

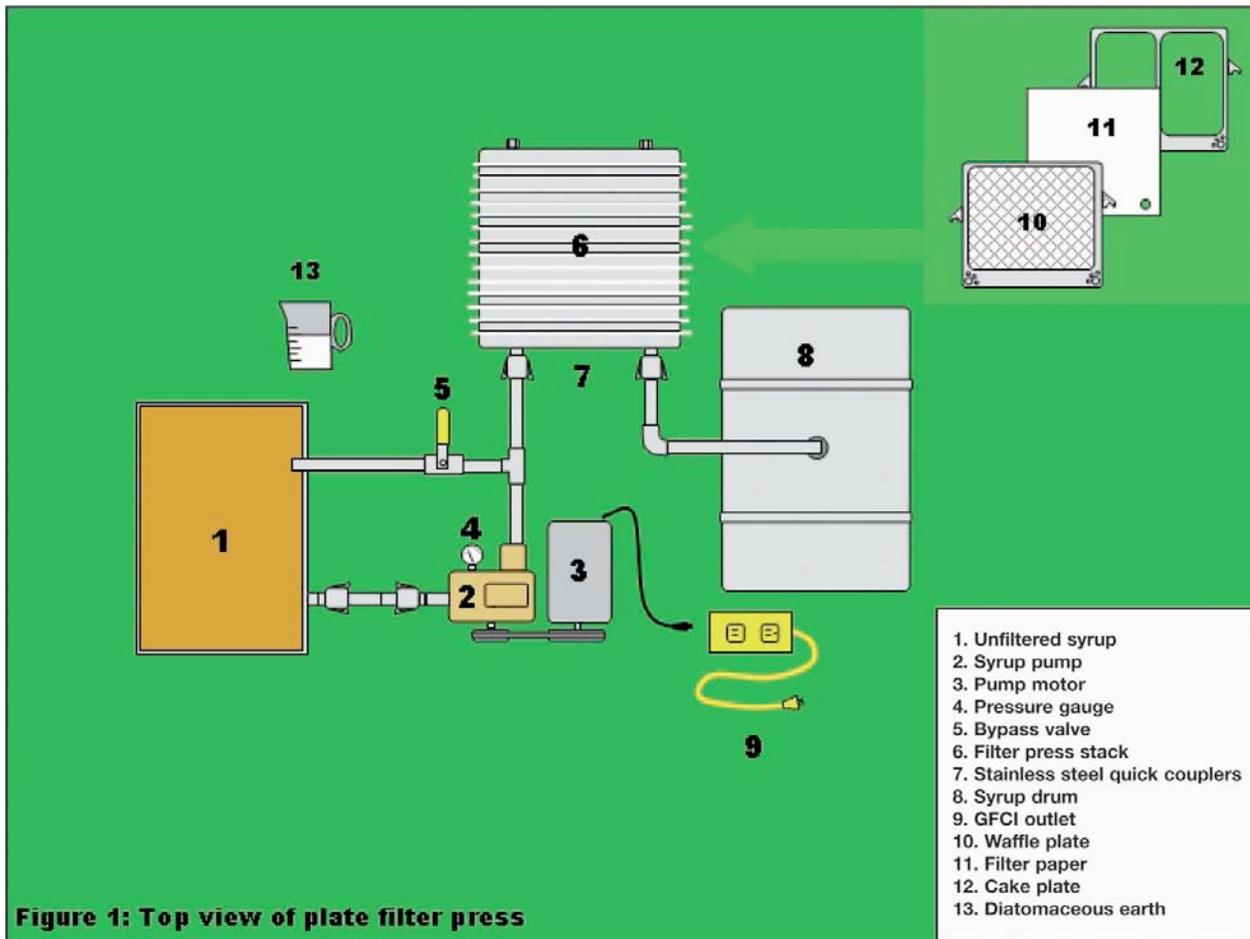
RECOMMENDATIONS FOR PROPER PLATE FILTER PRESS OPERATION

M. Isselhardt, S. Williams,
B. Stowe and T. Perkins



**Proctor Maple
Research Center**





INTRODUCTION

Consumers of pure maple syrup demand a high quality product. Like most food items, appearance can affect the value of maple syrup and the customer's perception of quality. Proper filtration is essential to remove sugar sand (niter) in order to ensure a quality finished product. The two main categories of filtration are gravity filters and pressure filters (filter presses). Both methods can produce excellent results; the major difference is the rate of processing. Filter presses are designed to filter large volumes of syrup in a relatively short amount of time.

New filter presses do not always include a complete set of instructions and the proper procedures in using a filter press are not always apparent. This publication is meant to provide guidelines for the proper use of plate filter presses.

THE PLATE FILTER PRESS

There are two main types of filter presses on the market: the canister and plate press. This guide deals specifically with plate presses.

The plate press works by pumping unfiltered syrup through a series of filters coated with filter aid under pressure. The result is an attractive "polished" product. This value added product generally commands a higher price in the marketplace.

THE PARTS OF A FILTER PRESS

Figure 1 shows the major components of a plate filter press: Syrup pump and motor with safety guard, filter press frame and filter plates, pressure gauge, bypass valve, filter papers and filter-aid (commonly Diatomaceous Earth or DE). A GFCI (ground fault circuit interrupt) is used in conjunction with a filter press.

SYRUP PUMP AND PUMP MOTOR: (2 & 3)

A variety of pumps are available for filter presses, including bronze gear pumps, plastic diaphragm pumps which require an air compressor, stainless steel gear pumps and hand operated pumps for small presses. Most filter presses come equipped with a gear type pump powered by an electric motor. The motor commonly has a rubber belt that drives the pump. This assembly should always be covered by a safety guard. **WARNING:** excessive re-

circulation of syrup through older bronze gear pumps may lead to elevated lead levels in syrup.

FILTER PRESS STACK AND FILTER PLATES: (6, 10 & 12)

The filter press frame acts as a support for the filter plates. The filter press is made up of a "stack" of waffle and cake plates. Waffle plates act to distribute the syrup evenly while providing a firm backing for the DE cake and filter paper. Cake plates have a cavity that allows the cake of DE to form. Filtering capacity increases with size and number of plates used. The method for tightening the plates is usually a pair of threaded bars with heavy-duty wing-nuts. A pan or container is needed to catch the syrup that weeps from the press. Many sugarmakers add a set of stainless steel quick couplers to the inlet and outlet of the press.

DIATOMACEOUS EARTH (FILTER AID): (13)

Diatomaceous earth works in a filter press by forming a complex matrix that traps suspended solids while allowing maple syrup to pass through. DE is essential to the operation of a filter press. DE, the skeletal remains of single-celled sea creatures called Diatoms accumulate on the ocean floor over millions of years forming thick layers. These layers are mined, sifted, and sorted by particle size. DE is also used in the beer and wine industry, it is the gritty substance in toothpaste and DE is used in pool filters. Not all DE is food grade and not all grit sizes will work for filtering maple syrup. Make sure that DE is purchased from a maple equipment distributor.

CAUTION: DE is a finely ground abrasive material and should always be handled with care. Do not inhale the dust and avoid eye and skin contact.

FILTER PAPER: (11)

The purpose of filter paper is to catch the DE suspended in syrup and provide a surface for the DE cake to form. During filter press set-up filter paper is placed between each plate. Filter papers have two holes that match the inlet and outlet hole in the plates. It is important that the correct size papers are used and that the alignment of the holes matches that of the plates. Lightly moistening the papers will help keep them in place during setup. Although filter paper has two distinct sides or textures, there is no detectable difference in filtering performance.

PRESSURE GAUGE AND BYPASS VALVE: (4&5)

The pressure gauge is used to monitor back-pressure in the filter press which can lead to filter paper failure. The gauge is plumbed into the pipes that carry the syrup to

the press and should be able to read a range of at least 0-50 Pounds Per square Inch (PSI).

A simple stainless steel ball valve can be used as a bypass valve. The valve is placed before the stack. A food grade hose or stainless steel pipe long enough to reach your syrup reservoir should be connected to your bypass valve.

GFCI GROUND FAULT OUTLET: (9)

These range from simple plug in type outlets to permanent hard wired outlets in the sugarhouse. These outlets prevent electrocution injuries caused by electrical service grounding through fluids (syrup or water). These outlets represent inexpensive insurance against injury to the operator or the equipment.

SETUP OF A PLATE FILTER PRESS

Make sure all parts of the press are clean, dry and that there are no obstructions in any pipes or plates that carry syrup. This is especially important for new filter presses right out of the box. Take extra time to make sure no debris or oils from the manufacture of the press remains.

Without the proper plate orientation the press will not function correctly. None of the plates should appear misaligned or sticking out of the stack. The plates should always alternate between hollow and waffle plates. The first and last plates in a press are waffle plates.

1. Begin with the first plate in the stack attached to the frame; place one sheet of filter paper against the waffle then slide on a cake plate, sandwiching the paper between the two plates. Some filter press frames do not have a set of guides to keep the filter papers in alignment. If this is the case, use a pair of appropriately sized dowels (1/2 inch for most presses) in the inlet and outlet holes of each plate to keep the papers at the right height during set up.

2. Place a filter paper on the other side of the cake plate and cover it with another waffle plate.

3. Repeat this process until all plates are used. Plates must alternate. At no time should two cake plates or two waffle plates be used next to each other.

4. The end plate is a waffle plate made from thicker metal than the rest of the stack. Attach this plate and secure using the manufacturer's hardware. Tighten down the stack. Remember, a filter press is under pressure; if the stack is loose during filtering, syrup may squirt out between the plates.

5. Make sure all the quick connects are closed; this includes the tubing from the syrup reservoir to the filter press, and out of the filter press to the drum.

CHARGING THE PRESS

The filter press works by completely coating the filter papers with a cake of DE. This process is called charging the press. Without completely coated papers, unfiltered syrup can mix with filtered syrup.

The syrup to be filtered must be heated to 200° Fahrenheit. Draw off three to five gallons of hot syrup into a stainless steel bucket or clean food grade pail used ONLY in maple production. This will be your precharge syrup. Begin by stirring half the DE into the pail of hot syrup (see Table 1-1). For example, a 45 gallon batch of syrup would require 4 1/2 cups of DE to charge a 10 inch press. Combine the DE and hot syrup until completely mixed. Add the remaining 4 1/2 cups of DE to the batch of syrup waiting to be filtered. Pump the bucket with syrup/DE mixture through the press. Catch the syrup exiting the press in another clean bucket at the outlet of the press. Pump the entire 3-5 gallons of syrup through the press before checking the clarity of the syrup leaving the press. The syrup should appear polished and free of any suspended solids. If any cloudiness is present; first shut off the pump, then return the cloudy syrup to the first pail and repeat filtering until syrup comes out clear. Very small air bubbles created by the pump can make the syrup look cloudy. When the syrup is clear, add it back into the batch of syrup waiting to be filtered. This will prevent low temperature syrup from entering a storage container.

Connect the press to the unfiltered syrup (finishing pan). Due to loss of heat while filtering syrup; heat your syrup to 200°F to maintain the minimum temperature of 180°F needed to sterilize syrup storage containers.

Table 1-1: General recommendations for Diatomaceous Earth needed for various filtering batch sizes in 7" or 10" plate filter presses. (More DE may be needed for dark or late season syrup.)

| <u>Gallons=</u> | <u>7" Plate Press</u> | <u>10" Plate Press</u> |
|-----------------|-----------------------|------------------------|
| 40 | 5 cups | 8 cups |
| 45 | 6 | 9 |
| 50 | 7 | 10 |
| 55 | 8 | 11 |

FILTER PRESS OPERATION

The press is now ready to operate. Connect the press to the unfiltered syrup (finishing pan). Make sure the drum or container to be filled is clean, dry and ready for use.

Make sure the bypass valve is closed and the return line to the unfiltered syrup (finishing pan) is in place. Turn on the pump.

Look over the entire press as it runs and make sure everything is operating smoothly. Monitor the pressure gauge for increases in pressure. If the pressure rises dramatically upon start-up then the press may have been set up incorrectly. Normal operating pressure for a 10-inch plate press with seven cake plates is between 0-20 PSI. This range is meant as a guideline. Presses may occasionally run into problems at lower pressures especially if papers or plates are not seated correctly.

Once back-pressure is observed the plates have begun to clog. This results in a slower rate of filtering and the imminent possibility of a ruptured paper. The bypass-valve can be used to relieve some of the back-pressure but it will decrease the filtering rate. When the valve is opened some of the syrup entering the stack is diverted back to the reservoir thus reducing the load on the filter press. The valve can help finish filtering a batch of syrup but will not allow filtering to continue indefinitely. A general rule of thumb is to clean your press if the bypass valve is used.

BATCH FILTERING

Sugarmakers who collect syrup into a finishing pan or some other holding container before filtering are using the "batch filtering" method.

When charging the press during batch filtering, half the total DE used to filter the batch of syrup is added to the charging bucket of syrup. The remaining DE is mixed with the remaining syrup to be filtered. This insures that DE will be constantly added to the existing cake in the filter press. By adding DE continually to the filter press more surface area is created during filtering. The impurities (niter) being filtered is spread out and filtering capacity is increased.

If more than one batch of syrup is sent through the same set of cakes and papers, care must be taken to prevent excessive cooling of the press.

CONTINUOUS FILTERING

An alternative to batch filtering is "continuous filtering", which involves the same steps for charging the press as batch filtering. With continuous filtering each draw off is sent directly through the press.

CHOOSING A FILTERING METHOD

Before deciding on continuous filtering, be aware of how much syrup will be filtered and at what rate. For example,

sugarmakers that will only produce a gallon of syrup an hour may encounter problems with clogging or noticeable drop in temperature within the press. A press that has cooled can in turn cool filtered syrup below 180°F. Gravity will naturally pull downward on the filter cakes over time. If the press is left idle for too long, gaps may be created in the DE cake allowing unfiltered syrup to pass through.

CLEANING THE PRESS

When filtering is complete, a small amount of syrup will remain in the press. This syrup can be recovered by pumping a few gallons of hot water through the press. Catch the discharge in one of the buckets used for charging the press. The mix can be held in a bucket until the next boil, added to the evaporator syrup pan or returned to the clean finishing pan to be incorporated with the next batch. If you add this concentrate to your evaporator from the filter press, be careful not to add too much at one time and scorch your pan. Only clean water should be used to clean the filter press.

Water should be run through the pump and the plates should be thoroughly scrubbed and then rinsed with hot water. It is important to make sure that all surfaces are clean and all of the small holes in the filter plates are clear of obstructions.

Dealer recommendations about when to grease the syrup pump vary and range from once a year to each day of use. Too much grease can be harmful, both to the pump

and any syrup that it might come in contact with. The amount of grease needed will vary with the volume of material filtered, its viscosity and the amount of time the pump is in operation. Always use food grade grease and dispense it using a grease gun that is only used for this purpose.

TIPS AND TROUBLE SHOOTING

- Watch for the appearance of back-pressure; this indicates clogging in the press. Sudden spikes of pressure indicate imminent paper failure.
- Occasionally niter is too small to filter. If this is the case, let the barrel stand for a month and then carefully pump out syrup without distributing niter that settled out. Filter the syrup a second time. This usually occurs at the beginning of the season.
- Look for seeps and weeps of syrup beyond normal. Check pressure, check stack tightening hardware.
- Do not run pump without fluid. This causes excessive wear and tear.
- Make sure papers are aligned correctly. If the filter press stand does not include a set of rails for keeping papers aligned then a set of two dowels run through the inlet and outlet holes of each plate will help keep the papers from falling out of place when setting up the press.
- Check for proper plate alignment
- Use DE; add more for darker or late season syrup.
- Avoid wearing loose fitting clothes around pulleys.
- Operate the press hot.
- Keep syrup temperature leaving the press above 180°F.

Pure Maple syrup is a carefully crafted product. It's value is judged not only on taste but appearance. Proper filtering of raw syrup is essential to making a high quality and appealing product. A filter press is a useful tool for modest to large sized sugaring operations. This pamphlet is intended to guide operators in the use of plate filter presses.

For more information, contact:
Proctor Maple Research Center
P.O. Box 233, Underhill Center, VT 05490
802-899-9926
www.uvm.edu/~pmrc
email: pmrc@uvm.edu

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. University of Vermont Extension, Burlington, Vermont. If you require special accommodations to participate in this program, please let our office know so we may assist you. Any reference to commercial products, trade names, or brand names is for information only, and no endorsement or approval is intended. This publication is made possible, in part, by funding from the USDA.

University of Vermont Extension and U.S. Department of Agriculture, cooperating, offer education and employment to everyone without regard to race, color, national origin, religion, age, disability, political beliefs, sexual orientation, or marital or familial status.