REVERSE OSMOSIS

Start up

- Install the membrane according to the instructions showed on the recirculation vessel.
- Before inserting the membrane in the pressure vessel, make sure that the u-cup o'ring on the membrane and all the o'rings on the adaptors are in perfect condition.
- Always coat lightly the u-cup and all the o'rings with silicone base lubricant before their installation.
- Once the membrane installation is completed, connect all the high pressure hoses to the reverse osmosis and at the base of the recirculation pump(s).
- Plug the electric cord of the recirculation pump to the reverse osmosis.
- Make sure that all the plumbing is in good condition.
- If the equipment was stored in an unheated room, warm up the apartment for 2 days before starting the pumps. This precaution will avoid damage to the pumps if ice has formed inside of the system.
- To start the equipment open the valve on the sap feed line and let the sap fill the unit by gravity.
  It is important to thoroughly rinse the membrane before you begin the concentration. You must follow the rinse instruction and start the equipment.

Troubleshooting

Problems & solutions

P: The feed pump starts, but it stops as soon as my finger is off the feed switch.

S: Check if the feed pressure reaches at least 20 psi.

1. Check the feed valve, it must be open.
2. Check the prefilters, they may have to be replaced.
3. Check if the plumbing is not plugged or damaged. A bad joint or bad seal will allow air in the system causing this problem.
4. Check the feed pump.

P: The feed pump starts, but the R.O. Stops as soon as I press on the high pressure switch.

S: Check if the feed pressure reaches at least 20 psi.

1. Replace the prefilter cartridges.
2. Check for obstruction of the feed line or the feed pump.
3. Check the feed pump.

P: The performance of the R.O. Equipment drops once it is started.

S:

1. Make sure the recirculation pump is running. Just place your hand under the recirculation pump motor if you feel air circulating the motor is running. If the recirculation system does not operate the membrane will foul rapidly.
2. At the beginning and the end of the sugar season, it is important to do a tight follow up of the membranes condition. During these periods, it is necessary to wash the membranes more often to keep a good level of performance.
   In the first days of the operation due to the cytoplasmic cells activity inside the maple, the sap has a tendency to foul the membranes. These cells produce an antifreeze like substance, which protects the maple during the winter frost. Frequent wash will be necessary during that period to avoid fouling.

REVERSE OSMOSIS

P: The recirculation pump does not operate

S: Normally when the recirculation fails, it will cause a complete stop of the R.O. The out of order light will come on.

1 Control panel.
- A Check if the breaker is on. (Note on older models the equipment will keep on running if the recirculation breaker is off)
- B Check if the recirculation overload is on, if it is off, the R.O. Stops and the out of order light comes on.
- C Check the electric wiring to the plug and the connections in the motor. (The R.O. Will keep on running despite the recirculation is out.)

2 Recirculation motor
- A Check if the recirculation motor can turn freely use a flat screw driver at the base of the motor.
- B If the motor turns freely check the electric wiring to the motor. If the wire connections and the power are fed properly through the electric circuit, the motor will have to be repaired or replaced by a qualified technician.

P: There is a noise coming out one of the electric motors.

S: It is not generally a very serious problem. Most likely it is a bearing failure, due to excessive wear or rust cause by dampness. Although it must be repaired immediately before extensive damage occurs a qualified technician can replace the bearings and check the pump to make sure it is in good running order.

Storage procedure

At the end of the crop. It is time to prepare your equipment for storage until the next crop. To begin, you must make sure to have a good volume of permeate to allow a proper wash of your membranes.

1 Even if you send your membrane to be washed at the manufacture. It is important to wash and clean the membranes before pulling them out of the recirculation vessel.
2 Disconnect the pressure hoses from the pressure vessels and the electric cord from the R.O.
3 Unfasten the bolts from the top lids and pull the membranes.
4 Insert the membranes in the canisters. If you send the units to the factory, add 1 litre of permeate to the canisters. The membranes must be kept in a damp environment. Long storage solution : for each 8" x 40" membrane: mix ½ cup of SMBS (sodium metabisulfite) with 4 gallons (18 litres) of cold permeate and 1 gallon (3.75 litres) of glycerine. Mix well and add the solution to the membrane in the storage canister.
   For 4" x 40" membrane mix 1/8 of a cup of SMBS to 1 gallon (4.5 litres) of cold permeate and add 1 litre of glycerine, mix well.
5 Drain the unit and all pumps completely.
6 It is strongly recommended to store the R.O. In a dry and heated room. This precaution will avoid certain problems due to humidity and bad surprises caused by an incomplete drainage.

REVERSE OSMOSIS

Concentration & performance test

The purpose of this sheet (page 5) is to keep a data of all parameters during the operation and performance test of your equipment.

To evaluate the good working order of the reverse osmosis equipment it is important to know the parameters detailed on the concentration & performance test sheet.

1. Brix percentage of the raw sap.
   It is the sap before the concentration process, Take note that the liquid temperature influences the reading on the hydrometer or refractometer. Always check the temperature range of the brix mesurement device.
2. Brix percentage of the concentrate.
   This test is normaly performed after 15 to 30 minutes of operation. For the mesurement follow the recommendations for the raw sap.
3. Permeate flow
   Note the reading of the permeate flow metre in litres or gallons per minute. To know the flow per hour, multiply the data per 60 minutes. Ex. : 3 GPM x 60 minutes = 180 GPH
4. Concentrate flow
   Follow the permeate flow procedure.
5. Total flow
   To evaluate the total flow. Add the data of the column #3 (permeate) and column #4 (concentrate). The result will be the total flow per minute. Multiplied by 60 minutes you get the total flow per hour. Ex. : 2+8X60= 600 GPH
   Take note, this data is influenced by temperature variation. The degree of concentration, the condition of the sap, the condition of the membranes and the operation pressure (PSI)
6. Concentration percentage
   The purpose of knowing the percentage of concentration, is to make sure to not exceed the operation recommendation.
   Ex. : For a R.O. Equipped with a 600 GPH pump and a membrane of 600 GPH the degree of concentration should not exceed 70%. Although by increasing the filtration surface by adding on extra membrane it is possible to surpass this recommendation to obtain a concentrate with a higher level of sugar and minerals.
   The osmonic pressure increases with the degree of concentration and has a down effect on the membrane flow.
   To determine the percentage of concentration. Divide the permeate flow by the total of the permeate and the concentrate..
   Ex. : Column 3 (permeate) = 8 Column 4 (concentrate) = 2 8 /10 = 80 %
7. Operation temperature
   The operation temperature, is the temperature of the sap at the inlet of the equipment.
   The temperature of the sap has a direct effect on the permeability of the membrane. Colder is the sap, lower the flow through the membrane film will be. To make the evaluation of the treatment capacity of the membrane, we must refer to the temperature correction factor.
8. Pressure of operation
   An other important element during the operation, or when conducting a performance test. The pressure has a direct effect on the flow and the permeability of the membrane. To increase the level of concentration, requires an increase of the pressure to maintain the flow. Although for the long life of the membranes, it is preferable to operate at a lower pressure than the recommended limit.
   Alway perform the performance test at the same pressure. It is important to maintain a good reference,
9. Corrected permeate flow
   Divide the reading of the permeate flow meter by the appropriate temperature correction factor.

Concentration & performance test										
	1	2	3	4	5	6	7	8	9	
date	% brix of the raw sap	% brix of concentrate	Permeate flow	Concentrate flow	Total flow (3+ 4)X60	% concentration 3/ (3+ 4)	Operation temperature	Pressure of operation	Corrected permeate flow	test

REVERSE OSMOSIS

HOW TO TEST THE PERFORMANCE OF THE MEMBRANE

When purchasing a new R.O., or a new membrane. The second day of use, check the performance of the membrane after a warm wash and cold permeate rinse. The permeate flow metre reading will be your reference 100%

To check the condition of a membrane, you must concentrate permeate. We recommend that you set the pressure at 225 PSI and adjust the concentrate flow at 3 GPM.

Example :

Table 1 Data to establish the 100% performance

Date	Time	Temp ^{O}C permeate	Permeate flow
march 10 2006	11:50	8^{O} C	5.2 GPM

Once the data reading is taken, you divide the permeate data flow by the temperature correction factor. The permeate flow is influenced by the temperature. Higher is the sap temperature, higher will the permeate flow be and vise-versa.

Table 2 Correction factors.

Temp. ^{O} C	Correction factor	Temp. ^{O} C	Correction factor
0	0.672	13	1.000
1	0.695	14	1.028
2	0.719	15	1.055
3	0.742	16	1.084
4	0.766	17	1.112
5	0.790	18	1.142
6	0.816	19	1.170
7	0.842	20	1.200
8	0.866	21	1.229
9	0.893	22	1.259
10	0.919	23	1.289
11	0.946	24	1.319
12	0.973	25	1.350

REVERSE OSMOSIS

HOW TO CALCULATE THE PERFORMANCE OF A MEMBRANE (CONTINUATION)

To figure the 100% capacity of the membrane at 13°C

5.2 GPM / 0.866 (correction factor 8°C) = 6.00 GPM
This result must be written down to compare the performance of the membrane year after year.
Therefore, if we wish to revise the performance of the membrane at a given moment, we must redo the above exercise and compare the result to the original test of the membrane.

Ex. : If we get 5.5 GPM at the second test (corrected at 13°C) the performance of the membrane would be:

((6.00 - 5.5) / 6.00) x 100 = 8.3% performance loss
OR
5.5 / 6.0 = 91.7% efficiency

Table 3 membrane performance listing

# membrane 28736465	Data reading	Temp °C	Corrected data to 13°C
2000	5.2	8	6.00 (100%)
2001	5.1	10	5.50 (91.7%)
2002			
2003			
2004			
2005			
2006			
2007			
2008			
2009			
2010			