I. Introduction

Filtration is used to clarify wines (when the filter pads have a nominal pore size > 0.45micron) and to remove unwanted micro organisms (<0.45 microns). It is not intended to replace racking or fining, since even the most coarse filter pad will readily become blocked, slowing filtering progress, by requiring frequent backwashing. Not all wines need to be filtered e.g. if the wine is clear, healthy (low VA), has had no microbially induced problems and has completed MLF. However, if any of the above conditions have occurred, the wine needs to be filtered prior to bottling.
With the Filtrox pad filter used at NVC we have the capability of running two sizes of pad filters at the same time which helps to maintain the integrity of the wine by not having to pump it more than once. Pads with a nominal pore size between 1 and 5 microns are utilized in the first section of the filter to remove coarser particles. Then the wine is passed through pads of a nominal pore size of 0.45 microns which removes finer particles and micro organisms. One common strategy is to load 2/3 of the filter with pads of about 2 or 2.5 microns and 1/3 of the filter with .45 nominal pads. This is considered a pre-sterile filtration. It is not truly sterile because of the nominal nature of the pore size on the pads. The main purpose of this is to allow the wine to pass cleanly through a truly sterile membrane filter during bottling.

This method describes how to set up the filter, clean and sterilize it, use it for filtration, and then how to finish a filtration once all the wine has passed through the filter.

II. Hazards

- **Pressure:** During filtration, hazardous levels of pressure can be generated in several ways:
  1. Pumping against clogged pads
  2. Pumping inadvertently against a closed valve
  3. The use or misuse of bottled gasses

- **Chemicals:** Citric acid is used to condition the pads before use which requires the use of gloves and goggles. In some protocols, SO2 may also be used which requires the use of a respirator.
III. MSDS #’s

- Citric Acid
- Sulfur Dioxide

IV. Personal Protective equipment

- Gloves
- Goggles
- Respirator of using SO2

V. Process equipment

- Pad filter
- Pump – A positive displacement pump such as the Vogelsang is recommended. An air pump can also be used.
- Hoses – When prepping the pump for use, make sure to include 3 hoses, as they will be needed for the filtration. The hose between the pump and the filter needs to be short and sturdy as this hose will incur the most pressure.
- Destination tank – don’t forget to vent
- Racking wand – suitable for racking from either barrels or tanks
- Sump cart or food grade can – For circulating filter conditioning solution
- Filter conditioning solution – This is a mixture of 1% Citric acid. Optionally, 100 ppms SO2 may be added. This step is omitted in a crowded cellar where safety concerns are heightened because the fumes may be irritating and harmful.
- Filter pads – verify sufficient quantity of desired grades and store carefully. Do not allow unused pads to become wet. Promptly seal unused pads in plastic using packing tape and return to storage area.
- .2 micron capsule filter if water filtration is desired
- Nitrogen
- Argon
- Ram extension (if using a small number of pads)

VI. Pre-operation preparation

- Order pads at least one week in advance
- 3-cycle clean the filter parts and plates. Rinse plates with water by placing on the filter frame and blasting them with the hose one at a time. Focus on the tiny inlet holes in the metal plates. (Very wet job, you may want rain-gear/boots)
- Be aware that the filter conditioning process involves 40 minutes of down time. Organize your workload to take advantage of this.
- Carefully read work order and clarify as necessary with supervisor.
- Sanitize (3 cycle wash) the receiving tank using the pump and lines to be used in the procedure outlined below.
- Vent the source tank and destination tank.
• Blanket the destination tank with Argon.

VII. Procedure

• Loading the filter
  1. The filter should be 3-cycle cleaned and sanitized with either quaternary ammonia or ozone. Select the number of plates you want based on wine volume. Realize that this filter has 4 types of plates:
     a. End plates – These 2 plates are made of stainless steel and have removable gaskets
     b. Cross-over plate – There is one of these. It is made of stainless and has removable gaskets
     c. Cross-over adjacent plates – There are 2 of these and they look like the standard plastic plates. If you look closely, you will see that one side of the plate does not have holes in it. They go next to the cross-over plate
     d. Standard plates – All the other plates are the same. Every other one is reversed so that there is a single gasket between each one.
  2. Load plates and inspect:
     a. Set the endplates, cross-over plate, cross-over adjacent plates and regular plates in accordance with your filtration strategy.
     b. Inspect the filter – Watch for:
        i. Missing gaskets on the end plates, cross-over plates and cross-over adjacent plates.
        ii. Double gaskets/missing gaskets on the regular plates. This happens when two regular plates are next to each other with their gaskets on the same side. Note that it may be necessary to remove or add a plate to make everything work.
        iii. Make sure the cross-over plate is facing the correct direction so that the wine flow is “blocked” and forced to the other side of the filter.
  3. Start inserting pads at the end away from the “screw.” This will be your inlet. Understand that wine does not move “down” the filter, it moves “across” the filter; basically zigzagging its way through the pad from one side to the other. Stand at the side of your filter that has the inlet. Place each pad in so that the fuzzy holes face the small metal plates with the holes in them that are on YOUR SIDE. In other words, the wine should push into the fuzzy side of the pads.
  4. The pads near the inlet are the coarse pads. Verify that each pad is square before pushing the next plate against it. A small portion of pad should extend around each side of the plate. Continue until you reach the cross-over plate or until the end if not using a cross-over plate.
  5. When you hit the cross-over plate. Move to the other side of the filter and continue loading with the tighter pads, remembering that the inlet is now on the other side.
  6. When you finish, tighten the screw until it is just snug against the pads. Use a hose to wet down the pads for a few minutes. Continue tightening the pads until they are very tight. Don’t strain too hard at this point. As the pads become more wet during conditioning, you can periodically tighten it further. If using a small number of pads (Less than 20 or so) it will be necessary to use the extension ram.
**Conditioning the pads**
1. Sanitize the sump cart or a 32 gallon food grade can
2. Fill with clean water (filter water if desired)
3. Pump water out of food grade can or sump and into the inlet of the filter. Flush with clean water for about 5 minutes.
4. Begin re-circulating the water into the food grade can and adjust the filter valves so that there is about 20 gallons of water in the can. The outlet valve should be back-pressured so that the filter is completely full of water/solution. Figure out how much water is in the system total: a completely loaded filter will hold about 30 gallons. Make a 1% citric acid solution based on this. Use about 10 mls (by volume) of citric acid per liter. Stop the pump, stir this in to the food grade can until completely dissolved, then circulate for 40 minutes. Optionally, you may add 100 ppms SO2 at this point, though this should be skipped in a crowded cellar.
5. Open the valves and allow the filter to drain. Empty the food grade can and rinse. Fill with clean water and flush the filter for 10 minutes. At the end of this period, taste the water. An improperly prepped filter will taste “papery” and the conditioning process should be repeated.
6. Open valves and allow filter to drain. Hook up nitrogen to the pump inlet and apply pressure. This will help the filter to drain further and also sparge out Oxygen.

**Change-over – from water to wine**
1. No matter how well you empty and sparge the filter, more water will remain inside. The volume can be surprising. Even after emptying, the fully loaded filter will likely hold 10 or 15 gallons of water and you may need to dump another 10 or 15 gallons before you get pure wine.
2. Prior to this operation, sanitize 4 x 5 gallon buckets. Open all of the valves on the filter, at least partially. Pushing out the filter happens quickly. Disconnect the outlet hose and replace it with an elbow that can be directed toward the buckets. Make sure that everything is prepared before you begin pumping wine.
3. Connect the inlet of your pump to wine and begin pumping. Water will begin pushing out of the filter valves in sequence from low to high, and from the inlet side to the outlet side (and back again if using a cross-over plate. Allow the water to dump onto the floor, and taste it with your cupped hand (wine glass is too slow) to determine when it is mostly wine. You can also evaluate its color. Then close the valve and move to the next one.
4. When you’ve moved through the filter and arrive at the outlet valve, you can allow the solution to dump onto the floor until you think you’re close, then begin filling buckets. Fill each bucket with about 3 or 4 gallons, then move to the next one. Be careful to keep the buckets in order.
5. When all buckets are filled, Shut off the pump and close the outlet valve. Taste a sample from the outlet valve. If it is satisfactorily pure wine, connect to the tank and begin filtering. If not, dump the first-filled bucket and fill that one from the filter.
6. The purpose of the buckets is that you don’t need to taste the wine perfectly on the fly. After the filter has been pushed through, you can taste each bucket and make a
determination of whether to keep it or dump it. Wine that is to be kept should be returned to the source tank so that it can go through the filter again.

7. This method is a small winery/small lot technique. With larger lots, you can taste the wine on the fly using a tee with valves that’s affixed to the destination tank. (See photo above). When the cut is ready to be made, the valves are simply switched.

- **Filtering**
  1. During filtration, monitor the pressure gauges. In general, you don’t want more than a 1 bar pressure differential between the inlet or the outlet, however, there may be times when you will cautiously push that up to 1.8 bar to get the last of the wine through. In any case, the differential should never be more than 2.0 bar.
  2. Initially, no wine should be kept from the drip pan. You can check this for yourself by tasting the wine from it. Even when the inside of the filters are properly prepped, the wine that drips off of the outside will be papery and acidic. As time goes on, the quality of this wine will improve. It is rare that wine will be worth keeping until at least 400 gallons or so have been pushed through it.

- **Change-over – From wine to wine**
  1. Choosing the order:
     (1) When filtering multiple wines, it’s critical to select a proper order of compatibility. Here are some general ideas to help make this decision: Good wines before bad wines, R.S. dry wines before sweet wines, ML dry wines before wines with malic present, low VA wines before higher VA wines. And oh yeah, white wines before red wines!
  2. Choosing the timing of the cut:
     (1) Remembering that a fully loaded filter will contain a great deal of wine, you can see that making the filter cut is essentially an act of blending. You can therefore make the cut early to ensure that none of the second wine gets into the first wine, late to make sure that none of the first wine gets into the second wine, or in the middle to try and split the two evenly.
     (2) Factors that will affect this choice are:
        (a) Quality – You don’t want to degrade a high-quality wine with a low quality wine.
        (b) Economics – You don’t want to unnecessarily reduce the quantities of your high-price point wines.
        (c) Stability – You don’t want to introduce instabilities into a stable wine. See “choosing the order above” for more info.
  3. Making the cut:
     (1) After the first wine is finished, push the filter through with Nitrogen. Hook up the new wine to the inlet. When it’s time to make the cut, shut down the pump and switch the wine to the new destination tank.
     (2) Exactly how you do this depends on the situation and the compatibility of the wines. For an early cut, you simply switch to the new wine and start with the new tank. For a middle or late cut, you will pump a certain amount of the second wine through before switching the destination tanks.
(3) In some cases, it may be necessary to taste the progress of the wine similar to the method used for pushing out water. This is commonly done when switching from whites to reds.

- **Pushing out the filter when finished**
  1. Push the filter through with Nitrogen.
  2. Open the lower valve on the outlet of the filter and recover any wine possible in a sanitized pitcher. Put this in the destination tank. You may recover wine from other valves but it cannot be regarded as filtered. Pushing through with water may or may not yield some additional clean wine.

**VIII. Clean-Up**

1. With the filter outside on the crush pad, open up the filter by releasing the screw.
2. Remove the pads and stack on a wood pallet. They are too heavy to place in a garbage can (it’s rude to the custodian).
3. Hose off all of the filter parts. Hose off the plates one at a time, focusing on the small metal plates with the holes in them.
4. Time permitting, 3-cycle clean the plates, scrubbing where necessary. Remove all of the filter parts and 3-cycle clean them as well. It is not necessary to sanitize at this point, we sanitize before we use things and clean after. If you are able to do a post-operation cleaning, it is very helpful to label it as such. Put a piece of tape on the filter saying: “3-cycle cleaned following filtration on 00/00/00” This may save time for the next filtration crew who can simply sanitize the equipment before use.
5. 3-Cycle clean the pump and hoses
6. Record operation, label tank, pull samples if requested on the CWO.