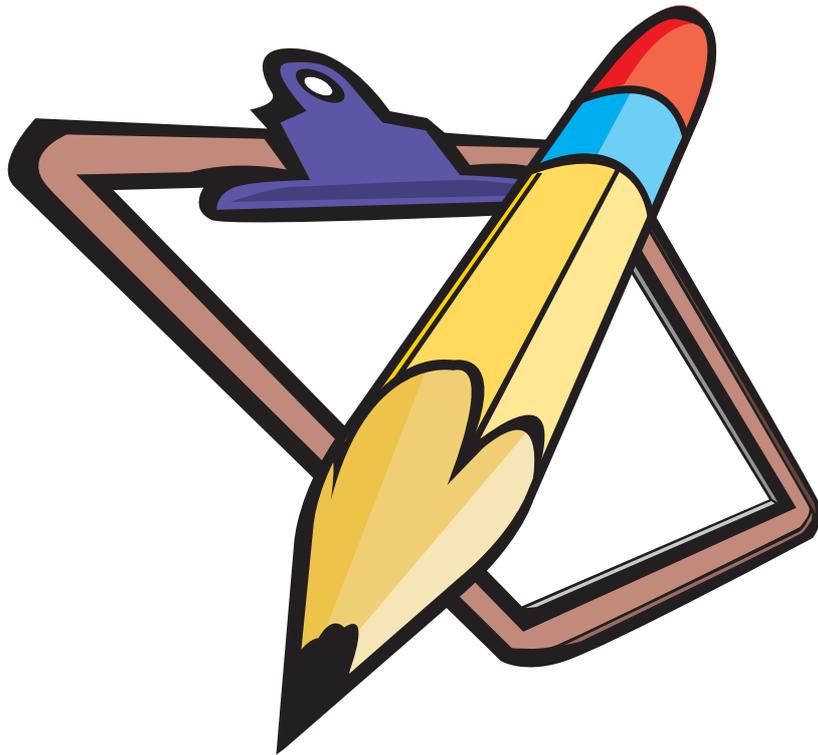




TECHNICAL SESSION



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 1/2 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.

- 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 measurement device.
- Brix percentage of the concentrate.
This test is normally performed after 15 to 30 minutes of operation. For the measurement follow the recommendations for the raw sap.
- 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
- Concentrate flow
Follow the permeate flow procedure.
- 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)
- 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 osmotic 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 $8 / 10 = 80 \%$
- 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.
- 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.
Always perform the performance test at the same pressure. It is important to maintain a good reference,
- Corrected permeate flow
Divide the reading of the permeate flow meter by the appropriate temperature correction factor.

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 °C permeate	Permeate flow
march 10 2006	11:50	8° 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. ° C	Correction factor	Temp. ° 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

$$5.2 \text{ GPM} / 0.866 \text{ (correction factor } 8^{\circ}\text{C)} = 6.00 \text{ GPM}$$

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:

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

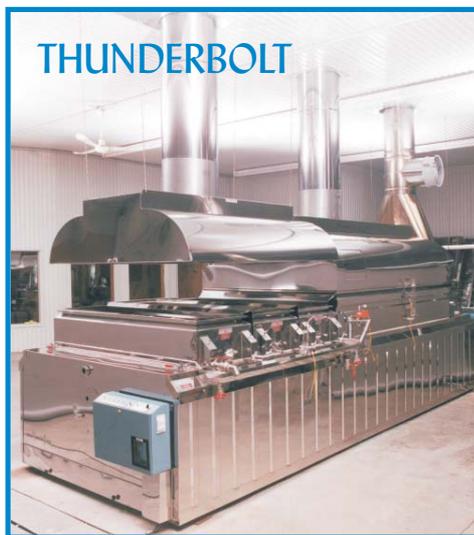
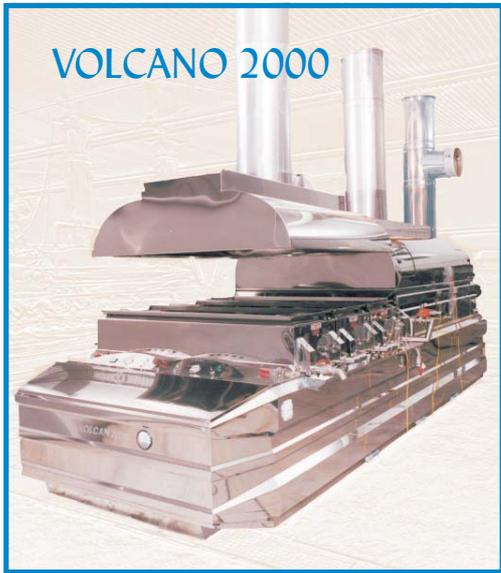
OR

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

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			

SAP EVAPORATOR



SAP EVAPORATOR

START UP & PRESEASON MAINTENANCE

Oil furnace

It is important to check the condition of the combustion chamber and its insulation. The ceramic fibre insulation, must cover entirely the combustion chamber adequately. Improper insulation will cause structural damages to the furnace. Rodents can cause serious damage to the insulation blanket if the access to the inside of the chamber is not restricted. Packed down insulation blanket must be replaced.

Oil burner

- Replace the oil filter. - Make sure there is no leak on the oil feed lines. - Use only -25°C #2 furnace oil. - If the burner refuses to ignite do not keep resetting the system. Accumulation of oil vapours may cause an explosion. Contact a qualified technician.

NOTE: at the end of the season. When storing the oil evaporator it is important to clean under the flue pan. An accumulation of white crystallized droplets will cause corrosion problems. These droplets to the contact of air and humidity will be transformed in sulphuric acid. (Green liquid deposit) This very aggressive acid will cause damage to the pan beyond repair . Remove the flue pan and clean under the pan using a water pressure washer.

Wood furnace

Repair all cracks in the combustion chamber and replace all damaged bricks. This yearly up keeping will prevent premature deterioration of your wood furnace structure. It is necessary to use high temperature refractory cement for this work.

Smoke stack & stack base

These must be in excellent shape. A bad smoke stack, and base will cause a fire.

The pans

Before proceeding to the evaporation. Fill the pans and boil for 15 minutes. Flush and rinse the pan before filling with maple sap. This precaution will eliminate the risk of contamination by chemical deposits.

Important : When shutting down the oil evaporator close the oil line valve and cut the electric power to the electric panel. This preventive action eliminates the risk of the burner starting on its own.

SAP EXTRACTORS



SAP EXTRACTORS

Pneumatic releaser

- Remove the lids and clean daily.
 - Clean and lubricate the interior of the vacuum, transfer cylinders and the pistons. Use hot water and dish detergent for cleaning and grease with a food grade lubricant.
 - Lubricate the vacuum control mechanism with a light mineral oil. (Sewing machine lubricant) If necessary clean with hot water and dish detergent before lubrication. Do not use grease or Vaseline, these products get thick and sticky by cold weather.
 - Clean the float rod with a scrubbing pad to eliminate the sugar accumulation and traces of corrosion. Coat lightly with mineral oil.
-

Electric sap extractor

These systems require little maintenance. Although to keep them in good condition, it is necessary to know certain details.

- First clean the extractor daily.
- Clean the float rod regularly.
- Make sure the float is in good condition, and there is no water in it.
- The plumbing connecting to the extraction pump must be perfectly airtight. Under vacuum an air intake will prevent the pump from priming itself. It wont be able to empty the extractor tank once the pump is kicked on by the level float.
- An air intake on the pump or a bad check valve will cause the same problem. Most of the time when the system is not under vacuum, you wont detect any water leak. But under vacuum the pump or its components may suck in air preventing the system from priming itself.
- If you notice bubbling in the extractor tank, the system is intaking air. You must check the plumbing and the pump check valve for air tightness.
- The power feed line to the pump must be in excellent condition, a damaged cable must be replaced, as you know electricity and water is a bad combination.

SAP EXTRACTORS



SYRUP FILTER



With the Lapierre syrup filter, you get a quality filtration for a maple syrup of an excellent limpidity. The filtration vessel is fast and easy to take a part when replacing the filtration cloth. The syrup filter vessel is available in 12" an 24" lenght.

Maintenance:

Lubrication and maintenance of the pump:

At the end of the day, lubricate the pump while circulating warm water through the pump. Place the suction and the return hose in a pail filled with warm water. Activate the pump and gently pump grease in each grease adaptor. This way the gear axis is getting properly lubricated while the inner case of the pump is being cleaned. You must use food grade lubricant available at your maple equipment distributor.

DO NOT USE AUTOMOTIVE TYPE LUBRICANT.

Syrup filter operation:

- Connect the pump suction hose to the syrup tank
- Connect the return hose and put the other end in the syrup tank.
- Connect the outlet hose from the filtration vessel to the filtered syrup tank.
- Connect the pressure hose between the pump and inlet of the filtration vessel.
- Activate the pump once syrup appears in the outlet hose of the filter press return the syrup in the unfiltered syrup tank and circulate for 30 seconds to obtain a limpid syrup. After you are ready to send the syrup to the filtered syrup tank, or in the drum. Adjust the pressure with the bypass valve at 10 to 15 psi. The pressure will increase gradually. Once the pressure reaches 35 to 40 psi it is time to replace the filter cloth.

MAXIMUM PRESSURE : DO NOT SURPASS 75 PSI

- The pressure safety valve is adjusted at the manufacture to not surpass 75 psi. Excessive pressure will damage the inner cylinder..

SYRUP FILTER

Cleaning:

Clean the filter cloths and the components of the cylinder with warm water. Hang to dry, NEVER USE BLEACH OR DETERGENT. Do not soak the cylinders in an acid or chlorine solution. These products will eat up the aluminium.

Installation of the filtration cloth:

The filter cloth is wrapped over the inner cylinder. A velcro band makes the joint one o'ring is placed over the cloth at each end to close the end around the cylinder. The grooves at each end indicate the position of the o'ring. Make sure the end of the cloth is not squeezed between the bottom or top lid and the inner cylinder. This problem will cause poor filtration. Do not over extend the usable life of the filter cloth. As they wear the quality of the filtration is affected. In many cases, it is recommended to replace them every year.

Pre season maintenance:

- 1 Check the condition of the o'ring. If they are cracked they must be replaced.
- 2 Coat the threads of the tightening rod with a food grade lubricant.
- 3 Check the condition of the clips to the bottom lid. Make sure it is properly compressed against the vessel.



SQUARE FRAME FILTER PRESS



7" and 10" square frame filter press with optional stainless steel rack on casters. Expansion possibility up to 10 frames.

Maintenance:

Lubrication & maintenance of the pump:

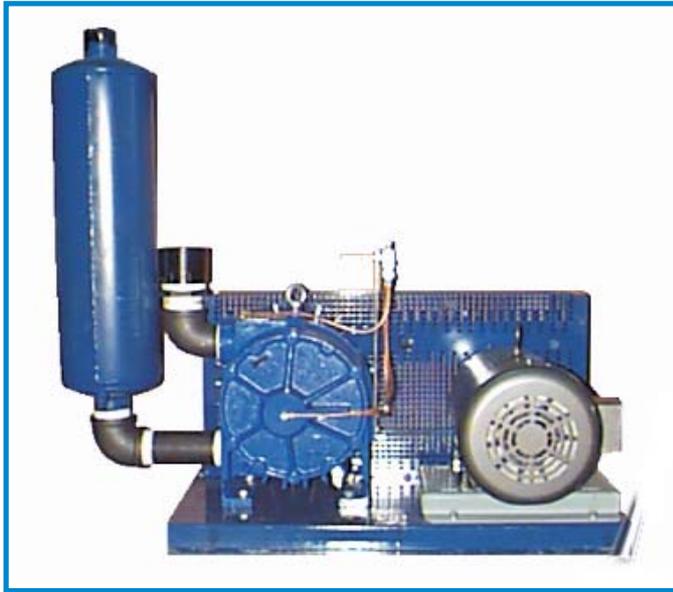
At the end of the day, Lubricate the pump while circulating warm water through the pump. Place the suction and the return hose in a pail filled with warm water. Activate the pump and gently pump grease in each grease adaptor. This way, the gear axis are getting properly lubricated while the inner case of the pump is being cleaned. You must use food grade lubricant available at your maple equipment distributor.

DO NOT USE AUTOMOTIVE TYPE LUBRICANT.

Filter press operation:

- Connect the pump suction hose to the syrup tank.
- Connect the return hose and put the other end in the syrup tank.
- Connect the outlet hose from the filter press to the filtered syrup tank.
- Connect the pressure hose between the pump and the inlet of the filter press.
- Activate the pump once syrup appears in the outlet hose of the filter press, return the syrup in the unfiltered syrup tank and circulate for 30 seconds to obtain a limpid syrup. After you are ready to send the syrup to the filtered syrup tank, or in the drum. Adjust the pressure with the bypass valve at 10 to 15 psi. The pressure will increase gradually. Once the pressure reaches 50 psi you must clean the frames and replace the filters.
- An excessive pressure will cause premature wear of the pump.
MAXIMUM PRESSURE : DO NOT SURPASS 75 PSI

OIL LUBRICATED VACUUM PUMP



Verification & Maintenance

A vacuum pump requires a certain checkup and maintenance. A preventive inspection will prevent premature break down during the operation.

Pre season verification:

- Check the condition of the drive belts
If the belts are in good shape, check if they are lined up properly.
- Check the belts tension. To make sure they are perfectly tight. Press down both belt at once between the two pulleys. With a reasonable pressure the play should be of a $\frac{1}{2}$ inch.
Too much tension will damage the bearings of the pump and the electric motor. Loose belts will slip causing an overload on the electric motor. You will notice the motor slowing down under load even resetting due to an overdraw of amps caused by slippage of the drive pulley on the belts.
- Retention or replace the belts is needed.
The vacuum pump head requires cleaning, not less than once a year. If the pump is equipped with an oil reclaimer or a flood lubrication system disconnect the exhaust outlet at the pump. Install a temporary pipe to allow recuperation of the residue from the cleaning.

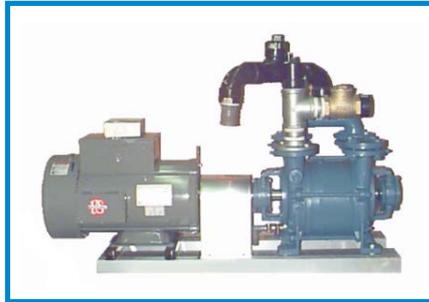
OIL LUBRICATED VACUUM PUMP

- With the help of a 5/16" tube and half a litre of diesel fuel, through the vacuum control opening, allow the pump to suck up the fuel. Do not run the pump this way too long once done repeat the operation with 1/2 litre of vacuum lubricant. Recuperate the residue in a drum or a safety container. Dispose of it according to the environmental regulations. Think of future generation, 1 litre of oil will pollute 1 million litres of drinking water.
- For pumps with lubricators, adjust each one of them to 20 drops per minute at a vacuum of 20 HG.
- Replace the filter of the oil reclaimer.
- Replace the reclaimer lubricant when needed. The oil must be clean and without traces of contamination.

Note: A vacuum pump should never be operated when not under load. The lubricant cannot be sucked into the pump. The vacuum dial should indicate no less than 12 HG.



LIQUID RING VACUUM PUMP (Sihi)



These extremely resistant pumps require very little maintenance. Although it is necessary to know certain details on this equipment.

Start up procedure:

- With water, fill the pump to the centre of the impeller shaft.
- Turn the transmission axis manually to ensure it is turning freely. If it does not turn, tap the end of the axis to free the impeller. The problem is usually caused by rust. A solvent may be necessary.
- Make sure the pump is turning in the direction indicated on the end covers.
- Check the alignment of the coupling on the drive shaft.
- Open the fresh water feed line..

Maintenance:

Very little maintenance is required.

- Lubricate the bearings every 3000 hours with a special bearing grease.
- In certain cases, it is necessary to use a descalent product. Scale build up is caused by impurities and minerals in the water. A periodic recirculation of descalent may be necessary.

Storage procedures:

The pump must be at all time protected from the frost. Drain the unit completely by removing the drain plugs. When draining, rotate the shaft by hand. Once properly drained, install back the plugs. Fill with antifreeze or frost resistant anti corrosion liquid.

Warning:

Follow the start up and shut down procedures Do not overfill the pump with water. It may cause damage to the motor.

NOTES



VACUUM PISTON PUMP



This system is being used where electricity is not available to power conventional pumps.

Installation:

In general this pump is installed with a mechanical extractor and a storage tank in a distant pump station. The pump will push the sap to the sugar camp, pulling its energy from the vacuum.

To achieve this, the vacuum at the pump house must be at a minimum of 18 HG. The room must have a source of heat (propane) to prevent freezing.

The pump is activated by a water level switch that controls the vacuum power. The level control unit is installed in the storage tank.

Maintenance:

To prevent from freezing, it is preferable to drain the pump and the pressure line to the sugar camp. At the end of the season, circulate warm water through the pump to make sure dried up sugar residue does not damage the inside of the system.

NOTES

