

# CDL HOBBY R/O MANUAL



100 or 200 US gallons per hour



Congratulation on your purchase of a CDL Hobby RO machine. Please look over the machine for any defects or damage before operating it for the first time.

### What you received with your RO

With your new CDL RO, you received 1 membrane and 1 prefilter.

### Definitions

Sap: liquid that comes out of the maple tree, usually has 2% sugar content.

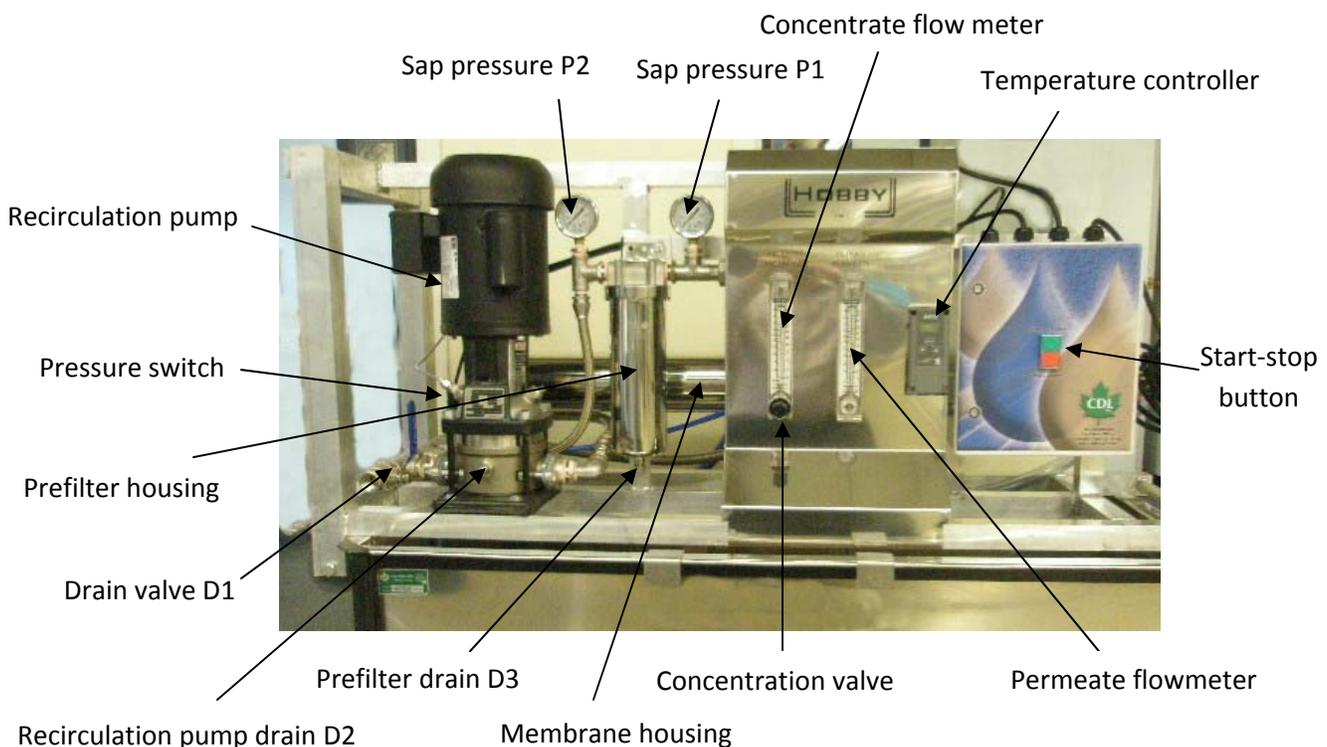
Concentrate: Liquid we get once it goes through an RO and remove pure water from the sap.

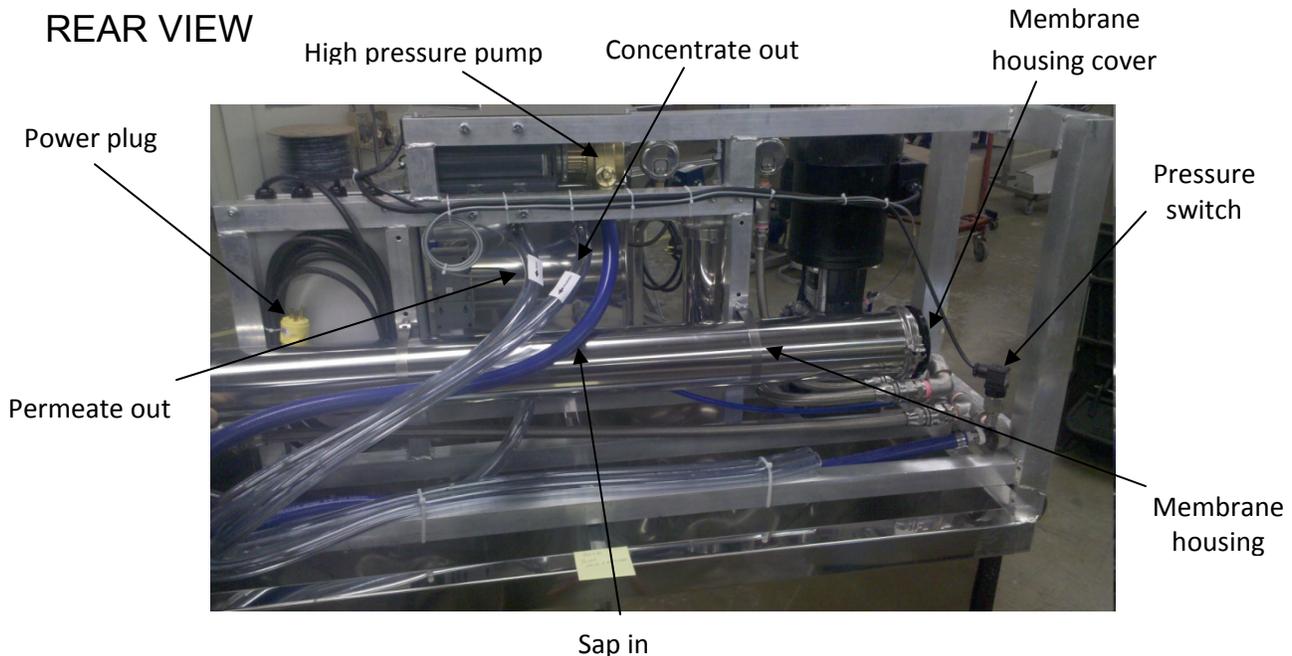
Permeate: Pure water removed from the maple sap.

### Machine overview

Facing your new machine, look at the pictures below and locate all the major components of the RO.

#### FRONT VIEW





High pressure pump: send pressurized sap to the membrane.

Prefilter housing: take housing apart to put the prefilter inside.

Drain valve: main drainage outlet.

Membrane housing: the membrane is inserted inside this piece.

Filter pressure gauge: When the pressure difference between the sap and the filter pressure reaches 50 psi, change the filter.

Sap pressure: Do not run machine over 250 psi (at P1).

Concentration valve: to adjust the concentration level. Need to adjust to double the brix (concentration %) level of the sap, no more. To get this, the permeate flow = concentrate flow.

Concentrate flowmeter: Indicates the concentrate flow (gallons per minute).

Permeate flowmeter: Indicates the permeate flow (gallons per minute).

Temperature gauge: shows sap temperature in Fahrenheit (or Celsius).

## Installation

This machine is powered by 110 volts single phase power. The machine needs a 20 amp breaker to run (both 100 and 200 models). Make sure that your power outlet has a fault reset, for safety. Set your CDL RO machine in place over your raw sap tank. The RO needs to be level and the motors away from any water or sap spills.

Install the membrane in the membrane housing. Please follow the procedure below for the 100 model:



Remove the clamp at the end of the membrane housing (end where the clear hose come out). Use a 1/2" key.

Remove the black quick coupling.

Unscrew the SS braided hose



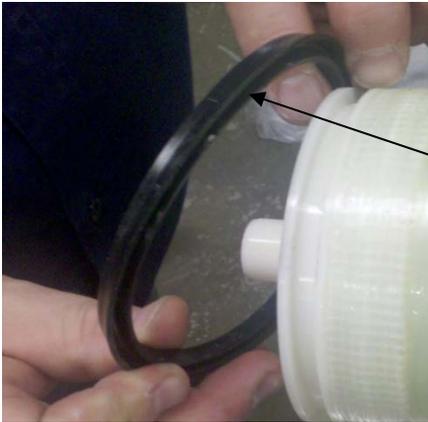
Remove the cap by pulling it out of the SS housing



Slide in the membrane. The end without the black o-ring (U-cup) goes in first. **IMPORTANT:** a new membrane has to soak in soft water or permeate for at least 24 hours before you can use it. If it's not done, the membrane performance will be altered for the rest of its life.



Push in the member with to U-cup last. **IMPORTANT:** It's very likely that a new membrane will come with the U-cup upside down. Remove it and make sure it's in the right position (see the next picture)



Notice the side with the groove is facing away from the technician



Insert back in the housing the black cap, making sure the pin of the membrane slides in the cap. Notice that it's possible that it will be quite hard to push the cover all the way in.



Assemble back SS clamp, the SS braided hose and the black quick connect. Repeat all the steps if you have a 2 posts RO. You're RO is ready.

Note: it is recommended to lubricate the U cup and the cap o'ring with Dow 111 food grade lubricant.

## Installation for the 200 model

Follow the same procedure as the 1 post model except that both black cap have to be removed together. DO NOT TAKE THE 2 QUICK COUPLINGS APART. Also, the U cup for the bottom post is placed the same as for the 1 post model, but the U cup for the top post is reversed vs the bottom one.

Never take these 2 SS quick couplings apart. Just pull both caps together



## Install a prefilter

Unscrew the SS ring

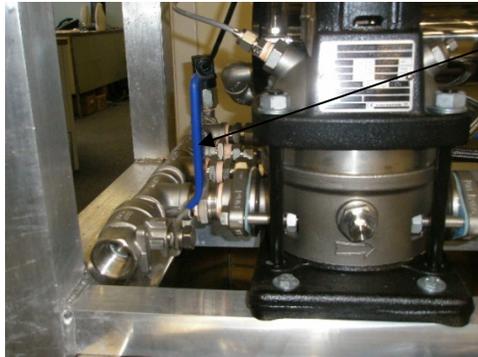


Insert a prefilter and assemble back

Pull down the SS housing

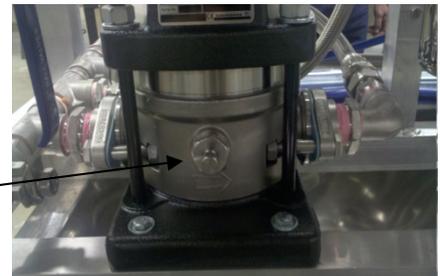
## Drain your RO

Unlike all the other RO, this one can operate in a non heated environment. In order to do that, it needs to be drained as soon as it stops running for more than an hour under freezing condition. Here's how to drain your RO:



Open the drain valve

Remove high pressure pump plug



Remove the prefilter canister and remove the prefilter. Next time you run, change the prefilter or keep the old one where it won't freeze between uses.



Take apart the black quick coupling and let the hose drain in the tank.



Note: always store your wet RO prefilters in a heated room so they don't freeze. A frozen prefilter will not work.

## **HOBBY R/O** **OPERATION INSTRUCTIONS**

1- Plug machine in no fault outlet 110 volts

Make sure the quick coupling is in place



2- Place suction hose in raw sap tank. Ideally the end of the hose should be  $\frac{3}{4}$  down the raw sap level. If you forget to stop the RO when the brix level gets too high, the machine will shut off by itself if the level gets lower than the hose level, protecting the membrane.



3a- Place concentrate in the raw sap tank for recirculation. This way, the brix level in the tank will slowly climb. When it gets to the desired level (maximum 8), you can start feeding the evaporator.

Concentrate hose

Raw sap hose

Permeate hose



3b- Optional set up; If you only want to double the brix level and boil the concentrate right away, you can set the concentrate hose in another tank that will feed the evaporator.

4- Place the permeate hose in the permeate tank. The permeate water will be used later to rinse and wash the membrane. The permeate tank should hold around 250 gallons.

5- Make sure prefilter is new or clean of any soap and that the prefilter housing is tight and the bottom plug is in place. Also, make sure the membrane quick coupling is on the housing. When the pressure difference between the filter and the sap pressures is more than 50 psi, it's time to replace the prefilter.



Sap pressure P2

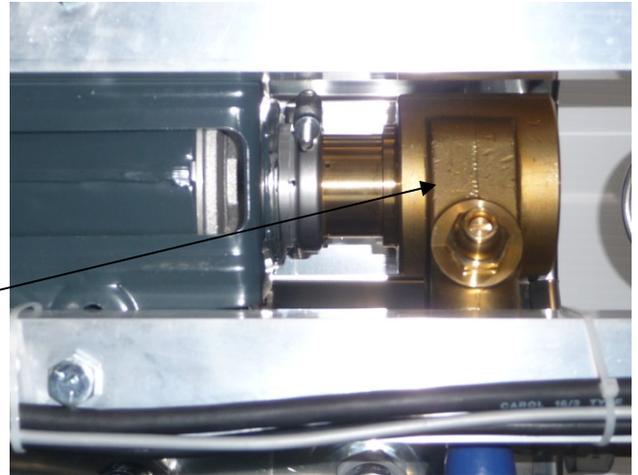
Sap pressure P1



Plug under prefilter housing (D3)

6- If the room temperature is below 32° F, it is recommended to take a towel, dip it in very hot water and wrap it around the brass feed pump (in case pieces of ice prevents it from turning).

Feed pump



7-Fully open the concentration valve (counter clockwise)

8- Make sure the drain plugs are in place (D2 and D3) and the quick connect fitting is in place on the membrane cannister.

Drain valve (D1)

Drain plug (D2)



9- Crack open the drain valve D1, then push the green start button until water gets to D1. If pressure P2 increases fast or water doesn't get to D1, the feed line is frozen.

Start button



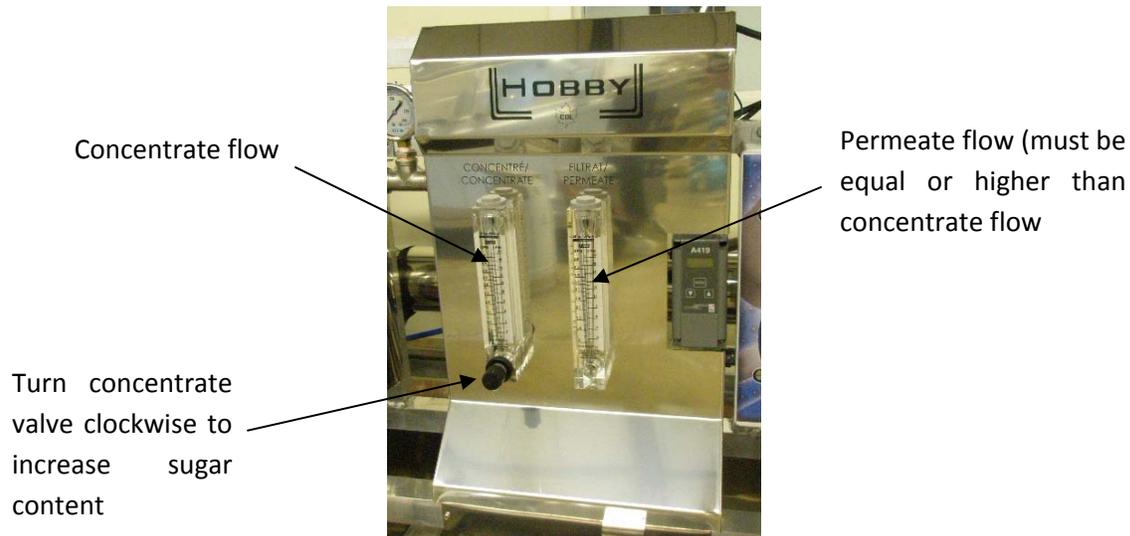
10- When water gets to D1, close it.

11- Push the start button and hold until you reach 4 gpm on the concentrate flow meter.

12- Close the concentrate valve (cw) and reopen 1/2 turn.

13- Push the start button until the green light stays on (20-30 seconds).

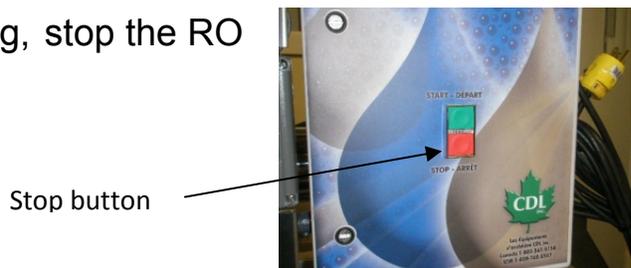
14- When the machine is running, turn the concentration valve clockwise until flow rate on both flowmeters are equal.



15- Occasionally, test Brix level of concentrate returning into raw sap tank, do not go higher than twice the incoming brix and not higher than 8 brix. If you do, you will plug your membrane and your efficiency will suffer. A plugged membrane is not covered under warranty.

16- Verify occasionally the sap pressure. In normal operation, sap pressure P1 should be between 125 and 250 psi. At the end of every running day, even if the pressure is less than 250 psi, you should do a wash to keep the membrane healthy.

17- When you are done concentrating, stop the RO by pushing the red stop button.



## **HOBBY R/O**

### **Rince & Wash Instruction**

- 1- Change the pre-filter(s). It's a good practice to use a different prefilter that you always use for the wash cycle.
- 2- Pull the blue line out of the sap tank and put in the permeate tank.
- 3- Put the concentrate and permeate lines to a drain.
- 4- Press the start button and hold until machine starts and stays on.
- 5- Turn the concentrate valve until P2 reaches 50 psi.
- 6- Run for approximately 10 minutes or until the concentrate is sugar free.
- 7- Stop the RO.
- 8- Fill a 5 gallon pail with permeate at room temperature or hotter.
- 9- Put soap in the pail (max. PH depending on your membranes specs.)
- 10- Put the blue hose and the conc entrate and permeate hoses in the pail.
- 11- Start the RO and adjust the concentrate valve to get 40 psi on P2.
- 12- Let the RO run until it shuts down by itself. It will stop when the wash water reaches the set temperature (84<sup>0</sup> F or 30<sup>0</sup> C).
- 13- After the wash, put the blue hose in the permeate tank and the 2 other hoses in the drain.
- 14- Start the RO and rinse the membrane with about 100 gallons of permeate (adjust pressure P2 at 50 psi).
- 15- Stop the RO or let it stop by itself when it runs out of permeate.
- 16- You are ready to start concentrating again.

### **End of season storage**

- 1- Prepare the machine the same way you do to drain the RO
- 2- Remove the membrane from the machine, store in your storage cylinder (sold separately) or in a large leak free bag.
- 3- Pour in the cylinder enough storage solution to cover the membrane
- 4- Close the cylinder
- 5- Store the membrane in a location where it won't freeze.

## **Troubleshooting**

The following table outlines some of the most frequently encountered minor problems when a reverse osmosis machine and how to solve them . Please refer to this table and check the indicated problem before calling Maple Pro or CDL for service. If the problem cannot be solved by referring to the troubleshooting table, please record all the problem characteristics and call Maple Pro for prompt professional service. Listed below are some examples of problem characteristics which may help Maple Pro deliver a faster service. Thank you for your cooperation.

### **Problem characteristics**

1. frequency of occurrence
2. when during the process and in which cycle does it happen
3. time of day
4. operating pressure
5. sap temp
6. pre filter pressure
7. permeate flow
8. concentrate flow

**Most problems are very simple and are solved over the phone however the above info will be needed in order for technician to make an accurate assessment over the phone (you are his eyes and ears be calm and thorough).**

## Problems and solutions (Before calling a technician)

PROBLEM	CAUSES	POSSIBLE SOLUTIONS
System does not start.	<ul style="list-style-type: none"> <li>• main power is not turned on.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Check circuit breaker.</li> </ul>
System does not start and red alarm light is on	<ul style="list-style-type: none"> <li>• high temperature alarm is activated (when you try to start right after the wash cycle).</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wait for temperature to drop 2 degrees, the red alarm light will shut off and press start to start the machine.</li> </ul>
Feed pump starts but shuts off as soon as start button is released	<ul style="list-style-type: none"> <li>• Pre-filter cartridge is dirty.</li> <li>• Blue suction hose not in the sap</li> <li>• Air is entering the system.</li> <li>• Feed pump doesn't prime itself</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace pre-filter cartridge.</li> <li>▪ Make sure the hose is inside the tank and below sap level</li> <li>▪ Check inlet supply plumbing for leaks or obstruction (ice, leaves, mouse...).</li> <li>▪ Check for air leaks.</li> <li>▪ Check for air leaks.</li> </ul>
Feed pump starts but doesn't stay on even if green light is on	<ul style="list-style-type: none"> <li>• Low pressure switch problem</li> </ul>	<ul style="list-style-type: none"> <li>▪ Remove the low pressure switch and gently rinse it with hot water, sugar crystals or rust stuck in is probably the problem.</li> </ul>
The wash cycle doesn't stop	<ul style="list-style-type: none"> <li>• Water temperature is stopping the wash cycle. If the temperature of the water and the room is cold, the RO may have a hard time to bring the water temperature high enough.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lower the water level in the wash tank by 1/3 before starting. You may have to lengthen the hoses going to the wash tank to prevent foaming.</li> </ul>
The machine stops by high pressure.	<ul style="list-style-type: none"> <li>• The machine stops because the pressure in the system goes over 250 PSI.</li> </ul>	<ul style="list-style-type: none"> <li>▪ The concentration control is clogged or closed too much.</li> <li>▪ The recirculating pump is not functioning</li> <li>▪ The membrane is clogged.</li> </ul>

## **Membrane information**

CDL RO comes with this membrane:

Membrane 4" NF270-40040 nanofiltration

Product	Water flow rate (gph)	Magnesium sulphate rejection (%)
NF270-4040	100	95
E4	100	99

- 1) Permeate flow and salt rejection based on the following test conditions : 2000 ppm MgSO<sub>4</sub>, 70 PSI (5.5 Mpa), 77 °F (25 °C).
- 2) Flow rates between filter can vary of 20%

### Operating limits

Membrane type :	Thin-film	composite
Maximal operating pressure :		250 PSI (1.7 Mpa)
Maximum feed flow rate :		100 gph
pH, range, short term cleaning(30 minutes)		9.5 for NF270-400 11 for E4
Maximal operating temperature	95	°F (35°C)
Free chlorine tolerance	<0.1	ppm

## **How to calculate the membrane performance**

### Step 1

After the first 20 hours of concentrating with your new ro you can now do an accurate performance calculation of your membrane. This result will be your reference 100% of your membrane. After completing a wash simply begin the rinse cycle. Let the rinse cycle run normally until you have used about half of your permeate. At this point you can simply start the pressure pump and adjust the concentrate flow meter reading to 3 gpm and set the system pressure to 250 psi. Now you will need to record the permeate flow reading and the temperature.

Example :

**Table 1 Readings to take for the 100% performance**

Date	Time	T. °C Permeate	Permeate flow
March/07/2010	11 :50	8 °C	5,2 GPM

**Directly obtained on the RO**

Once the above readings are taken, the permeate flow obtained must be divided by the temperature after a correction factor is applied because the permeate output varies with the water temperature. The higher the temperature is, the higher the output will be and vice versa. By using a correction factor, we are correcting the flow as if the temperature would always be 13°C.

**Table 2 Correction factors**

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

Thus, to obtain the 100% output flow of the membrane at 13°C or 55 °F

$$5,2 \text{ GPM} \div 0.866 \text{ (Correction factor } 8 \text{ °C)} = 6.00 \text{ GPM}$$

Or, if you want to see if your machine is performing the way it should, take 600 gallons per hour of flow, multiply by the number of columns and by the temperature correction factor. That will give you the flow you should be getting at 8% concentration rate. If you concentrate higher, the flow will come down.

Flow vs concentration rate

Brix	8	10	12	16
Correction factor	1	0.85	0.71	0.65

So, if a membrane concentrate 55 degree F sap from 2 to 8 brix, it will flow 600 GPH. If you go from 2 to 12 brix, it will flow:

$$600 \times 0.71 = 426 \text{ GPH of sap}$$

If you are seeing performance drop during your concentrate cycle it is likely it is being effected by a variable such as sap quality. The only way to know for sure is to perform this test after the wash and see what your temperature corrected flow is with permeate.

If we want to check the performance at any given time, the above exercise must be repeated and compared with the 100% result.

For example, if we are obtaining 5.5 GPM at the second verification (corrected at 13 °C), the membrane performance would be :

$$((6.00 - 5.5) \div 6.00) \times 100 = 8.3\% \text{ of loss}$$

or

$$5.5 \div 6.0 = 91.7\% \text{ efficiency}$$

**Table 3 Example of table to fill.**

Membrane #	Results	T °C	Corrected results at 13 °C
<b>28736465</b>			
2009	5.2	8	6.00 (100%)
2010	6.0	10	5.50 (91.7%)
2011			
2012			
2013			
2014			
2015			
2016			
2017			
2018			
2019			

Maple Pro offers a factory cleaning and storing of membranes. This is a very effective procedure and will help you maintain performance with minimum loss of flow over the life of your membrane. A Typical gain with this wash is 5 to 10%. The price of the wash will more than pay for itself in fuel savings the following season.

## **Warranty**

Your RO is covered by a CDL 2 year warranty. So, all parts and labour are covered for a period of 2 years from the date of the invoice. The warranty doesn't cover the membrane that is covered by a 1 year limited warranty by the membrane manufacturer (see the membrane manufacturer's warranty for details) and the pre-filters. The warranty will be void if one of the following events occur:

- If a defect is the result of negligence or accident damaging the machine.
- If the RO is kept in an ambient temperature below the freezing point without being drained as per CDL's instructions.
- If anything else than maple sap is processed in the machine.
- If the machine ran dry.
- If the machine concentrated ordinary water.
- If normal maintenance is not performed as specified in the CDL owner's manual.