see page 30).
17. Repeat the rinse cycle (see page 27) again filling the wash tank as specified then add R/O soap (LEADER Order # 69992) to the wash tank and mix. Mix alkaline R/O soap with the liquid in the wash tank until the required pH is reached. To determine the required pH, refer to the Machine Serial Number Data Sheet that initially accompanied the system. NOTE: If the membrane is changed, reference the data sheet accompanying the new membrane.
18. Run an alkaline wash cycle (see page 30).
19. Perform a rinse cycle (see page 27) using a minimum of 600 US gallons of water.
20. Drain the wash tank using valve WD (horizontal left) then reposition the valve for recirculation (vertical up).
21. Perform a permeability test (see page 19).
   a. Compare the results to the results of the test when the system was new or at the completion of preparation for storage at the end of the previous season. If the results are not acceptable contact LEADER EVAPORATOR or your local Distributor / Dealer for assistance.
   b. Record the results, if acceptable, and use these results as the reference for test for the season.
## TROUBLESHOOTING CHART

The following conditions may occur during operations.

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>CAUSE</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed pump does not start when START button is pressed</td>
<td>No power</td>
<td>Verify power is “ON” at the source.</td>
</tr>
<tr>
<td>Feed pump starts but system does not continue running – Low Pressure Alarm</td>
<td>Low Pressure</td>
<td>Inspect incoming plumbing for leaks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and clean Y-strainer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre Filters need changing (alarm light blinking)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>System needs to be bled</td>
</tr>
<tr>
<td></td>
<td>No liquid coming from storage</td>
<td>Check the positions of all valves</td>
</tr>
<tr>
<td>Low rate found during permeability test</td>
<td>Suspected bacteria buildup</td>
<td>Rewash system with R/O alkali soap</td>
</tr>
<tr>
<td></td>
<td>Suspected Mineral Buildup</td>
<td>Acid wash system</td>
</tr>
<tr>
<td>Sugar in the permeate</td>
<td>Leak at alignment coupling or membrane plug</td>
<td>Replace O-ring on alignment coupling or the membrane plug</td>
</tr>
<tr>
<td></td>
<td>Membrane deterioration</td>
<td>Replace membrane</td>
</tr>
<tr>
<td>Temperature Alarm Indicator</td>
<td>Normal operations for wash cycle</td>
<td>Reset alarm by pressing the STOP button</td>
</tr>
<tr>
<td>Motor Failure Alarm Indicator</td>
<td>Motor contactor has tripped</td>
<td>Contact LEADER Technical Service</td>
</tr>
</tbody>
</table>
**ATTACHMENT #2 – OPERATION DATA LOGSHEET**

Water Removal % = \((\text{permeate 1 flow} + \text{permeate 2 flow}) / (\text{permeate 1 flow} + \text{permeate 2 flow} + \text{concentrate flow})\) * 100

GPH Processed = \((\text{permeate 1 flow} + \text{permeate 2 flow} + \text{concentrate flow})\) * 60

---

### SPRINGTECH EXTREME 2 OPERATIONS DATA

<table>
<thead>
<tr>
<th>DATE</th>
<th>ACTIVITY (C or T)</th>
<th>SUGAR CONCENTRATION</th>
<th>FLOW (gpm)</th>
<th>PRESSURE (psi)</th>
<th>TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SAP</td>
<td></td>
<td>FEED PUMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PERMEATE 1</td>
<td></td>
<td></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></td>
<td></td>
<td></td>
<td>PERMEATE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MEMBRANE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PERMEATE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WATER REMOVAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PERMEATE 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CONCENTRATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**DATE**

**ACTIVITY (C or T)**

**SUGAR CONCENTRATION**

**FLOW (gpm)**

**PRESSURE (psi)**

**TEMPERATURE**

**WATER REMOVAL %**

**GPH PROCESSED**
**ATTACHMENT #3 - MEMBRANE PERMEABILITY TEST SHEET**

**MEMBRANE PERMEABILITY TEST SHEET**

<table>
<thead>
<tr>
<th>Customer Name</th>
<th>Model</th>
<th>Machine Serial #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXTREME 2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Membrane Location</th>
<th>Membrane Manufacturer</th>
<th>Membrane Serial #</th>
</tr>
</thead>
</table>

Test at 55°F with pressure adjusted to 200 psi.
OR
Test at 70°F with pressure adjusted to 150 psi.

**TEST CODE:**
- N - Test after normal alkali soap wash cycle
- S - Retest after reclean with alkali soap wash cycle
- A - Retest after clean with acid wash cycle

\[
\left( \frac{\text{Benchmark Flow Rate} - \text{Measured Flow Rate}}{\text{Benchmark Flow Rate}} \right) \times 100 = \text{Measured Difference (\%)}
\]

<table>
<thead>
<tr>
<th>DATE</th>
<th>Benchmark Flow Rate (GPM)</th>
<th>Test Code</th>
<th>Measured Flow Rate (GPM)</th>
<th>Measured Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Leader Evaporator Co., Inc.
49 Jonergin Drive
Swanton, VT 05488
Tel: (802) 868-5444
Fax: (802) 868-5445
www.leaderevaporator.com

Leader Evaporator Manufacturer’s Warranty
For Springtech Extreme Reverse Osmosis Machines

Leader Evaporator Co., Inc. warranties our Springtech Extreme line of Reverse Osmosis Machines against any manufacturer defects for a period of two years from the date of purchase. This warranty is at the discretion of the manufacturer, Leader Evaporator Co., Inc., to be replaced or repaired, as necessary. All replaced parts become the manufacturer’s property. Leader Evaporator Co., Inc. shall not be held responsible for any damage or injury arising from negligence, abuse, improper handling or installation.