Reverse osmosis is used to concentrate sap by pushing sap under pressure through a semi-permeable membrane. The membrane will remove ultra-pure water (permeate) and make a more concentrated sap (concentrate).

The membrane is the key element of your osmosis system, it allows sugar and water separation. Its structure is spiral wound, and its surface is porous. Bacteria proliferation and accumulation (fungal growth) can foul the membrane and cause permanent damage; it is important to keep the membrane well cleaned. Good maintenance will also ensure quality maple syrup production for many years.

The Concentrator is a reliable and efficient system that allows low cost and quality production. Exposing the membrane to iron or other minerals can compromise its life and performance. Cleaning and rinsing shall always be performed with unchlorinated demineralized water or with permeate water.

Membrane performance will decrease by time and can be measured by recording daily or weekly flow. It is important to consider temperature correction factor while calculating flow performance.

H2O Innovation is offering a membrane deep cleaning industrial service. You can take advantage of this low-cost service at the end of the season by shipping your membrane to H2O Innovation.

**Note:** Concentrator warranty is only valid with maintenance documented proof. H2O Innovation recommends keeping an updated logbook. You will find a logbook example at the end of this manual.
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II. INTRODUCTION

The Concentrator is a small reverse osmosis system developed for the maple producer getting started. This equipment can concentrate between 200 and 300 gallons per hour at up to 10 Brix while using 2 or 3 membranes. To achieve optimal performance, the concentrator is supplied with good size and length pipes. Any modifications may affect the separator performance and/or break it.

When starting the concentrator at the beginning of season calculate the pure water permeability (PWP) of your membranes. This will allow, you during the season, to quickly determine when it is necessary to clean your membranes. Go to the “PWP” section of this manual to see calculations examples.

III. SPECIFICATIONS

Install the Concentrator on a level surface. To facilitate operations and maintenance, ensure there is enough free space around the Concentrator.
NOTE: Stainless braided hoses are for concentrate sap.

Clear hoses are for permeate water.
Below, a typical installation with its required tanks and piping.
IV. MEMBRANE INSTALLATION

Remove the clamps and the black plugs at the end of the membrane vessel. Once the clips are removed, the plugs will come out easily. Insert the membrane in the membrane housing.

Install the U-Cup in the groove at the end of the membrane. The U-Shape of the ring should be facing the outside of the housing. Lubricate the U-Cup and the seal cap with water safe synthetic grease. Then firmly push the membrane into the housing while turning to fit it well.

Reinstall the black plugs and the clamps.
Ensure the 2 bolts on both sides are screwed evenly to have a properly tighten housing.

Each membrane comes with a sleeve in a small bag. You can dispose of it; its purpose is only for membranes in series, on the Concentrator they are parallel.

When opening the membrane housing, do not use PVC piping as “handgrips”. Doing so could damage the equipment and create leaks. Remove the lid by pulling on the cap.

It’s important to ensure o-rings are well positioned. To facilitate handling, we highly recommend greasing the o-rings, the permeate outlet and the sap inlet (in the lid). This will allow easier insertion of the lid into the vessel and membrane.

Clamps and bolts on the membrane housings must be checked periodically to ensure everything is tight.
V. 5 MICRON FILTER INSTALLATION

The prefilter will protect the membranes and increase their life. Remove the flange and unscrew by hand the filter housing. Set up the 5 microns filter, retighten the housing by hand, ensure the o-ring is seated properly.

VI. STARTUP AND INITIAL RINSE

Insert the membranes in their housing. Install a new 5-micron pre-filter. To rinse the membranes, you will need ultrapure water, permeate or maple sap. Required volume is 100 gallons per membrane (200 gallons for an organic maple farm).

1. Make sure the pump is not frozen;
2. Connect the Concentrator inlet to the sap or permeate tank with the “quick connect”;
3. Open the supply valve from the permeate tank, close all drain valves and close the concentration control valve;
4. Put the permeate and concentrate outlet to the drain;
5. Place the selector switch to the “START” position. This will start the booster pump. Hold the selector in this position until the pressure pump starts. Once the pump is running, release the switch. It will go back by itself to the “ON” position.
6. Gradually open the concentration control valve. For optimal rinse adjust pre-filter pressure to 50-60 psi;
7. To properly remove left over soap or storage solution, run 100 gallons permeate per membrane and send to the drain (200 gallons for an organic maple farm);
8. To stop the system, close the supply valve.

NB. The pressure switch is adjusted at 30-40 psi. When starting the system, gradually open the concentration control valve. The concentrator will run by itself when the pressure reaches 30-40 psi (you will hear the “click” of the pressure switch). You can release the start switch. Do not allow the pressure to drop below 25-30 psi as the system will shut down itself.

NOTE: Never use tap water or well water. Those types of water are containing minerals as iron, manganese, limestone and chlorine for tap water. All these elements will damage membranes and accelerate their premature aging.
VII. CONCENTRATION

- Open the supply valve from the sap tank;
- Put the permeate pipe in the permeate tank;
- Put the concentrate pipe in the concentrate tank or in the evaporator to boil directly;
- Completely close the concentration control valve*;
- Start osmosis with the “ON/OFF/START” switch, adjust the concentration control valve so that the flow level indicators are at the same level (50% permeate and 50% concentrate) concentration level of 50%;
- Take a sample of concentrate after 15 minutes of operation, sugar content will have doubled.

This adjustment will give an 8°Brix concentrate. This concentrate can then be evaporated. Check permeate sugar content occasionally to ensure your concentrator is working properly.

*The ball inside the concentration control valve is pierced, therefore when the valve is completely closed, flow is at its optimum pressure.

VIII. RINSING (AFTER 4 HOURS OF CONTINUOUS OPERATION)

- Close the sap supply valve;
- Open the feed valve from the permeate tank;
- Put the permeate pipe in the drain;
- Start osmosis with the selector and gradually open the concentration control valve until you reach 50-60 psi;
- When your concentrate no longer contains sugar (about 2-3 minutes), put the concentrate pipe in the drain;
- Circulate 100 gal. of permeate per membrane.

You must leave your system clean and well drained at the end of each day. Do a rinse or a rinse followed by a wash each day and ensure your system is well drained.
IX. WASHING EVERY TWO DAYS

To determine when a soap wash is needed, perform a pure water permeability test (PWP). This test will allow you to check your membrane loss of efficiency. However, if you’re not performing this test, it is recommended to perform a Bio-membrane wash every other day instead of a rinse. NOTE: If your rinses are effective enough, only one end-of season wash may be necessary. Wash should always be done after a rinse.

It is recommended to use another 5 microns pre-filter when you are performing a wash.

- Fill the wash tank with 5 gal. of permeate;
- Put permeate, concentrate and feeding pipes in the washing tank, close the concentration control valve;
- Start the osmosis and gradually open the concentration control valve to reach a pressure between 50-60psi;
- Add per membrane 2 ounces (60 ml or 4 tablespoon) of Bio-Membrane in the wash tank;
- Let it run until the temperature reaches 104°F (40°C);
- The unit will stop automatically once it reaches this temperature;
- Do a permeate rinse (100 gal per membrane or 200 gallons for an organic maple farm);
- When shutting down the system, be sure to drain it properly using the drain valves. If the system freezes while it is full, you risk damaging it.

NOTE: Soap efficiency is optimal between 85 and 104°F. So, washing time should not be too short.

X. DRAINAGE END OF EACH DAY

Never let the unit freeze. If you are in a heated area, it will only be necessary to drain the unit at the end-of season. Otherwise, it is important to drain the concentrator after each use (daily).

- Close your tanks feed valves;
- Unplug the quick connect of the concentrator inlet;
- Open all valves to completely drain the system;
- Unscrew and remove the Ronvik pre-filter;
- Open the valve under the 5 microns pre-filter.
XI. 5 MICRON FILTER MAINTENANCE

Filter frequency of changes

- After washing, if the pressure differential between the inlet and outlet pressure gauge is 30-40psi, it’s time to change your filter.

Replacement procedure

- Shut down the system and close the feed valve;
- Open the drain valves to bring back the system to atmospheric pressure;
- Unscrew the 5 microns housing (it should be unscrewed by hand);
- Remove the cartridge and replace with a new one;
- Retighten the filter housing by hand, ensure the O-Ring is seated properly.

XII. PRE-FILTER MAINTENANCE

Cleaning procedure, if needed, when you see dirt or when the mesh filter housing becomes opaque.

- Shut down the system and close the supply valve;
- Open the drain valves to bring back the system to atmospheric pressure;
- Unscrew the clear filter housing (it should be unscrewed by hand);
- Remove the filter, sediments and clean the filter housing;
- Retighten the clear filter housing by hand, ensure the O-Ring is seated properly.
XIII. END-SEASON STORAGE

For the end-season storage, it’s important to take the time to thoroughly wash your system. Do a rinse first, then wash the membrane and redo a permeate rinse. It is highly recommended to wash the membrane a second time and redo a permeate rinse before storing the system. Drain the system well.

- Remove the membranes of their housing;
- Put the membranes in storage housing;
- Per membrane, use 1/3 cup metabisulfite with 5 gallons permeate or ½ gallon of storage solution, do not add water to the storage solution. Using a storage solution will prevent the growth of bacteria;
- Ensure the cap of the housing is correctly sealed;
- Discard the 5 microns filter;
- Drain the concentrator, even without heating, it will be ok to leave in the sugar house.

The storage of your membrane is the most important part of storing your Concentrator. Four recommendations are to be followed according to membrane manufacturers:

- The membrane should never be exposed to freezing. The warranty does not cover a membrane that has been exposed to freezing;
- The membrane must be stored in a storage solution, in a cool place above the freezing point (about 7°C/45°F);
- The membrane should always remain moist. Storing either fully immersed in metabisulfite solution or partially wetted with a half-gallon of liquid storage solution.

Note: Remove the membranes U-Cup. Do not let them in the storage solution. The storage solution attacks the plastic of the U-Cup drying them up and making them unusable.
XIV. TROUBLESHOOTING

THE CONCENTRATOR DOES NOT START

- Circuit breaker is not in “ON” position, a circuit has been interrupted. Check your panel.
- Concentrator is not plugged. Plug it.

CONCENTRATOR DOES NOT REMAIN “ON” WHEN THE SELECTOR IS AT “ON”

- Obstructed 5 microns filter. Change the 5 microns filter.
- Insufficient level of sap or permeate. Refill sap and/or permeate tank.
- Pressure is not adjusted properly. Ensure the valve pressure is at 50 psi.

THE CONCENTRATOR DO NOT MAINTAIN ITS PRESSURE

- Clogged prefilter, clean the prefilter.
- The concentration control valve is not adjusted properly. Readjust the valve.

THERE IS A LEAK OF PERMEATE OR CONCENTRATE ON THE CONCENTRATOR

- Membrane plug is leaking. Ensure the 2 bolts on both sides are screwed evenly to have a properly tighten housing. Lubricate the U-Cup, the o-rings, the permeate outlet and the sap inlet.
- Check the piping connections, ensure the clamps are tight. Ensure there is no broken, cracked or disconnected pipe.

CONCENTRATE RATE IS TOO LOW

- Membrane is passing sugar, check general condition of plugs and o-rings and their positioning. Replace if needed.
- Broken membrane, replace it.
- If it is difficult to concentrate, check the U-Cup, ensure they are seated properly and that they are not dried and/or cracked.
<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAS3A02B-02</td>
<td>Thermometer 3” OD x 2 ½ spindle ½ NPT, 25-125F</td>
</tr>
<tr>
<td>ERA40711SS</td>
<td>Mini stainless sample valve SS304 F X M ¼</td>
</tr>
<tr>
<td>ERARONPREF</td>
<td>Ronvik complete pre-filter</td>
</tr>
<tr>
<td>SCH9013FRG2J35</td>
<td>Pressure switch 30-50psi square D</td>
</tr>
<tr>
<td>HOSCHA3/4X18</td>
<td>Water heater hose ¾” x 18”</td>
</tr>
<tr>
<td>SHERH5808-A-B</td>
<td>Complete stainless filter 20”, ¾” inlet and outlet</td>
</tr>
<tr>
<td>FLOY63BL300</td>
<td>Pressure gauge 300 PSI 2.5” DIAL 1/4” NPT SS back mount</td>
</tr>
<tr>
<td>POM560-5086MARATHON</td>
<td>Booster pump WGS-8-150, 8gpm, 1-1/2HP 4” 115/230V, 1PH</td>
</tr>
<tr>
<td>PURSSMH-4040-1234</td>
<td>Stainless steel pressure vessel # 4040, 300 psi</td>
</tr>
<tr>
<td>POM560-5159</td>
<td>Surpression pump 20GPM 1/2HP 4” 230V, 1PH</td>
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<tr>
<td>SPH-MINI-CONCENTRATOR-D01</td>
<td>Concentrator 200/300 frame</td>
</tr>
<tr>
<td>H2O-704040</td>
<td>H2O Membrane 4”</td>
</tr>
<tr>
<td>MCM298K22</td>
<td>Water safe synthetic grease</td>
</tr>
</tbody>
</table>
The pure water permeability (PWP) is used to check the current state of cleanliness of the membrane. PWP consists in measuring the membrane filtration rate when using pure water or filtrate. Membrane efficiency is obtained by comparing the membrane filtration rate when first used with its current filtration rate.

**Procedure:**
- Rinse the membrane using permeate
- Adjust the pressure to 150 psi
- Record the permeate flow
- Record the water temperature
- Take the permeate value and divide it by the temperature correction factor at 13°C (55°F)

See the correction factor table on next page.

**Example**
Initial PWP = 7 gpm
The initial PWP is to be taken when the membranes are new, after 12 to 24 hours of use.

Today your readings are: 150 psi, 68°F and a permeate flow of 6gpm.

**PWP calculation**
PWP = permeate flow / temperature correction factor
PWP = 6 gpm / 1,2 = 5 gpm (flow at 55°F)

Yield loss calculation:
(PWP/PWP\text{initial}) \times 100 = \% efficiency
(5 / 7) \times 100 = 71,4 \% efficiency

100 \% - \% efficiency = \% yield loss
100 \% - 71,4 \% = 28,6 \% yield loss

A was is required because the loss is more than 20%.
XVII. **TEMPERATURE CORRECTION FACTOR TABLE**

*P.W.P. Reference temperature: 13 °C / 55 °F*

<table>
<thead>
<tr>
<th>Temperature °C / °F</th>
<th>Correction Factor</th>
<th>Temperature °C / °F</th>
<th>Correction Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 / 32</td>
<td>0.672</td>
<td>13 / 55</td>
<td>1.000</td>
</tr>
<tr>
<td>1 / 34</td>
<td>0.695</td>
<td>14 / 57</td>
<td>1.028</td>
</tr>
<tr>
<td>2 / 36</td>
<td>0.719</td>
<td>15 / 59</td>
<td>1.055</td>
</tr>
<tr>
<td>3 / 37</td>
<td>0.742</td>
<td>16 / 61</td>
<td>1.084</td>
</tr>
<tr>
<td>4 / 39</td>
<td>0.766</td>
<td>17 / 63</td>
<td>1.112</td>
</tr>
<tr>
<td>5 / 41</td>
<td>0.790</td>
<td>18 / 64</td>
<td>1.142</td>
</tr>
<tr>
<td>6 / 43</td>
<td>0.816</td>
<td>19 / 66</td>
<td>1.170</td>
</tr>
<tr>
<td>7 / 45</td>
<td>0.842</td>
<td>20 / 68</td>
<td>1.200</td>
</tr>
<tr>
<td>8 / 46</td>
<td>0.866</td>
<td>21 / 70</td>
<td>1.229</td>
</tr>
<tr>
<td>9 / 48</td>
<td>0.893</td>
<td>22 / 72</td>
<td>1.259</td>
</tr>
<tr>
<td>10 / 50</td>
<td>0.919</td>
<td>23 / 73</td>
<td>1.289</td>
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<tr>
<td>11 / 52</td>
<td>0.946</td>
<td>24 / 75</td>
<td>1.319</td>
</tr>
<tr>
<td>12 / 54</td>
<td>0.973</td>
<td>25 / 77</td>
<td>1.350</td>
</tr>
</tbody>
</table>

*When the PWP reaches 15% you have to wash the membrane. When the PWP is more than 20% it will be difficult to wash the membrane properly.*
# Logbook - Maintenance & Operation

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours of operation</th>
<th>Outlet temperature °C / °F</th>
<th>Sap Brix °</th>
<th>Concentrate Brix °</th>
<th>Concentrate Flow GPM</th>
<th>Permeate Flow GPM</th>
<th>Corrected @ 55 °F</th>
<th>Membrane Pressure</th>
<th>Pre-Filter Pressure</th>
</tr>
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<tbody>
<tr>
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